

The Criminal Investigation Process and the Role of Forensic Evidence: A Review of Empirical Findings

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ABSTRACT: Highlights from the major empirical studies on the criminal investigation process, and the role played by physical evidence in that process, are reviewed in light of findings from empirical studies on the effects of forensic analyses on criminal cases. The review reveals that most criminal cases do not involve the use of any physical evidence and that such evidence, even when available, is seldom seen by police detectives as having any intrinsic value. Detectives use physical evidence primarily to strengthen their position vis à vis the suspect's for the purpose of clearing cases by confession. Nevertheless, some research shows that physical evidence improves clearances and convictions in burglary and robbery cases, which traditionally have low case resolution rates. Enhancement of the use and value of physical evidence to investigators, crime laboratory specialists, and others involved in criminal processing requires improved communication and collaborative efforts. Training of police and prosecutors should be particularly emphasized because they have the most to say about whether and how physical evidence is used in the investigation of criminal cases.

KEYWORDS: forensic science, criminal investigation, forensic evidence, investigation process, detective work

Among the modernized countries in the world, the US has the highest rate of reported crime, even though most crimes are never made known to the police (1). Moreover, for every 1000 serious crimes that are committed in the US, the police make only about 100 arrests (2). If one considers only major crimes tabulated in the Uniform Crime Reports (UCR) as index offenses (murder, rape, robbery, assault, burglary, larceny, motor vehicle thefts, and arson), about one in five results in an arrest and, of course, a far smaller percentage result in a conviction in court (1,3). Most of these convictions are a product of the plea bargaining process, not typically the outcome of evidentiary presentations in judicial proceedings (1,2). These figures, based on the most definitive sources of national crime statistics, show clearly that the police are generally able to resolve only a small proportion of the crimes to which they respond.

Among the crimes that are investigated by the police, including those that result in a court conviction, most do not involve the use of physical evidence (4). In fact, the role of such evidence is

a limited one in most investigations, and the outcomes of criminal events are even less frequently influenced by scientific analyses. Thus, the use of physical evidence and application of the forensic sciences, in spite of the popular perception to the contrary, are not prominent in reality; systematic sleuthing and scientific successes do not characterize the criminal investigation process or what might be called, in other words, detective work.

The purpose of this paper is to review and discuss this facet of the criminal investigative process and the role that physical evidence plays in it.³ In doing this, there are two lines of empirical findings that will be considered. The first of these deals with research on police detectives and the investigative process, derived from studies carried out since 1966 in the US, Canada, and Japan. The second approach includes studies in the US regarding the uses and effects of the forensic sciences in criminal cases; these studies relied primarily on either nonpolice data or on information only partially derived from police sources. Thus, the two types of studies reviewed here serve complementary purposes. In considering both types, then, it will be possible to shed some light on both the nature of the investigative process as it is now practiced and how scientifically analyzable evidence is viewed in that context. In addition, because both kinds of studies offer insight into the investigative process from different perspectives, this review provides a basis for informed commentary on how the use of physical evidence particularly and the forensic sciences generally might be bolstered.

The Criminal Investigation Process

The literature reviewed here pertaining to the criminal investigation process includes the eight major research studies carried out directly or indirectly on "detective work" from 1966 through 1992. These projects examined detective work in both federal and local law enforcement agencies and, in addition, two were based on observations made in foreign countries, specifically Canada and Japan. Hence, where appropriate, commentary on apparent cultural effects on detective work will be possible. There are two limitations to be noted about this review. First, only the essential findings in the studies are considered. That is, the focus here is to highlight the major similarities in empirical results in order that the essence

³The terms "physical evidence," "forensic evidence," and "scientifically analyzable evidence" are used throughout this paper somewhat synonymously. This is done because, unfortunately, in most of the research on the criminal investigation process, a distinction is seldom made between physical evidence that can be and typically is submitted for scientific analysis and that which is not. Because researchers have not been specific with respect to physical evidence that is "forensic" in nature and that which either was not scientifically analyzed or was not capable of being so analyzed, we have assumed that the availability of physical evidence also indicated an ability to carry out standard forensic tests.

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of the investigative process, as it is now understood, is made clear. Second, this review is restricted to consideration of investigative work that is reactive in nature. Studies that have centered on proactive, or instigative, efforts such as those which typify drug and other vice crime investigations are excluded. With these points in mind, let us now turn to the review of the literature on detective work.

