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The Scientific Detection of Crime

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THE SCIENTIFIC DETECTION OF CRIME

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THE general apathy in this country toward the possibility of detecting crime scientifically may seem discouraging to those from whose minds any such doubts long since have vanished. But this seems to be expected, because mankind usually manifests similar reactions to almost all things novel or out of the ordinary. When men of science suggested the utility of many of our modern inventions, and when medical research made known to the world new discoveries which would lead to the eradication of a disease, there was considerable skepticism. Proposals and theories now recognized as facts of common knowledge have had to force their way through the veil of human understanding. Men had to see the airplane, hear the radio, and read by the light of the incandescent bulb to appreciate even vaguely the meaning of science. What, then, can be expected as a normal reaction to the somewhat novel idea of reliance upon science in the detection of criminal offenders?

Our own country, which has given to the world more than its share of inventions based upon scientific study, has been more backward than European countries in the application of science to criminal investigations. For decades European centers have supported public organizations devoted exclusively to the scientific detection of criminals.[1] European capitals usually possess both a scientific police laboratory and a medico-legal institute. Cases involving matters of a strictly medical nature are allotted to the medico-legal institute; all others, such as those involving fingerprints, firearms identification, document examination, etc., go to the scientific police laboratory. In the United States we find only one well equipped laboratory devoted exclusively to this purpose.

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[1]For a detailed description of the European system, see Goddard, Scientific Crime Detection Laboratories in Europe, (1930) 1 Am. J. Police Sci. 13, 125. Also Methods and Problems of Medical Education (9th series, Rockefeller Foundation). Although numerous citations are available for practically every statement in this article, the authors have selected only a few of the most authoritative.

Perhaps the reason for European advancement in the scientific methods of detecting crime is the fact that the police forces of Europe usually are composed of men of the highest intelligence and thorough training, and they appreciate to the fullest extent the value of science as an adjunct to police efficiency. Almost without exception European police officials are doctors of law, science, philosophy, or medicine.[2] It is only natural to expect from these "professional" men a departure from old-fashioned methods of police activities and an adoption of scientific contributions which will facilitate their criminal investigations. Unfortunately, a similar concept of police efficiency has not developed in the United States, although we do find a growing consciousness on the part of the police that their work requires the same rigorous training as do other professions.

It is our intention in this article to point out the value of a scientific crime detection laboratory by the use of various illustrations, arranged for convenience in case form, as such problems may present themselves to medico-legal experts. Every case listed is within the realm of possibility, but they are used merely as the basis of the presentation of the technique of the scientist. Many of them represent, either in whole or in part, situations taken from the records of the Scientific Crime Detection Laboratory of Northwestern University, from incidents of privately conducted investigations, or from the case-files of the laboratories of Europe, where most of the methods employed have passed the stage of experimentation and now represent routine police activity. These

[2]Goddard, Scientific Crime Detection Laboratories in Europe, (1930) 1 Am. J. Police Sci. 15. See also Fosdick, European Police Systems. It should be noted that public recognition of scientific methods in detection is hampered by the practice followed in the United States of allowing the use of expert testimony by both the prosecution and the defense. As a result we find many so-called "experts" who are willing to pervert scientific data to fit the particular needs of such "experts." This misuse of "science" is not an indictment of scientific methods in general, but it does much to keep alive the skeptical attitude so prevalent among us. The fact that many psychologists are willing to demonstrate home-made "lie-detectors" with exaggerated notions of their utility, has made it necessary for the qualified specialists in this line to avoid court demonstrations of their methods of detecting deception. The testimony of incompetent persons who made the study of firearms a "hobby" delayed the acceptance by courts of the testimony of the highly trained specialists in firearms identification. One individual, a graduate of a school of pharmacy, has set himself up as an "expert" in twenty-three different lines and for the suitable price is willing to testify for either side in a criminal case. This, of course, has resulted in holding back general recognition of the usefulness of science in the detection of crime.

cases are arranged to show the part played by science in unravelling crimes—*cases impossible to solve by the ordinary standards of criminal investigation.* No attempt is made to explain in detail the methods employed; the idea is only to present situations wherein the services of a trained scientist may be of practical utility. We seek to avoid generalities or predictions, but it is hoped that the possibilities of the field may be made clear by the use of concrete examples.

I

The superintendent of a coal mine was found shot to death. Bullets removed from the corpse constituted the sole material evidence with which the police had to work. A firearms identification expert examined the fatal bullets and found that they were fired from a revolver of German manufacture, and of a particular type and caliber used during the World War. Although this fact in itself proved nothing as to the identity of the murderer, the police investigators were prompted to direct their attention toward a group of foreigners, three of whom had been discharged from the mine because of the dissatisfaction they aroused in fellow workers by advocating certain socialistic doctrines.

A search was made of the apartment occupied by these men, which resulted in the finding of a weapon fitting the description given by the expert who examined the fatal bullets. Test shots were fired from the pistol seized. When observed under a comparison microscope, it was evident from the matching of numerous marks made upon the bullets as they passed through the barrel of the pistol that both the fatal and the test bullets were fired from the same weapon,[3] the one found in the possession of the so-called "radicals."

[3]The mathematical probability of a duplication of the markings on a fatal bullet by those made upon another bullet fired from a different weapon is so remote that it is safe to assume that it is impossible. Osborn gives an interesting example concerning the probability of finding two individuals having eight distinct physical characteristics exactly alike. Applying Newcomb's formula—that the probability of concurrence of all the events is equal to the continued product of the probabilities of all the separate events —even with an extremely small fraction representing how frequently each point may be found, Osborn concludes that the possibility of a duplication is one in thirty-eight trillion and four hundred billion, or something more than thirty thousand times the total population of the earth. Osborn, Questioned Documents 2d ed., 226 et seq. The same principle holds true in the science of firearms identification. So, when a fatal bullet contains not eight, but usually a hundred or more individual and characteristic markings, it is reasonably safe to conclude that only a test bullet fired from the same weapon could duplicate these markings. For a detailed explanation

Fortified with this valuable circumstantial evidence, prosecution was begun against all three of the former employees. The testimony of the firearms expert was introduced together with enlarged photographs showing the striking similarity between the test and fatal bullets. A conviction seemed inevitable as the trial neared its end.

The case occasioned considerable interest in the community with public sentiment favoring the defendants. It seemed to be the consensus of opinion in the vicinity that the accused persons were being prosecuted as radicals rather than as criminals. Few people attached any significance to the unmistakable evidence that the pistol in question was the weapon used in the murder of the mine's superintendent.

However, the defendants were found guilty and sentenced to death. Shortly thereafter defense counsel signified their intention to request a new trial upon the ground of freshly discovered evidence. Meanwhile the presiding judge had received two anonymous letters threatening his life in the event of a refusal to grant another trial. One of the letters was typewritten, the other pen-printed. Nevertheless, the judge denied the application, and the defendants were hanged. But all difficulties did not end with their execution.