The first reported study that is informative of the police investigative function is the now classic work by Skolnick (6) in 1966. Although his study focused on "street policing," not investigators, *per se*, it did, nevertheless, provide insight into how detectives function in the police subculture. What Skolnick found was that police officers, in fulfilling their mandate for investigation of criminal events, find themselves in a hostile, dangerous, and isolating environment. Neither the public nor the courts are "on their side"; they are forced to adapt to these conditions. In doing investigations, they recognize the limits of science and scientific advancements in helping them fulfill their mission; they emphasize, therefore, the human aspects of their craft. They make the "facts" that they observe into evidence, meaning that they convert criteria governing investigative matters from personally meaningful to legally binding ones. In other words, for consideration here, physical evidence has no inherent meaning and generally is useful only to the extent that it can be used to gain police-defined objectives. Skolnick asserts, in fact, that advances in technology only "make the police more competent to interfere with individual liberty" (6) and thus he offers up a degree of skepticism—maybe cynicism—about the use of technology to improve the police investigative mission.

In the decade after Skolnick's work, the seminal study on police detectives, commonly known as the Rand Study (5), was reported. This controversial research showed that police detectives contribute little to the "resolution" of crimes, and that most arrests for most crimes are actually made by patrol officers. More to the point, however, the study also revealed that the police collect far more physical evidence—especially fingerprints—than they can productively process and that, aside from fingerprints, scientific evidence is of little usefulness in most cases. For these reasons, the Rand authors recommended that police agencies make greater use of specialists to collect and process physical evidence. Enhanced use of information systems was suggested as a means of improving the productivity of investigators and the utility of forensic evidence.

In his study of detective work in a county sheriff's department, Sanders (7) observed detectives working juvenile offenses, burglaries, and major crimes. It is of interest to note that in this 225-page volume, the value of scientific (scientifically analyzable) evidence in detective work is mentioned in fewer than ten pages scattered throughout the work. Sanders views such evidence as "information," or leads, and focuses his presentation on how detectives recognize these. Essentially, as Skolnick (6) also observed, the value of physical evidence rests on the detective's ability to "interpret" it. Physical evidence "is made available for practical use only through the interpretive schemes employed by the detectives. Without their interpretive work physical evidence would not only remain mute, it would cease to exist" (7). Nothing by itself, independent of this interpretive work, is recognizable as information; the "facts" do not speak for themselves. Sanders goes on to explain that physical evidence is rarely used to identify a suspect independent of witnesses' testimony. Instead, it is used primarily during the interview of a suspect to persuade him to admit to the crime and "get the whole thing over with" (7).

In a research study that was reported almost simultaneously with the Rand study, Wilson (8) reported on investigative work by the Federal Bureau of Investigation (FBI) and the Drug Enforcement Agency (DEA). The work of the agents in these two agencies was "investigative" and "instigative," respectively. That is, DEA agents instigated cases for investigation, and for that reason, the focus here is only on Wilson's observations of FBI agents. In fairness to Wilson, it should be noted that his interest was in organizational and contextual features of the work environment rather than in investigative work *per se*. This shows clearly in his effort because he did not directly address the impact or effects of physical evidence. But he does echo the essence of findings reported by others. That is, once a suspect is identified, the primary investigative task is to develop confirming evidence. In other words, evidence becomes most useful after a suspect has been identified, not before. According to Wilson, then, detective work has less to do with physical evidence than with other activities; it boils down to this: "Whether developing an informant, speaking to a victim or witness, or canvassing the neighborhood of the crime, the essential task and critical skill of the detective is his ability to conduct a productive interview" (8).

In a study that appears to have been an attempt at correcting some of the claimed misimpressions of investigators created by the controversial Rand Study, Eck (4) looked closely at detective work in three cities, focusing on burglary and robbery cases. What he found was that the collection of physical, scientifically analyzable evidence is accomplished primarily during the preliminary investigation phase conducted by the patrol officer before the involvement of detectives. (Although this may be somewhat surprising, it is essentially a consequence of the routine police response to crime. As was pointed out by Meesig and Horvath (9), patrol officers are typically the first officers to respond to a reported crime and thus have the initial opportunity to collect evidence, make arrests, and resolve cases.) In many police agencies, burglary and robbery cases that are not resolved by patrol officers during their initial response to and preliminary investigation of the crime, are referred to detectives, who typically comprise only 10 to 20% of a department's sworn personnel, and who are primarily responsible for follow-up investigations. The referred cases are reviewed, and the ones deemed to be most solvable are actually assigned for investigation. One of the factors that is often considered in determining the likelihood that a case is solvable is whether or not physical evidence was collected during the preliminary investigation by the patrol officer.

Eck (4) found that physical evidence is actually collected in only about 10% of the cases. Such evidence, however, was never observed to lead to the identification of a suspect but, as was found in other studies, it was used primarily after the identification of a suspect as a means of buttressing legal proceedings. Eck recommended, as did the Rand study, that specialists be used to collect evidence and that such collection should be emphasized when the evidence could be put to use in either identifying or prosecuting suspects. He concluded that the use of evidence in investigative work could be improved by enhanced police information (computer) systems.

In many ways, the most interesting and informative study on the investigative process is Simon's (10) recent year-long ethnographic study of homicide detectives in Baltimore. Because Simon observed only homicide detectives, one would anticipate that the value and prominence of physical evidence would be especially evident. And, indeed, in a certain way, this expectation is realized. Simon puts it succinctly that it is the "holy trinity" that solves

crimes—physical evidence, witnesses, and confessions (10). He explains that, without one of the first two, there is little chance that a detective will find a suspect capable of providing the third. Physical evidence, viewed in this way, provides leverage, and without physical evidence, there is often stalemate. Further, the detective and his or her view of the context of the case and the evidence are critical to the process. The postmortem examination, for example, is shown to be essentially valueless when viewed out of the context provided by the detective's knowledge of the case and his or her particular investigative skills. But Simon elaborates on this theme by stating: "There are, of course, those sacred occasions when physical evidence itself identifies a suspect" (10). These occasions, however, even in homicide investigations, are rare. In reality, it is personal questioning (e.g., interviewing and interrogation) that leads to a confession—at least from the detective's perspective—that is of greatest importance in most cases. Without a confession, there is nothing left of the investigation. The witnesses, the crime scene, and even the physical evidence might never be known without information provided by the suspect.

Now, let us briefly turn to the two major studies produced in foreign countries where, of course, the formal and informal rules of the criminal investigative process vary somewhat from those found in the US. For example, in both of the studies reviewed here, it was reported that the role of the patrol officer in conducting preliminary investigations is typically much more limited than in the US. In these studies, detectives are shown to have major responsibility for almost all investigative activities.

In his Canadian study, Ericson (11) reported that detective work involved essentially the gathering and manipulation of information, people, and rules to effect a desired outcome. He focused on the interpersonal transactions among detectives and their clientele. Although physical evidence and scientific analyses—did not play a major role in investigations, it did help to convict a suspect once he or she was identified. But, of the 295 cases Ericson observed, 86% involved no reported physical clues whatsoever. Moreover, even when physical evidence was available, it often was not used. When it was, it was primarily for the purpose of gaining leverage during interviews and interrogations to produce confessions.

In the most recently released study, Miyazawa (12) reported that even though evidentiary rules are much more liberal in Japan than in the US and Canada, detectives there still rely primarily on interviewing and interrogation to investigate crimes. What is of interest here, however, is that generally the ordering of events is the reverse of what is shown in North American policing. Confessions are of primary interest; they are the first sought evidence. Detectives interrogate—and the legal rules seem to accommodate them—not merely for the sake of a confession, but for the purpose of a conviction. Physical evidence is sought to corroborate and authenticate confessions. In other words, physical evidence is of minor, only secondary importance; it is used essentially to create opportunities: i.e., to convict the accused, to develop intelligence, and to resolve additional investigations.

From this overview of the investigative literature, two major themes are prominent. The first of these is that detectives view investigations within the context of their knowledge and skills (6,7,10). Because their training in and knowledge of physical evidence and scientific analyses are limited (13), they tend to focus on the human aspects of investigations, primarily interviews and interrogations over which they have the most control (6–8,10–12). For these reasons, physical, scientifically analyzable evidence has little inherent meaning to detectives, and it plays a very subordinate role in the great majority of criminal investigations (6,7,10). The

second related point to be made is this: Even when it is available, physical evidence has value corresponding only to the investigator's ability to interpret it appropriately within the context of the investigation (6,7,10). Currently, detectives use physical evidence primarily for its practical value as leverage to assist in either obtaining or corroborating confessions (4,8,12) and in collecting intelligence (7,10). Seldom is physical evidence relied upon solely for its intrinsic value in identifying or locating a suspect (4,5,7,10,11).