Within two weeks of the execution, a suspicious looking package was found in the basement of the judge's home. A maid servant picked it up and removed the string covering, upon which there followed a slight explosion from a bomb. Fortunately, a

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of the science of firearms identification see Goddard, Scientific Identification of Firearms and Bullets, (1926) 17 J. Crim. L. and Criminology 254; Churchill, Examination of Fire-arms and Ammunition, (1932) 25 Trans. Medico-Legal Soc. 82.

As to the admissibility of "ballistics" testimony in evidence see Wigmore, Identification of Bullet and Firearm, (1931) 25 Ill. L. Rev. 692; Serhant, The Admissibility of Ballistics in Evidence, (1931) 2 Am. J. Police Sci. 202; Buxton, The Science of Ballistics: Judicial Applications, (1931) 2 Am. J. Police Sci. 211; Baker, The Campbell Case, (1932) 3 Am. J. Police Sci. 21; (1931) 21 J. Crim. Law and Criminology 607; (1931) 29 Mich. L. Rev. 513; (1931) 4 So. Cal. L. Rev. 311; (1932) 66 U. S. L. Rev. 180. For an article concerning the difficulties attendant to the introduction of "ballistics" testimony in the trial court, see Wiard, The Cross-Examination of Expert Witnesses, (1931) 2 Am. J. Police Sci. 538. Firearms identification is now approved by the supreme courts of many states, and numerous citations to such cases may be found in the foregoing articles. The outstanding cases on the subject are: Evans v. Commonwealth, (1929) 230 Ky. 411, 19 S. W. (2d) 1091; People v. Fisher, (1930) 340 Ill. 216, 172 N. E. 743; State v. Campbell, (1931) 213 Ia. 677, 239 N. W. 715.

defect in the mechanism prevented damage other than minor injuries to the servant.

Among the salvaged remains of the bomb were three metal parts—a trigger, consisting of a flat plate of steel, and two rings, evidently cuttings from a small pipe. The nature and construction of the explosive, although home-made, indicated that the guilty party was one skilled in the use of machinery necessary to cut the parts into suitable sizes and shapes. An investigation was made of the neighborhood wherein resided the most rabid sympathizers and friends of the men found guilty of murdering the mine superintendent. Suspicion fell upon an employee of the mine who had an unusually well equipped workshop in his home. A search of the premises revealed a release mechanism on a gas engine similar to that found on the bomb. This piece of mechanism, together with a flat piece of metal and some small pipes found in the workshop, was taken to a laboratory for metallographic analysis. Through this method a comparison was made under the microscope of the crystalline structure of the bomb trigger and the metal taken from the suspect's workshop. The surfaces of both were polished, and upon the application of a chemical reagent the microscope disclosed not only similar crystalline structure and arrangement, but also a most unique type of crystals seldom found in that particular kind of steel. This, of course, made the situation look even more suspicious. Then again, the rings to which the trigger was attached appeared to be strikingly similar to the pipe found in the workshop.[4]

[4]In a Wisconsin case the testimony of an expert along the lines outlined above played an important part in the prosecution of a bomb-sender. See Mathews, Metallographic Analysis in Crime Detection, (1930) 1 Am. J. Police Sci. 439. And the use of this evidence was approved by the supreme court of Wisconsin. See Magnuson v. State, (1925) 187 Wis. 122, 203 N. W. 749. Perhaps this is the most remarkable case to be found in the law reports concerning scientific crime detection. Testimony was also admitted to prove that the handwriting on the paper wrapper was that of the defendant; that a round fountain pen had been used—one similar to a pen found in the defendant's possession; that the ink used to address the bomb gave the same chemical reaction as that found in the defendant's fountain pen; that an analysis of the glue used to fasten down the string disclosed the fact that it was of the same kind as that found in the defendant's possession; that the sawdust taken from the defendant's workbench was of white elm—a significant fact because the defendant denied that he had ever worked with elm (a piece of which had been used in the construction of the bomb). Regarding the propriety of the trial court's admission of all this circumstantial evidence the Wisconsin supreme court stated: "The sufficiency of the evidence to sustain the verdict in this case is not challenged. We have, however, set out the evidence with greater

Unquestionably this particular mechanic was in some way connected with the manufacture of the bomb. Nevertheless, the prosecution was reluctant to proceed upon this evidence alone. It then was resolved to obtain specimens or standards of the penprinting of members of the accused's household, together with samples of the typewriting of a machine belonging to the mechanic's daughter, for the purpose of comparison with the threatening letters received by the judge prior to the execution of the three "radicals." These standards were taken to an expert in document examination. The individual characteristics of the penprinted threatening letter were identical with the standards obtained from the mechanic's brother who was living in the same house. Although eight similar individual characteristics would render the possibility of a duplication extremely remote, the handwriting expert found considerably more.[5] The standards obtained from the typewriter indicated beyond doubt that the threatening letters were written upon the same machine. Here, too, the expert found distinctive similarities which satisfied the mathematical improbability of a duplication.[6]

The trial of the mechanic and his brother had not proceeded very far when they changed their pleas from not guilty to guilty. They also gratuitously furnished information proving that the previous jury did not err in accepting the "ballistics testimony" in rendering its verdict against the three "radicals."

II

Early one morning the police received a telephone call reporting a murder at a road-house located in a sparsely populated sec-

particularity than would ordinarily be warranted under such circumstances, because it discloses what may be done by a diligent prosecuting official 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."

[5]On this point see Lee and Abbey, Classification and Identification of Handwriting 40 et seq. Also supra note 3. See Sellers, Science and Advancement in the Examination of Questioned Documents, (1932) 3 Am. J. Police Sci. 110; Walters, Rex. v. Mike Hack—Handwriting in a Murder Trial in Western Canada, (1932) 3 Am. J. of Police Sci. 47. Also an interesting article, accompanied by photographs, on the handwriting aspect of the Loeb-Leopold case: Wood, The Loeb-Leopold Case, (1930) 1 Am. J. Police Sci. 339.

[6]The possibility of a coincidence of scars and deformities is as remote with typewriters as with persons. Osborn, Questioned Documents 598 et seq. The mathematical probability of the particular divergences of one typewriter uniting with those of another machine is at best only one in ten billion. Ibid.

tion along a country highway. The informant, a professional gambler, was the owner of the establishment. According to his story he and the murdered man were the only ones present after a small crowd of gambling customers had departed; they were standing near a window when the report of a shot was heard outside the house, and immediately thereafter his friend dropped dead with a bullet through his head.

Apparently substantiating the gambler's story was a bullet hole in the window pane. There was nothing about the position of the dead body to discredit the explanation given. Moreover, a pistol containing two discharged cartridges was found along the roadside. There were no fingerprints[7] upon it, and its serial number was defaced by filing, presumably for the purpose of preventing the tracing of ownership to the perpetrator of the deed.

The gambler himself had a revolver in his possession, but obviously not of the caliber which fired the fatal shot. Nevertheless, the police were not convinced of the truthfulness of the story given by their informant, especially since an examination of the surrounding premises failed to reveal any footprints or traces of the mysterious third party involved. This fact induced the investigators to make an effort to determine whether the bullet was fired from the direction pointed out by the witness.