These two themes—investigators' view of physical evidence and their use of it—appear to be well established features of detective work. These findings are even more noteworthy when one considers that the studies that produced them involved several different research methodologies, were carried out over a period of more than two decades, and were performed in quite different cultural, social, and legal contexts of three countries.

Effects of Scientific Evidence

There are only three recent empirical studies of the use and effects of scientific evidence in criminal cases in the US. All of these studies, which were carried out by Peterson and his colleagues, were generally well conducted and are the best current sources of information on the topic. In the first study in 1984, Peterson, Mihajlovic, and Gilliland (14) retrospectively reviewed 2700 criminal cases that had been selected randomly from police and crime laboratory files in four separate jurisdictions, namely Chicago, Peoria, Kansas City, and Oakland. Their purposes were twofold: to determine the extent of use of physical evidence in the investigations and to evaluate the effects of scientifically analyzed evidence on the resolution of the cases and the apprehension and prosecution of suspects.

In a second study, Peterson, Mihajlovic, and Bedrosian (15) conducted a survey of all federal, state, and local crime laboratories in the US to determine the services provided, number of personnel, evidence caseloads, scientific and research activities, and relationships with user agencies. The survey response rate was 81% (257/319 usable questionnaires).

In the third study, Peterson, Ryan, Houlden, and Mihajlovic (16) used a variety of data-gathering strategies to assess the uses and effects of forensic evidence in the adjudication of felony cases. In this project, they interviewed prosecutors, defense attorneys, and forensic scientists; they also conducted exit surveys of former jurors and reviewed several thousand randomly chosen felony case files from prosecutor jurisdictions in six cities across the US. (These cities were the four included in the 1984 study, plus New Haven and Litchfield).

For the purposes of presentation here, the important findings in these studies relevant to the investigative process are considered with respect to evidence collection, evidence analysis, and case outcomes. In this discussion, the two major themes identified in the review of the criminal investigative process provide a focus for presentation.

Evidence Collection

The research on the investigative process shows clearly that physical evidence is not collected in most cases investigated by police; when it is collected, much of it is not scientifically analyzed; and when it is analyzed, it is used not to promote investigative efficiency, but rather to bolster prosecutorial proceedings (4,5,11,12). Unfortunately, the literature is almost silent on the issue of whether or not, even in the most important cases, physical

evidence is actually available but remains uncollected. An early study that addressed this issue was carried out by Parker & Peterson (17). In this unique research, observers who accompanied investigators to crime scenes noted that physical evidence was actually available in a far greater proportion of crimes than would be determined by crime laboratory submissions. For example, over 80% of the burglaries investigated showed the presence of physical evidence; yet, such crimes constitute only a small percentage, perhaps less than 5%, of requests for scientific analyses. Moreover, in these as in certain other offenses, multiple forms of potentially useful evidence were noted. An analysis of these findings in light of the role played by crime laboratories and evidence collection specialists in the investigative process can be found in an early monograph by Peterson (18).

In those situations in which physical evidence is collected, however, Peterson, Mihajlovic, and Gilliland (14) found that most is submitted for laboratory analysis by evidence technicians and others who specialize in crime scene processing, rather than by patrol officers who respond to crimes, or by detectives who conduct follow-up investigations. (We note here that the use of crime scene specialists may well have been a specific feature of the particular sites chosen for analysis in the Peterson et al. study or, if it is a more general practice, a response to recommendations made in the controversial Rand study, cited earlier). Moreover, it was shown that although specialists collect crime scene evidence, it is patrol officers and detectives who collect evidence from suspects; but the extent to which suspects are searched for physical evidence varies widely among jurisdictions.

Because evidence collection at crime scenes is the responsibility of specialists, this finding, at the least, raises the question of whether or not the specialists' knowledge, skills, and understanding of the context of the investigation are, in fact, superior to those of either patrol officers (who respond to the crime) or detectives who carry out the follow-up investigation. In other words, because it is known that the value of physical evidence, to detectives at least, is strongly associated with how they view the context of an investigation, there is reason to suggest that this is also the case with specialists. Thus, at the present time, there is no basis for suggesting the specialists as opposed to detectives or patrol officers actually improve the odds that the most important, or the most meaningful evidence actually will be collected. This also, of course, suggests that the practices of specialists might not actually improve the use of evidence even if it is collected.

In most criminal investigations, it is the patrol officer who initially responds to and collects the majority of physical evidence (4). This collection usually precedes that done by either specialists or detectives. Thus, in most instances, what the patrol officer does during this preliminary investigation has a significant impact on whether the case will survive the case screening process, and be assigned for follow-up investigation (4). Therefore, if in this initial response, there is a failure to recognize or to collect potentially valuable evidence, particularly from a suspect, the case outcome is likely to be adversely affected. Although some of the research recognizes this concern, the empirical data on the use of physical evidence fail to differentiate between that which is collected by patrol officers and that which is collected by others (detectives or specialists) subsequent to the initial response; hence, the point at which intervention to improve evidence collection might be made is, at this time, unknown.

One of the recommendations made by Peterson, Mihajlovic, and Gilliland (14) was that clear written policies and criteria be established among police departments and crime laboratories to

provide direction regarding the types of physical evidence to be collected and when it will be examined. Whereas this is a logical and necessary recommendation, the research on detective work suggests that such action would be significantly short of the mark. What appears to be requisite to improve the evidence collection process is the implementation of policies and practices that enhance the collaborative efforts and understandings of those who collect, process, and ultimately make use of evidence. That is, because it is known, for instance, that detectives view the value of physical evidence in a quite restricted way, primarily for the leverage it provides in interrogations, enhancement in their understanding of the relationship between the collection of physical evidence and its value in the further processing of criminal suspects is necessary.

Evidence Analysis

Peterson, Mihajlovic, and Gilliland (14) found that far more physical evidence is submitted to crime laboratories than is actually analyzed; this is true, by the way, whether the evidence is collected by specialists or detectives (4,5). Excluding alcohol and drug analysis (which comprises almost two-thirds of laboratory workloads), the most frequently collected kinds of physical evidence are firearms, fingerprints, blood, hair, and semen. With the possible exception of fingerprints, most of these forms of evidence, of course, are generally unavailable in many types of crimes (14). Physical evidence is analyzed for the purpose of identification and classification, for associating a suspect with a crime, and for exculpation. However, many types of analyses are of little value with crime scene samples alone. For example, to associate a suspect with a crime (which is of paramount importance to investigators in most cases), a crime scene sample and a standard from a suspect are required. Hence, in many cases, unless a suspect has been identified, the crime scene evidence is typically not analyzed because it has no intrinsic ability to identify an offender who is otherwise unknown. Moreover, even when a suspect is available, scientific analysis often does not produce an individualized result; that is, it does not conclusively confirm a suspect's involvement in a crime.

It can be seen, therefore, why the two lines of research—that on detective work and that on the effects of scientific evidence—reveal that in the cases in which physical evidence is found, far more is collected than is analyzed. However, whereas the detective work literature, at least in its early stages (4,5), suggested that the use of specialists as opposed to investigators themselves would alleviate this problem, the more recent literature dealing with the effects of physical evidence shows that this is not true (14). Even when there are no evidence standards for comparison, collected evidence may not be analyzed for other reasons, including limitations in the availability of scientific methods and shortcomings in information systems. Thus, analysis of evidence is not a facet of investigations that can be improved merely by changes in the personnel who collect it. As Peterson, Mihajlovic, and Gilliland (14) recommend, what is required is a much closer coordination and collaboration among investigators, evidence specialists, and others involved in the processing of evidence if improvements are to be expected.

This recommendation is generally consistent with the finding that the use of physical evidence depends on the ability of the investigator to interpret it within the context of a specific crime. Investigators, generally, may have only a minimal understanding of the practical needs and constraints involved in scientific evidence analyses. This, of course, negatively affects their ability to appreciate the use of scientific analysis as it relates to their investigative

work. Similarly, the efforts of specialists may be limited or misdirected for the same reasons. Without some understanding of the nature of a case and its investigative development, specialists may not be able to prioritize effectively the analysis of evidence or to proceed with the most appropriate analyses likely to link suspects to crimes. Indeed, in some cases, they may not even recognize physical items as evidence to be collected unless they have knowledge of the nature and context of the investigation. Thus, improvements in the mutual exchange of information among investigators and others involved in the collection, analysis, and use of physical evidence would enhance the value that such evidence has in cases in which it is available.