An expert, who had done considerable experimentation as to the effect of missiles piercing glass, was called into the case. He carefully examined the window pane, and although consulted only to determine the angle from which the bullet entered the room, he concluded from the nature of the break that the bullet was not fired from *without* but from *within* the very room in which the body lay. The basis for this decision was the discovery that the splintering was not on the inside of the window pane, as would have been the case had the shot been fired from without, but that it was on the outside of the glass.[8] This seemed to be damaging

[7]The science of fingerprint identification is admitted in evidence without much difficulty, owing to the fact of its universal application and acceptance. As to the technical aspect of fingerprints, see Henry, Classification and Uses of Fingerprints, 6th issue of 4th ed.; Wilder and Wentworth, Personal Identification, 2d ed. Also see Garson, Finger-Print Evidence, (1906) 3 Trans. Medico-Legal Soc. 1.

[8]"When the destructive force is applied to a particular area of one of the surfaces of the glass pane (we call it the 'front' one), the glass bends outward because of its elasticity. When the elastic limit is exceeded, it cracks along lines which radiate from the point of application of the force, as a center. These cracks originate on the opposite surface of the glass, for it is here that the greatest tension is produced. The front surface upon

to the suspect's cause in view of his admission that he and the murdered man were the only persons in the room at the time of the shooting.

The discovered pistol was taken to a laboratory where chemicals were applied to the filed surface in an effort to determine its serial number, thereby possibly supplying some information as to its ownership. Shortly after the application of an etching fluid the unknown numbers began to appear[9]—826137. A telegram was sent to the manufacturer requesting a history of the weapon. The reply stated that the owner of the gambling establishment had purchased the weapon directly from the factory about ten years previously.

When confronted with this evidence—one of his own pistols, with two discharged cartridges, and a broken window pane bearing testimony of a bullet being fired from *within* the room admittedly occupied by the two men alone—the gambler confessed to the murder. He admitted that after shooting his companion he fired a second shot through the window pane, placed the body in a position to bear out this carefully planned explanation, wiped his fingerprints from the revolver, then walked to the porch and threw it as far as possible from the road-house and yet close enough to the highway so that it could be found easily, and thereby divert suspicion.

III

While passing through a wooded field on her way home from school, a young girl was seized from behind and a cloth was thrown over her head and face. Then she was brutally assaulted. A short time later a suspect was arrested and identified by the child, but since she had not seen her abductor very well it hardly seemed possible to secure a conviction upon her testimony. Moreover, common knowledge of the unreliability of eye witness testi-

which the force is applied is in compression. This situation may be easily illustrated if we bend a sheet of heavy cardboard together—the rear surface cracks." Matwejeff, Criminal Investigation of Broken Window Panes, (1931) 2 Am. J. Police Sci. 148, 156.

[9]When numbers are stamped upon metal (whether it be on an automobile engine or gun) the underlying surface is also affected. Consequently, when the numbers are filed off, unless all effects of the stamping are removed, there remains a portion of the metal containing vague contour lines of the figures. Although the numbers are made invisible by the filing process, this etching fluid finds its way into the minute crevices and permits discernment of the serial numbers.

mony even under the best of conditions induced the officials to attach little credibility to the child's identification.[10]

An examination of the scene of the crime revealed a cleverly constructed blind consisting of fir branches and saplings simulating the surrounding growth. The branches had been cut with a large pocket knife apparently the same size as that found upon the suspected individual. This fact alone meant nothing, except as vague and worthless circumstantial evidence. And yet, in this case an expert positively demonstrated that the knife found upon the accused was the one which had been employed to cut the material used in the blind. This identification was made by utilizing the same principles by which it is ascertained whether or not a fatal shell or bullet came from the particular weapon in question. *No two natural or man-made objects are ever precisely the same*—they often may appear to be so, but with the assistance of the microscope they may be shown to be entirely different.

When placed under the microscope the markings made by the knife used to cut the branches corresponded identically with those made upon similar wood cut with the accused's knife. And the possibility of a duplication of the numerous markings by another knife was as remote as in the cases of fired shells, discharged bullets, handwriting, and typewriting.[11] When the blade of a knife is examined under a powerful microscope, the apparently smooth edge appears jagged and rough, resembling the teeth of a saw. Each irregularity in the blade naturally leaves a corresponding impression on the object cut, which impression cannot be duplicated by any other cutting edge. As a result of a demonstration of this fact the jury found the defendant guilty, and upon appeal the admission of this evidence was sustained by the Supreme Court of Washington.[12]

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[10]See, for example, a recent collection of cases illustrating the danger of relying upon eye-witness identification: Borchard, Convicting the Innocent.

[11]Supra notes 3, 6.

[12]State v. Clark, (1930) 156 Wash. 543, 287 Pac. 18. The opinion stated: "Courts are no longer skeptical that, by the aid of scientific appliances, the identity of a person may be established by finger prints. There is no difference in principle in the utilization of the photomicrograph to determine that the same tool that made one impression is the same instrument that made another impression. The edge of one blade differs as greatly from the edge of another blade as the lines of one human hand differ from the lines of another. *This is a progressive age. The scientific means afforded should be used to apprehend the criminal.*" (1930) 156 Wash. 543, 549, 287 Pac. 18, 20. (Italics added.)

IV

The last time anyone had seen X was when he stopped his automobile to give a ride to a stranger. X was a traveling salesman, and because of his unscheduled itinerary his disappearance was not noticed until some days after he was seen with this unknown person.

Foul play was suspected. The police authorities of neighboring towns and states were given a description of both car and stranger. Some time later one Y was arrested for violating a traffic regulation. At the police station someone suspected him of being the person sought in connection with the unexplained disappearance of X. Both Y and the car seemed to answer the general description.

In an effort to explain his possession of the car, Y produced a bill of sale, actually signed by the missing man, but indicating that perhaps the signature was obtained under duress. Also, there was in the suspect's possession a watch belonging to X. Not satisfied with Y's explanation the authorities held him for further investigation.

After news of Y's arrest was circulated, the police were informed that he was suspected of being involved in four other cases in which the supposed victims were never found. Consequently Y was thought to have employed some ingenious method of disposing of the bodies of his victims.

The suspect was taken to a laboratory where he was tested on a "lie detector"—the Keeler Polygraph.[13] As was expected, his

[13]No person is forced to submit to the test, but the impelling motive for willingly submitting is the fear that a refusal may indicate guilt and the confidence in the uselessness and ineffectiveness of the test itself.

This particular "lie-detector" is a mechanical device registering changes in blood pressure and respiration accompanying emotion, by which it is possible to determine whether or not persons undergoing interrogation are replying truthfully. Mr. Leonarde Keeler, who perfected the instrument now known as the Keeler Polygraph, has conducted approximately fourteen thousand tests within the past eleven years. In some seventy-five per cent of those cases in which the records indicated guilt full confessions have been secured. The "lie-detector" is used frequently by Chicago banks to detect embezzling among employees. In one instance a bank desired to detect the embezzler of a sum of five thousand dollars. Tests were run upon all fifty-six employees but, instead of finding one liar in the group, twelve were discovered. Of the twelve, nine confessed to embezzlements hitherto unknown to the bank officials. For a detailed description of the "lie-detector," and a discussion of the physiological principles involved, see Keeler, A Method of Detecting Deception, (1930) 1 Am. J. Police Sci. 38. See also McCormick, Deception Tests and the Law of Evidence, (1927) 15 Cal. L. Rev. 484, (1931) 2 Am. J. Police Sci. 388.

A "lie-detector" must record two or more bodily changes, for no one

record indicated false answers to questions asked to find out whether or not he had murdered the missing man. But the important problem was to find the body, since the first step in criminal prosecution in homicide cases is the proof of death. He was asked whether his victims were poisoned, shot, drowned, etc. A specific response was recorded as to shooting. (Incidently, a pistol was found under the seat of his car.) Then he was questioned as to the method of disposing of the bodies. "Did you burn them?" "Did you bury them?" Numerous questions of this type were asked, to only one of which the suspect responded in a guilty fashion. He had buried the bodies. But where? Where was the body of X? After numerous questions to that effect, such as "near the river," "by the railroad," "in a cemetery," Y responded specifically to "cemetery." The next inquiries were directed toward the exact location. A map of three states in which Y might have disposed of the body was shown to him. His record indicated a false response as to one of these. Attention was directed then to that particular state. A larger map was procured, and divided into ten sections of the state. By a similar process nine sections were eliminated. Finally, the possible area was narrowed down to one and one-half square miles, within which were two small cemeteries. At this point of the investigation Y became so incensed that he jerked away the equipment and proceeded to pound upon the machine with his fists, rendering it unserviceable.

A careful examination was made of the burial grounds. One grave in particular gave evidence of tampering. After digging therein a short time, the body of X was unearthed about three feet beneath the surface. The modus operandi in disposing of the victims of this particular criminal was to take the body to a cemetery in which there had been a recent burial. He would dig into the freshly disturbed mud and there place the lifeless body of his

change can be depended upon to give true and significant responses to deception. The psycho-galvanic reflex is a valuable indicator in some cases. It indicates the change in skin resistance to electric current, which is an extremely sensitive criterion for changes in an individual's emotional state, but it cannot be relied upon alone. The blood pressure, pulse and respiration are indispensable responses in order to get a reliable cross-section of psychophysical reactions. A record of the combination of all these bodily variations is most desirable for detecting deception.

It must be remembered that the successful use of any such device depends largely upon the skill of the operator in selecting the questions propounded and correlating the emotional responses. This is something an untrained "psychologist" cannot do!

victim. In this clever manner Y thought he had completely disposed of the corpus delicti; and were it not for the "lie-detector" the body might never have been discovered.

V

One cold wintry day, after heavy rainfall, an inhabitant of a small town departed from his home for an afternoon's hunt in nearby fields. The next morning his dead body was found riddled with buckshot. Some few yards away from the place where the body lay was a fired shell and also footprints, apparently those of the person who fired the fatal shot. The footprints led to a muddy road, at which place began the tire tracks of an automobile. Appearances indicated that the murderer escaped from the scene in a vehicle which left the tracks imbedded in the mud.

Because of the paucity of any further clues it seemed highly desirable to preserve the perishable evidence of the footprints and tire tracks. An expert skilled in the technique of "Moulage" (a method of making casts)[14] was employed to make permanent impressions of both footprints and tire tracks by this process of trace fixation. In the resulting casts there were preserved even the most minute details such as the number of nails in the shoes and the small holes and cuts in the automobile tires. Consulting available data it was determined what type, size, and make of tires were used on the automobile in which the murderer escaped.

There was only one person in the community who had any noticeable dislike for the murdered man. Suspicion fell upon him. When questioned, he denied any knowledge of the unfortunate event. But the tires of his automobile checked as to the size and make of those from which the "Moulage" casts were made.[15] The suspect was held for further investigation. Then it was found that the prints of his shoes were similar to the footprints at the scene of the crime. But the suspect denied even using his gun recently. Here again a fallacy was detected; an expert in the use of firearms positively determined that the gun had been fired

[14]See Watzek, Searching for and Recording Circumstantial Evidence, (1930) 1 Am. J. Police Sci. 272. Also, Goddefroy, A Process of "Moulage" for Reproducing Marks Indicative of Forcible Entry and Molding Those Left by Tools, (1932) 3 Am. J. Police Sci. 42.

[15]See Chavigny, Tracks of Vehicles, (1930) 1 Am. J. Police Sci. 156, for a discussion of tire prints in general. For an example of such a case in which tire prints played an important role in a criminal prosecution in Pennsylvania, see Paessler, The Cessero Case, (1930) 1 Am. J. Police Sci. 193.

only a short time previously, and judging from a few unburned grains of powder lodged in the barrel he ascertained that it was of the same kind as that used in the fatal shell. Yet there was a more certain and definite test. A cartridge was fired from the gun belonging to the suspect. Examined under a microscope, the marks left by the firing pin and the breach face of the gun upon the head of a comparison shell were identical with those found upon the fatal shell itself. The possibility of another firing pin or another breach face leaving the same number and kind of markings was infinitely remote.[16]

Ordinarily, proof of the fatal shot being fired from the accused's weapon would not constitute sufficient evidence to sustain a conviction, because such testimony does not place the gun into the hands of the suspect. But in the instant case the preserved footprints and tire tracks constituted sufficient circumstantial evidence for the jury to render a verdict against the accused for murder in the first degree.

VI

One night the report of a pistol shot was heard from the kitchen of a dwelling house. The occupant was found dead, and there was no indication of suicide. Upon investigation by the police they found none of the conventional traces of a criminal who came to commit burglary and killed when taken by surprise. The mute evidence remaining was an apple bearing teeth marks, apparently made by the person who had stalked about the kitchen after entering through its window.[17] By examining the teeth impressions upon the apple, it was determined that the teeth were wide apart, and that two of the upper set, one incisor and a canine, were broken at the edges. This eliminated the deceased as the person who bit into the apple, because almost all of his teeth in

[16]Supra, notes 3, 6, as to the mathematical probability of a duplication. The firing pin is that part of the mechanism which on the pull of the trigger strikes the shell, causing the explosion. Because of the machining operations it undergoes in the course of manufacture it acquires characteristic markings which are impressed upon the center of the shell. The breach face markings are made when the empty shell is hurled violently back against the breach face as a result of the recoil. These are characteristic and distinctive of that particular gun and no other, just as much as finger-prints vary with each person. See Mezger, Heess, and Hasslacher, Determination of the Type of Pistol Employed from an Examination of Fired Bullets and Shells, 89 Archiv. für Kriminologie 1, 93; (1931) 2 Am. J. Police Sci. 473, (1932) 3 Am. J. Police Sci. 124.