Physical Evidence and Case Outcomes

Peterson, Mihajlovic, and Gilliland found that both clearance and conviction rates for burglary and robbery cases were significantly higher when physical evidence was collected and examined (14). For other case types, the effect of evidence analysis was less pronounced, varied by jurisdiction, and interacted with witness and suspect testimony. In a later study, Peterson, Mihajlovic, and Bedrosian (15) reported that laboratory officials considered forensic evidence to be of moderate importance in prosecutors' decisions to charge suspects; of greatest importance in corroborating suspect involvement in crimes during trial; and of minimal importance in the sentencing process. However, Peterson, Ryan, Houlden, and Mihajlovic (16) found that scientific evidence actually had little effect on prosecutors' decisions to charge and that confessions and tangible evidence (physical evidence that may link a suspect to a crime but which is not examined scientifically) had more impact than scientifically analyzed evidence in trials. Additionally, technical reports from forensic scientists and their trial testimony were found to have the greatest effect on the sentencing process, particularly with regard to increasing both the likelihood and length of incarceration.

Because scientific analyses of physical evidence improve clearance and conviction rates in certain cases, and also the sentencing process regardless of case type, it is likely that more attention may have even more pronounced effects. This is suggested by the fact that burglary and robbery case types typically have very low case resolution rates (burglary –13%, and robbery –24%) compared with other UCR index crimes (3).

Peterson, Mihajlovic, and Bedrosian (15) showed that forensic scientists differ from judicial and other criminal justice officials with respect to their views on the use and effectiveness of scientifically analyzed physical evidence. Possibly, these differing views arise partly out of disparities in knowledge regarding scientific issues and partly, perhaps, out of the roles these persons perform and the demands that are placed on them. These, as well as other explanations, seem to coincide with the findings on detective work that investigators view and interpret physical evidence only within the limits of their particular knowledge and skills. If so, it can be suggested that one of the significant improvements that can be made lies in better information management systems to monitor the collection and use of physical evidence and its effects on case outcomes. These systems, as indicated both in the literature on detective work (4,5) and on the effects of forensic evidence (14,16), need to be integrated across police, prosecutor, and court agencies to facilitate and enhance the understanding, interpretation, and use of forensic evidence.

Discussion

The literature reviewed here, the great bulk of that which is available on this topic, shows that the police investigate only a small percentage of crimes; that physical evidence is collected in only a small percentage of cases investigated; that only a small proportion of the collected evidence actually undergoes scientific analysis; and, in most cases, that physical evidence is not determinative of case outcomes. Sometimes, however, physical evidence makes a big difference in individual cases. Usually, though, the impact of physical evidence is seen in increased odds in favor of conviction, with little change in the odds of arrest or clearance. Yet, despite this minimal use of physical evidence and the problems surrounding it, such evidence—when used—appears to improve clearance and conviction rates in cases that traditionally have low resolution rates, and it also has been shown to play a role in certain court processes. The literature on the police investigative process consistently reveals that the use of physical evidence is limited by the knowledge and skills of investigators as well as the extent to which they are able to interpret it within the context of their investigations (6,7,10). Moreover, others involved in the processing of cases in the justice system seem also to be constrained by similar limitations. Thus, improvements in the collaborative efforts of investigative, crime laboratory, and other justice system personnel is one of the predominant needs if there is an expectation of enhancing the use of physical evidence.

In this review of the literature on the investigative process, it was noted that there were strong consistencies in findings across studies, whether carried out in the US, Canada, or Japan. Interestingly, this crosscultural similarity can also be seen in reports dealing with the effects of scientific evidence in criminal cases. In an early report by Ramsay (19) in England, for example, the police were shown to submit physical evidence for analysis in only a small proportion of cases; generally, these were the more serious crimes and the forensic evidence was used essentially to buttress legal proceedings against a suspect who had already been identified. Ramsay noted, furthermore, that one of the critical needs was improved communication among forensic specialists and police investigators; persons in these roles, as in the US, often have different, and sometimes, conflicting perspectives on the value of physical evidence.

In a recent paper, in part a follow-up to the Ramsay report, Roberts and Willmore (20) studied a small sample of criminal cases ($n = 27$) in England. In each of these, forensic evidence played a role in the legal proceedings and a variety of scientific and legal specialists involved in the proceedings were interviewed to determine how forensic evidence is produced, used, and abused. The findings in this study were parallel to those that have been reported in the U.S. Forensic evidence is actually used in only a small sample of the criminal cases that are processed; but, when used, such evidence can play a significant role in the court outcome. Moreover, Roberts and Willmore's results clearly reinforce a major concern raised by others: The disparate views of physical evidence held by those in the investigative and legal processes need to be reconciled so that the true value of such evidence can be realized.