[17]This may seem strange—eating food when the mission is to steal—but it is a common occurrence.

the upper jaw were false and unbroken. A number of suspects were apprehended, and one of them was arrested upon the basis of the similarity of his teeth with the markings found upon the apple. (Researches have indicated that teeth are distinctive in much the same way as are fingerprints.)

Obviously the apple would not remain as evidence until the time of the trial of the suspected murderer who, of course, could be expected to secure continuances. Here, again, science came to the aid of the criminal investigator. A "Moulage" cast was made of the teeth impressions. And it played an important part in the circumstantial evidence which finally brought about the criminal's conviction.

Today the permanent record of the same teeth impressions—the "Moulage" cast—adorns the prosecutor's desk, long after the apple itself has become a disintegrated mass.

VII

In another homicide case the only clue to the possible identity of the murderer was a bloody coat found a short distance from the scene of the crime. The victim was a stranger in the community. Before burial, however, a "Moulage" cast was made of his face, thereby leaving with the police a permanent means of subsequent identification long after the interment of the body. (And true enough the victim was identified in this manner.)

Although some inference could be drawn as to the size and weight of the owner of the coat, it seemed to yield no further information. On the inside lining of one of the sleeves, however, there was a faint trace of a laundry mark. The numbers were not discernible to the naked eye, nor was a magnifying glass of any help. At the particular laboratory to which the coat was taken, the lining of the sleeve was placed under ultra-violet rays, artificially produced by means of a mercury vapor arc lamp.[18] And as though some unseen hand was at work, the fluorescence given off by the ink which had been absorbed deeply within the cloth disclosed three letters and two numbers—"F. E. W. 26." A check-up on the laundry records of the community traced the ownership of the coat to a person whose name corresponded with the initials.

[18]For detailed information as regards the application of ultra-violet light to the detecting of crime, see Pacini, The Ultra-Violet Detective, (1930) 1 Am. J. Police Sci. 237; Goodman, Medico-legal Uses of Filtered Ultra-Violet or Black Light, (1930) 1 Am. J. Police Sci. 260.

After being arrested the suspect admitted that the coat belonged to him but denied that the blood was of human origin. According to his explanation, as is usually the case, it was the blood from an animal—this time the blood of a rabbit which had been shot and carried over his shoulder. Not wishing to soil his car he "hung the rabbit on the door handle and threw the old coat away at the point where found." This explanation seemed plausible, in view of the fact that blood was found only upon the back of the coat. Moreover, the suspect had been hunting rabbits about the time stated. Perhaps this coherent story might have won his freedom, were it not for the result of a serological test proving the blood to be that of a human being and not that of an animal.[19]

While in the county jail, the owner of the bloody coat requested the privilege of communicating with a friend of his, known to the police as a dangerous character. The accused was not anxious for a personal interview, but preferred to write a letter. Although there appeared to be something queer about his choice, since this particular friend lived but a short distance away in the same city, the request was granted. The letter itself contained nothing more than a short paragraph requesting a friend to obtain a lawyer for the accused. Still suspicious about this peculiar arrangement, the keeper consulted the same expert who had unveiled the laundry numbers which led to the arrest, and was informed that possibly the letter contained some invisible means of communication. To test this theory the letter was placed under ultra-violet rays in the same manner as in the case of the lining of the bloody coat sleeve. To the utter amazement of the keeper and other on-lookers, the following message came into view between the visible lines: "You helped me get into this mess, now help me out of it. At one thirty tonight bring tools near my cell and whistle twice." In writing this message an ordinary

[19]The serological or precipitin test is based upon the fact that when an animal, usually a rabbit, is injected with defibrinated blood, (i. e., the serous or clear part of the blood) of an unrelated animal (e. g., a human being) an antiserum is produced in the rabbit's blood. This antiserum will precipitate the serum of the animal whose blood was injected. The precipitins are specific, that is, they precipitate only to the serum of the same species against which the rabbit has been immunized, and the tests may be made of very old blood stains; in one recorded case, after fourteen and one-half years. See Webster, Legal Medicine and Toxicology 178; Glaister, Some Results of Recent Medico-Legal Research in the Examination of Blood-Stains and Hairs, (1928) 1 Police Journal 62.

stick pin had been used with urine as the writing fluid.[20] This was a rather effective procedure, for all a recipient needed to do in order to bring out the invisible message was to place a hot flat iron upon the paper. Of course, the police authorities could have done likewise, but by the use of the ultra-violet rays there was no marring of the letter itself. The message was delivered to the unsuspecting party, the police retaining a photograph of the secret writing as disclosed under the ultra-violet, and preparations were made for the capture of another guilty participant in the principal crime as well as in the attempted jail break.

At the appointed hour the recipient of the secret message appeared near the jail house and whistled twice. A guard, armed with a shotgun, ordered him to surrender. What transpired thereafter only the guard and another member of the police force knew. According to their stories the man attempted to get away, stopped after having run about twenty feet and then turned around to shoot with his pistol, whereupon the guard fired upon him with the shotgun. The man died immediately.

The prosecuting attorney regretted the death of this accomplice, thinking that his presence as a co-defendant would have simplified matters. This, coupled with the fact that the police superintendent doubted the guard's story about the necessity for the shooting, prompted an investigation to determine the distance at which the gun was fired from the place where the deceased stood. It appeared that the guard fired from a distance much shorter than that which he stated. An expert in the use of firearms fired the guard's gun at various distances to determine the extent to which the shots scattered when they struck the large sheet of paper placed at distances of five, ten, fifteen, twenty, and twenty-five feet. These patterns, which disclosed the extent of the scattering of the shots, were compared with the pattern upon the body of the accomplice, and in this way it was ascertained definitely that the man was shot at a distance of not less than twenty feet, thus confirming the statement of the guard.

VIII

One cold windy night, fire broke out in a home located in an

[20]Lemon juice, milk, and starch water are a few of the easily accessible fluids which may be used as a means of invisible communication. For a list of the numerous possible methods see Kytka, Description of Methods by Which Secret Communications May Be Prepared—and of the Procedure Employed to Render them Visible, (1930) 1 Am. J. Police Sci. 326.

exclusive residential district of a suburb adjoining one of the country's largest cities. The flames enveloped this once beautiful structure in a relatively short time, and before the arrival of fire engines it was completely destroyed. Two adjacent buildings were badly damaged. No one was home at the time the fire started, and consequently no explanation was obtainable as to its origin.

A member of the fire investigation bureau proceeded to investigate the premises the following morning. Accompanying him was a representative of the insurance company which had issued a policy covering the loss. The rapidity with which the fire spread, the recent depreciation in property values, and the fact that only a short time before the owner of the building had incurred severe financial reverses, when considered together, suggested the possibility of arson. In fact, a cursory examination prompted another of a more thorough nature.

Although the house had been burned almost to its foundation, the investigators discovered that under the remains of each bed there was a considerable amount of short pieces of charred wood and ashes apparently different from the charred wood and ashes which remained from the burned floors. Without disturbing the arrangement, plans and sketches[21] were made of the premises and its contents, and photographs were taken of the materials and surroundings under each bed.[22] Then samples were secured of the burned material, which appeared to have served the purpose of kindling wood, also parts of the flooring both under the bed and some distance away. These specimens were taken to a laboratory containing proper equipment for conducting a microscopic examination.

Within less than a week after the fire the insurance company denied liability for the loss. Moreover, the police authorities prepared to instigate proceedings against the owner of the building

[21]As to the importance of making diagrams, etc., of the scene of the crime, see Gross, Criminal Investigation; Hutchinson, Plans and Sketches; 1 Shore, Crime and Its Detection 183.

[22]Photographs of evidence prove invaluable to the prosecution's cause in numerous cases. An enlarged photograph is far more impressive to the jury than the best verbal description given by an expert witness, regardless of his capability. Especially is this true in matching the markings left by rifle barrels upon fatal and test bullets, or in matching the impressions made upon fatal and test shells by the firing pin or breech face, and in the comparison of handwritten or typewritten questioned documents with the genuine specimens.

for violating a statute making it a crime to set fire to buildings with the purpose of defrauding an insurance company. And it was upon the following evidence that the prosecution was begun and successfully carried on: from all indications it appeared that the fire had originated under the beds; and moreover, the cross checks on the burned flooring at those places indicated that some material had burned there with a hotter flame than is produced by the burning of normal wood.[23] It was certain from the results of microscopic examinations that the short pieces of charred wood under the bed were of pine, whereas the floor boards of the house were of cypress, and the beds of birch.[24] Probably the most valuable evidence, and that which impressed the jury most of all, was that indicating that kerosene had been used upon the wood kindling and also upon the floor board area under the beds.[25]

IX

The body of a young girl was found by the side of a lonely road. She had been strangled to death, and there was evidence of rape. Apparently her body had been thrown from an automobile. Not the slightest material clue remained as to the identity of the criminal. The girl herself was identified; the approximate path she traversed on the day of her death was known—but nothing more.

An investigator proficient in the use of a microscope, and possessing adequate knowledge and data concerning the structure and chemical composition of soil, vegetable matter, particles of dust, and such other substances, was called upon to furnish a possible clue. Working carefully he took samples of scrapings

[23]When wood burns normally, the cross-checks on the charcoal have a definite size, but the checks are finer and closer together if some material is present that burns with a hotter flame than wood.

[24]The differentiation between charcoals from different kinds of wood depends upon the presence of perforations in the wood, the size and proximity of which are characteristic for wood from various species of trees. For instance, birch charcoal shows series of minute perforations very near to each other, while pine charcoal has large perforations much wider apart. Mitchell, Science and the Detective, 1 Shore, Crime and Its Detection 78.

[25]Every combustive liquid leaves its own telltale mark on the wood. For example, if turpentine is burned on pine, the photomicrograph shows long rough ridges with cross cracks. If it was linseed oil, the ridges are higher and more uniform. A rough plane without cross cracks indicates that alcohol was used. If the plane is smoother, but with cracks, kerosene was employed, and if the plane is smooth with large cracks, then gasoline was the agent that carried the fire. Wolfe, Fire Detectives Make Ashes Talk, (1932) 56 Popular Mechanics 917.

from the soles of the shoes worn by the victim.[26] The dust from the clothing was removed very cautiously by beating it into a large paper bag. Upon returning to his laboratory, this microscopist, whose methods had been scoffed at by persons who witnessed his procedure, prepared slides of the specimens obtained, and then studied them under the microscope. In both instances he was able to determine the presence of slaked lime, which is sometimes used as fertilizer, grains of oats, and small particles of straw. What did this indicate? That very likely the girl had been in a farm barn recently, and presumably at the time she was ravished. Not only did the microscopic examination reveal this, but it also pointed out the particular barn. After searching the various farm buildings of the vicinity, one was found in which there was a supply of slaked lime, scattered grains of oats, and straw. This happened to be the only farm in the community upon which slaked lime was used for fertilizing purposes. The farmer, his family, and the farm hands were questioned. But, of all these persons the police were looking for a particular one who should have a scratch upon either neck or face. Why? Because a microscopical and chemical analysis of the finger-nail scrapings taken from the deceased revealed the presence of skin and blood cells. Much to the surprise of many persons present, a farm hand's face had a large scratch upon it, running from the eye down to the lip. He explained its presence there as being the result of an encounter with a piece of wood in the dark the night before. The situation began to look suspicious, and a further search was made of the clothing worn by this particular individual. His garments worn the previous night were examined to see if they bore stains of seminal fluid. To determine this, the stained portions were placed under filtered ultra-violet light, where they fluoresced with a lavender color characteristic of the chemical composition of seminal fluid. The area involved was marked off, and bits of material were cut out for microscopical study, which revealed the presence of individual spermatozoa. When the investigation reached this

[26]In this connection see Gross, Criminal Investigation 144; Locard, Dust and Its Analysis, (1928) 1 Police Journal 177; Schatz and Saale, Dirt Scraped from Shoes, as a Means of Identification of Dust Traces, (1930) 1 Am. J. Police Sci. 55; Locard, the Analysis of Dust Traces, (1930) 1 Am. J. Police Sci. 276, 401, 496. Especially note pp. 496 et seq., containing a group of twenty-two actual cases in Europe where the criminals were detected by knowledge obtained from analyses of dust traces. See also Mitchell, Circumstantial Evidence from Hairs and Fibres, (1930) 1 Am. J. Police Sci. 594.

point it came to an end, for the suspect broke down and confessed that he had committed the crime.

X

A young girl was found choked to death. Medical examination disclosed the fact that her murderer had forced two fingers down her throat and compressed the larynx until suffocation resulted. There was no evidence other than this, with the exception of a few strands of hair between the victim's fingers. The hair was taken to a scientific crime detection laboratory where a microscopic examination revealed certain peculiarities latent to the naked eye.

As a result of the study of the hair by a microscopist who had devoted considerable time to research along these lines, an approximation was made as to the age of the murderer.[27] Moreover, the expert was able to say that the hair came from a brunette who was approaching baldness. This further fact induced the police to search for a rather elderly individual—at least one with hair fitting this description.

Equipped with this information the police apprehended one of the victim's friends, the least suspected of the lot, because of his advanced maturity over the girl's other suitors. Nevertheless, he fitted the description in every respect. After his arrest a sample was taken of his fingernail scrapings. Upon microscopical examination they were found to contain epithelial cells and human blood corpuscles. Chemical tests further confirmed the presence of blood.