The True Value of Physical Evidence

Scientific evidence and its presumed lack of bias and distortion, compared with the testimony of suspects, witnesses, and informants, has for a long while fascinated observers of our criminal justice process. And, over the years, the police have been urged to adopt a more scientific approach in their investigations and to

rely more on physical evidence and tangible clues than on personal accounts. Indeed, such a suggestion was implied, if not made explicit, in the now famous Escobedo and Miranda decisions of the US Supreme Court in the mid-1960s, which were based, in part, on the idea that scientific, objective means of resolving crimes were preferable to and more promising than interrogation and other forms of police activity. Clearly, since that time, judging from the available research, there has not been dramatic progress. In our view, one of the primary reasons for this situation is that sensationalized accounts of technological and scientific developments have oversold the actual advantages they offer in dealing with crime. In addition, the popular media, as well as other sources, often portray investigators and criminal investigations unrealistically; physical evidence and scientific analyses, in spite of their value, cannot make a "science" out of what may be often systematic and methodical but not scientific work. In the present environment of almost overwhelming workloads and constrained resources, physical, scientifically analyzable evidence, as valuable as it is in some cases, simply does not have much use in the great majority of criminal offenses that the police are called upon to investigate.

We would argue, however, that the current research literature is not an accurate reflection of the true value of physical evidence and scientific analyses. Rather, it may reflect as much or more the manner of practice in both police investigations and laboratory analyses than any inherent limitations in science and scientific evidence. That is, investigators and judicial personnel who are not familiar with the potential value of scientific evidence are less likely to use it effectively in their work. Moreover, evidence specialists who are not familiar with the context of the crime regarding which forensic evidence is collected, or the context of the judicial process in which the forensic analysis is presented, are less likely to conduct and report their analysis in the most effective manner.

The Need for Collaborative Training

These issues would suggest the need for more solid collaborative training efforts regarding the value, use and, importantly, the limitations of forensic techniques. We can envision programs at three levels: first, the forensic scientists; those who both collect and analyze physical evidence; second, the consumers of forensic services, including, of course, police officers and investigators; and, third and most importantly, those who make public policy decisions in this domain, specifically judges and prosecutors. It is the persons in these latter two groups who have the most to say about the degree to which there is reliance on physical evidence during the investigative process, and yet training efforts directed at them are rather sporadic, unsystematic, and uncoordinated. Surely, the promise of forensic analysis depends to a great degree on how well police, prosecutorial, and judicial officials recognize and respond to these needs. And indeed, it is likely that the extent to which such persons are made aware of forensic issues will affect the demand for more informative and scientifically sound research in this area.

Future Research

The studies reviewed in this paper reveal some important methodological problems to be dealt with in future research. With regard to the studies on the investigative process, it is clear that these researchers were primarily interested in the general nature of the process; they only peripherally, if at all, addressed the use of physical evidence, and showed even less concern about issues related to scientific analyses of such items. For this reason, the findings in these projects need to be supplemented with research

in which the role of evidence in the investigative process is made evident. Also, the police typically screen out and decline to investigate cases in which they claim there are no clues, or which otherwise appear unsolvable. By observing police work only in those cases that are accepted for investigation, as was true in some of the available research, the observations are biased in the direction of the choices made on the basis of prevailing practices. Hence, such studies may not consider crimes in which scientifically analyzable evidence may actually be available but which the police decline to investigate for whatever reason.

Because the effect of forensic evidence on case outcomes, as shown in the studies on that topic, varies with the type of case and the sites where the observations were made, there is a need to understand more fully the factors underlying these differences. However, the most important concern here is similar to the one found in the investigative literature: the findings pertain only to a rather selective sampling of cases—those which focus essentially on the experiential preferences of personnel involved in the police investigative process. By all accounts, these instances in which physical evidence plays an identifiable role are, statistically speaking, rather infrequent occurrences.

Thus, in conclusion, from both the investigative and forensic perspectives, it is apparent that research [similar to that reported by Parker & Peterson (17)] must be done that clearly distinguishes between those crimes reported to the police in which "scientifically analyzable" evidence is available and might be used, and those in which, in spite of the best informed efforts, such evidence cannot be detected. When it is possible to distinguish between such cases, it then will be feasible to assess the actual value of physical versus other forms of evidence in the criminal investigative, prosecutorial, and judicial processes.

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