Undoubtedly the presence of the tissue and blood under his fingernails would have required considerable explanation before he

[27]The principle upon which this new method of identification is founded is the number of tiny rings on a single shaft of hair. In growing, rings are formed upon the hair shaft at right angles to its long axis, and by counting these rings it is possible to approximate a person's age. For instance, in the case of a young person the rings are far apart. In the hair of an old person they are found much closer together. A comparison with records of known hair samples enables a qualified expert to determine age fairly definitely. E. Carleton Hood, of the Scientific Crime Detection Laboratory of Northwestern University, is accredited with having discovered this method of identification in 1931, after nine months of research. As to the importance of hair in criminal investigation see Gross, Criminal Investigation 131 et seq. Often the position of hair fibres in the clutched hand of a victim will indicate whether or not they were placed there as a plant rather than having been extracted from the head of an assailant. See also, Glaister, Some Results of Recent Medico-Legal Research in the Examination of Blood Stains and Hairs, (1928) 1 Police Journal 62.

could sustain an alibi, but the accused was spared this difficulty when he committed suicide while awaiting trial.

XI

One Sunday morning the police received a telephone call from a woman stating that her husband had committed suicide in their bedroom. The police found the body with a pistol in one hand and a bullet wound through the head. But the body was cold already. In fact, rigor mortis had set in, which indicated that death had occurred before the time stated by the wife of this man.[28] That fact provoked further investigation. A man identified as the wife's paramour was questioned, but he denied having any knowledge of the affair. He seemed so convinced of his innocence that he consented to a scopolamine (truth serum) test.[29]

While under the influence of this drug, which had been administered by a sub-cutaneous injection, the subject was asked "what he did with the pistol after the killing." To this question he replied: "I threw it into the river." As to the disposition of the body he stated that he covered it with branches. At this point the interrogators were in a quandary because obviously nothing like this could have taken place in the instant case. For that reason the questions were repeated. The subject then answered that he "hid the gun in a house and threw the body into a river in Ontario." *He also gave the name of the victim.* After further questioning the man stated that the woman in the instant case shot her husband, but that he did nothing more than strike the husband with his fist. Evidently the suspect was giving *more information* than he expected to give, and certainly *more* than the officers had counted on receiving.

When the subject regained consciousness, he was told that he had implicated himself and that he should sign a written confession to that effect. But he merely laughed at the experts, be-

[28]Cadaveric rigidity appears generally within five or six hours and disappears from twenty-four to thirty-six hours. Webster, Legal Medicine and Toxicology 76. (Much depends, however, upon the state of the body at death.)

[29]Scopolamine is used frequently in obstetrics cases under the commonly known name of "twilight sleep." It was in such a case that the "truth telling" effects of the drug were first noticed. A few injections of scopolamine will depress the cerebrum to such a degree that it destroys the power of reasoning, consequently paralyzing the "inventive faculty" of lying. See House, The Use of Scopolamine in Criminology, Texas State Journal of Medicine (Sept. 1922), (1931) 2 Am. J. Police Sci. 328.

ing firmly convinced that the test was worthless. Then he was reminded of the time when he threw a pistol into a river, and "covered the body with branches." Upon hearing this the man's face paled. He was reminded of the "murder in Ontario." Then came the climax. He slumped in his chair and made a complete confession. He told how the husband in the instant case arrived home and found him there as an unwelcome guest. There was a struggle with the husband; the wife ran for a pistol and placed it close to the husband's head and fired, without her paramour knowing of her intentions.

As to this particular crime the man apparently was guilty only of being an accessory after the fact, *but the authorities in Ontario* had a clear cut case of murder in the other killing to which he had confessed while under the influence of scopolamine. After the woman had been convicted of the murder of her husband, her friend was taken to Canada where he paid the extreme penalty for the murder which would have gone unavenged were it not for this new and powerful instrument for the detection of crime—scopolamine.

XII

The cashier of a bank was suspected of covering up his shortage by manipulating his accounts and by even changing the dates upon some of his receipts. There was one receipt in particular which was questioned concerning the genuineness of its date. The year 1924 was written upon it, when in fact it should have been 1921. But there seemed to be nothing irregular about the figures themselves. Nevertheless, the bank officials consulted an expert in document examination.

After viewing the figures—1924—under a microscope, the handwriting expert suspected that different ink had been used in making the angular portion of the four than was employed in making the 1921. A bit of hydrochloric acid was placed upon all four numbers. The result plainly indicated an alteration, for the angular portion of the four turned a purple red, whereas the other figures turned blue green. Evidently iron gall ink had been used when the original figures were made, whereas the alteration was made with logwood ink. Both inks give different color reactions when they come in contact with hydrochloric acid.

Although the embezzler in this case made a good job of the

actual penning of the forgery, he displayed his ignorance of inks when he used the wrong kind in making the alteration.[30]

XIII

In a homicide case the inference to be drawn from the nature of the wound and the circumstances surrounding the crime was that death had been effected by means of an axe or some such similar instrument. No clues were left at the scene of the crime. Nevertheless, suspicion fell upon a neighbor who was on unfriendly terms with the murdered man. This particular individual owned an axe, but a cursory examination of the instrument yielded no clue. Nearby, however, was found a piece of burned cloth with another bit of fibrous matter within. When questioned whether or not the charred mass contained some destroyed evidence, perhaps human hair or tissue wiped off the axe blade, the suspect stated that it consisted of house sweepings containing dirt and stray hairs from his pet watch dog. The explanation seemed plausible enough; there was no blood on the axe; there was a dog lying on the carpet by the door; the suspect's wife stated that her husband had not left home upon the night of the murder. In spite of all this, the burned mass, together with the axe, was taken to a laboratory for examination.

An expert made a careful study of the burned contents, and concluded that there was no trace of the presence of animal hair fibres, but he found distinct evidence that the so-called sweepings contained human hair. This was unbelievable. How could such an assertion be made after a microscopic examination of a mass of burned trash? And yet the evidence was unmistakable. The effects of burns upon human and animal hairs are vastly different.[31] Satisfied upon this point, a careful examination was made of the axe blade itself. It is almost impossible to clean a cutting edge sufficiently to prevent the finding of evidence under a microscope, and sure enough, imbedded in a niche upon the cutting surface was found a piece of hair fibre. Upon examination is was ascertained beyond doubt that the fibre was from the head of a human being, as evidenced by the arrangement of the pigment, which is

[30]See Popular Science, October 1931, for a similar case. For an account of the detection of forgeries as a result of study of the inks used, see Osborn, Questioned Documents 449 et seq.

[31]After being burned, hair of human origin has a tendency to hook over and twist back upon the unburned portion, whereas that of an animal does not. Supra note 27.

entirely different from that of animal hairs. Moreover, this particular fibre found on the axe was similar in texture to that of the victim. And when slides of cross sections of the evidence hair were examined under the microscope, there appeared a striking similarity of the pigment. When confronted with the expert's finding, the suspect confessed to the crime. He himself attached considerably more weight to this than a jury might have done. At any rate he bemoaned the fact that he had not thrown his axe into a nearby stream, taking a chance of explaining away its absence.[32]

XIV

The owner of a cheap rooming house seemed most unfortunate in the health and welfare of her boarders. Within a period of five years three of them had died, and apparently all had suffered from the same general ailment. In each case the owner collected on one or more life insurance policies. No one policy exceeded five hundred dollars, and for that reason the insurance companies did not concern themselves unduly with the peculiar surrounding circumstances. Finally another roomer, this time the woman's own nephew, died in a similar fashion. Needless to say, she was also the beneficiary under a policy taken out on the life of the deceased. Since death had resulted from a seemingly chronic condition, the physician, none too skilled in his profession, proclaimed death due to ulcerations of the stomach. Another relative of the deceased, however, became suspicious and requested that an autopsy be performed for the purpose of ascertaining whether or not there were traces of poisoning.

The report of the toxicologist attributed death to arsenic poisoning, and the police began their search for evidence by which they might determine the guilt of the suspect, if such were the fact. There were no traces of arsenic on the premises, and the neighboring druggists had no record of purchases of poison being made by the suspect. However, the investigators did locate in the basement of the rooming house an unusually large supply of flypaper of the toxic type. Although little significance was attached to this finding, the toxicologist who made the chemical analysis determining the true cause of the nephew's death was re-

[32]Until scientific testimony is generally accepted in evidence, the results of scientific investigation prove to be of most value in inducing confessions, as suggested by this case.

quested to examine the paper. He recognized it as that particular kind composed of a sugar coating containing sodium arsenite, and informed the prosecutor that it was a relatively simple matter for a person to soak the paper in a pail of water and thereby extract sufficient arsenic to obtain a lethal dose.

Armed with this circumstantial evidence, together with the suspicious factor of the insurance policies, prosecution was commenced against the accused. And the evidence proved to be so convincing that she is now serving a life sentence for the murder of her nephew.[33]

XV

The body of a young girl was found floating down a river. A post mortem examination indicated that the girl had been pregnant for about three months at the time of her death. An examination of the stomach contents indicated that shortly before her death she had eaten a large quantity of grapes.

There was village gossip to the effect that the young girl and one of her suitors had been holding tryst near the river in a garden in which there were numerous grapevines. Suspicion was cast upon the young man in question, but he denied having been near the regular meeting place within a week prior to the time when the body was discovered.

The investigators inferred that if the deceased had been eating grapes while in the orchard, her assailant probably did likewise. This prompted them to make an examination of a stool specimen of the suspected individual, but only after he had committed himself further by stating that he had not even eaten grapes within the previous week. Curiously enough the stool specimen, when examined under the microscope, revealed the presence of grape seeds as well as the undigested portions of grape skin. Thus science had exploded another seemingly perfect alibi.[34] Without further inquiry the suspect confessed that he had pushed the young girl into the river because of his fear of the consequences of an illegitimate birth to which he was a contributing factor.

XVI

A man was found dead near the water front of a seaport, with

[33]As to the scientific methods of detecting the presence of arsenic in human organs, see Blyth, Poisons: Their Effects and Detection 554 et seq., 5th ed. Also, Webster, Legal Medicine and Toxicology.

[34]See Gross, Criminal Investigation.

his hand clutched about his own knife. From all appearances it seemed that the victim died while making a feeble gesture to stab his assailant as a means of protecting himself after he had been felled by a deadly blow from some blunt instrument. This suspicion seemed to be confirmed when the blade of the knife was examined carefully under a microscope. Upon it were fibres of some fabric, apparently from the trousers of the assailant.

The results of the microscopic examination were very encouraging. The fibres on the knife blade were found to be of blue serge similar to the material used in the trousers worn by sailors.[35] It so happened that at that particular time there was a United States battleship in port. Consequently, the police authorities obtained permission of the commander to conduct an investigation. At the very moment when the officer and the investigators entered the crew's quarters there was a sailor seated upon his bunk mending a tear in the leg of his trousers. He was questioned as to the killing, and thereupon he readily admitted the homicide.

According to the sailor's story, he was returning to the ship in a slightly intoxicated condition when the deceased attempted to hold him up, faking his knife for a pistol. Upon discovering the sham, the sailor grappled with his assailant and then picked up a stick and struck him upon the head with it, which blow caused his death. Realizing his perilous position, he disposed of the bloody stick and hurriedly made his way back to the ship.

Police fingerprint records of the deceased were on file at the bureau of identification, and since the reason for their being there was due to the arrest and conviction of this particular individual for a similar crime committed five years previously, the truthfulness of the sailor's version of the affair seemed probable. As a result, the sailor appeared to have a certain defense, and the charge of murder against him was dropped. The solution of the affair, however, was dependent upon the careful study of a few tiny fibres hardly visible to the human eye.

Conclusion

The old sailing vessel, the stage coach, the horse and buggy

[35]A properly equipped crime detection laboratory will contain mounted specimens or enlarged microscopical photographs of the fibres of various clothing material such as wool, cotton, linen, silk, etc., in the raw state as well as dyed. By comparison with known specimens, the particular fibre or fibres found upon the scene of a crime may give an indication as to the clothing worn by the criminal. See in this connection Barnes, The Identification of Cloth in Criminal Investigation, (1931) 4 Police Journal 44.

all made a stand to retain their importance in the program of modern man. So it seems with all things as they approach the threshold of obsolescence. And the old time "common sense" detective is no exception. However, he is not likely to disappear completely. There will remain always a need for the detective who is acquainted with criminals and who knows their habits. In apprehending offenders much may be said in favor of the "drag net" methods. But guess work in dealing with suspects in most cases should be supplemented by deductions to be drawn from scientific data. All police departments must concede eventually that science can be of direct aid in the detection of crime, but at the same time the scientist must not forget that without the cooperation of an intelligent police force all his efforts would go for naught. As an illustration: an expert in firearms identification *can determine* whether a certain gun fired the fatal bullet, but it remains for the police first to find the gun and then the man who fired it. As has been shown in most of the illustrations used in this article, science is of greatest importance in the verification of suspicion, but it is primarily the concern of the police to secure suspects and bring them to the scientist.

Sooner or later the numerous methods of detecting crime scientifically will find their way into the courts as evidence of the guilt or innocence of an accused. In our zeal to safeguard the rights of a person on trial for a criminal offense, we have reached a point where the defendant seems to have all the advantages. The state must prove its case beyond a reasonable doubt. Ordinary circumstantial evidence often fails, and frequently only slight consideration is given to scientific evidence even in those cases where it is admissible. The criminal can utilize the latest scientific developments to commit a crime, but only a few of the latest methods of detection can be used to convict him. This defect in our administration of criminal justice is not attributable solely to the attitude of the courts. There remains a vast amount of research to be done in the field of scientific crime detection, and the field must be cleared of amateurs and "quacks." But reliability in scientific detection seems due to arrive before the criminal courts are ready with the stamp of approval.

Every step in the promotion of scientific crime detection is a step toward the abolition of the cruel and ineffective methods of establishing criminal identity, such as the "third degree," and

also a step toward the realization of a criminal trial unhampered by technical procedure and unreliable evidence. The use of brutality by the police in securing confessions, the reception of flimsy testimony as to identity, and the ineffectiveness of circumstantial evidence may be curtailed by more reliance upon scientific data and less reliance upon individual "reasoning."