Techniques of Crime Scene Investigation

Also by Barry Fisher

with David Fisher and Jason Kolowski
Forensics Demystified (2007)

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with William Tillstone and Catherine Woytowicz
Introduction to Criminalistics: The Foundation of Forensic Science (2009)

Techniques of Crime Scene Investigation

Ninth Edition

Barry A.J. Fisher and David R. Fisher

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In memory of the victims of terrorism around the world…may God avenge their blood.

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Foreword

The challenges facing law enforcement investigators in the 21st century are enormous! Never before in history has the investigation process been as complex and multifaceted as it is today. Individual criminals, small criminal groups, street gangs, and highly organized domestic and international criminal enterprises utilize sophisticated techniques to engage in their particular brand of criminal conduct. Additionally, extremely tech-savvy terrorist organizations and "home grown" terrorists pose a grave threat to public safety and are no longer exclusively investigated by federal authorities. Law enforcement investigators must be capable of dealing with the plethora of threats to public safety caused by criminals and terrorists who utilize innovative tradecraft and state-of-the-art technology.

Additionally, investigators are increasingly called upon to assist in their department's crime prevention mission. Successful police executives understand that investigators can no longer exclusively function in a reactive mode. During my years as the NYPD's Chief of Detectives (and before that, as the Deputy Commissioner of Operations directing COMPSTAT), "preventing potential unlawful activity" was a critically important element of the Detective Bureau's mission and the overall NYPD crime reduction strategy.

At the same time as they face these daunting challenges, investigators must address significant potential problems associated with the reliability of traditional investigative techniques involving eyewitness identification, interrogation, informants, and forensic science. Serious legitimate questions regarding these techniques have been raised by the Innocence Project and similar organizations, and this has had a very significant impact on criminal investigations and the entire criminal justice system.

In the face of these unprecedented difficulties, forensic evidence has never been more crucial to the criminal investigation process than it is now! *All* law enforcement personnel including the first responding patrol officer, assigned detective, crime scene investigator, intelligence analyst, and criminalist (as well as supervisors and executives) should be knowledgeable regarding the correct procedures involving forensic evidence recognition, documentation, preservation, processing, collection, invoicing, analysis, and storage. In today's challenging environment, it is absolutely essential that law enforcement personnel thoroughly understand and meticulously comply with the forensic evidence procedures that are applicable to their function in the investigation process.

For the past 20 years, it has been a singular honor and privilege to work with Barry A.J. Fisher and to call him my friend. As a world-renowned forensic scientist and former Director of the Los Angeles County Sheriff's Department Scientific Services Bureau, Barry Fisher has been a remarkable innovator and exemplary leader within the forensic science community. I am extremely pleased that Barry has included new material regarding Crime Scene Unit accreditation, the electronic crime scene, and the latest in DNA technology in this ninth edition of his ground-breaking book *Techniques of Crime Scene Investigation*. This book continues to be both a scholarly forensic science textbook and practical crime scene guide for law enforcement responders. *Techniques of Crime Scene Investigation* is a must-read for all law enforcement personnel involved in the criminal investigation process who want to ensure that they are complying with the proper techniques regarding crime scene processing and forensic evidence analysis.

Phil Pulaski
Chief of Detectives (ret.), New York City Police Department

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Preface

This is the ninth edition of this textbook. It seems like only yesterday when, in the late 1970s, I (Barry) was invited to revise a classic criminal justice textbook, *Techniques of Crime Scene Investigation*, which was first published in 1949 in Swedish under the title *Handbok i brottsplatsundersökning* and subsequently in English in 1964. The original authors were Arne Svensson and Otto Wendel, two police investigators from Sweden. In 1981, I revised the text in the third edition and since then have served as the principal author. My son, David, who is also a forensic scientist, joined me as co-author in the previous edition (eighth) and again in this latest ninth edition.

Readers may well ask why a new edition. The answer lies in the fact that there is an increased focus on forensic science due to several factors. One factor was the publication of the report by The National Academy of Sciences: *Strengthening Forensic Science in the United States: A Path Forward*.* Another factor has been the work done by the Organization of Scientific Area Committees (OSAC)† for Forensic Science. Finally, the debunking of a few forensic science disciplines that were long thought to have been based on sound science has increased the focus on forensic science in general, and crime scene investigation in particular, among the public. New practitioners and students of this field must be made aware of the increased scrutiny that they will face in the judicial system. Judges are taking a more involved role than ever before as far as the types of evidence and testimony that they allow into their courtrooms. No longer will substandard forensic science or crime scene investigation be acceptable.

Having said all this, criminal investigations remain as complex as ever and require professionals from many disciplines to work cooperatively toward one common goal: the delivery of justice in a fair and impartial manner. Police investigators, prosecutors, and defense attorneys must be able to use these resources to their fullest potential.

Science and technology applied to the solution of criminal acts solves crimes and potentially saves lives. Scientific crime scene investigation aids police investigators in identifying suspects and victims of crimes, clearing innocent persons of suspicion, and ultimately bringing the wrongdoers to justice. When the justice system is able to remove a criminal from society, innocent persons do not become new victims of criminal acts.

This book is about the proper and effective use of science and technology in support of justice. The ninth edition of *Techniques of Crime Scene Investigation* is written for students of crime scene investigation, police investigators, crime scene technicians, forensic scientists, and attorneys. The material presented in this text covers the proper ways to examine crime scenes and collect a wide variety of physical evidence that may be encountered at crime scenes. It is not possible to cover every imaginable situation, but this book is a guide that attempts to promote best practices and recommendations. The areas are discussed in general terms to give the reader some idea of the information that can be developed from physical evidence if it is collected properly. Few of the procedures mentioned in the book are not inviolable, meaning that readers should not presume that practices referenced in the text can never be modified. On the contrary, crime scene investigation requires a degree of common sense and innovation. It is not possible to conjure up every imaginable situation a crime scene investigator may encounter in a case.

We do not claim to be experts in each and every discipline presented herein. Neither will studying the contents of this text make you an expert in all types of crime scene investigations or forensic science. But we hope that it gives students, police investigators, and others engaged in or interested in the subject some insight into the field and helps interested readers to pursue further studies.

The use of forensic science in criminal investigations depends on a number of factors. Police investigators must be knowledgeable about the capabilities of the forensic science support services available to them and appreciate how to

* https://www.ojp.gov/pdffiles1/nij/grants/228091.pdf.
† https://www.nist.gov/osac.

use them effectively. Forensic practitioners must be familiar with police investigative procedures, the scientific theory that supports their own activities, and the legal aspects needed to convey the information from the crime scene to the members of a jury. Judges, prosecutors, and defense attorneys must understand the scientific and technological issues of the case and be able to work with the expert to admit expert testimony into court. Police agencies that run forensic science labs must fund them at an appropriate level to ensure quality, reliability, and timely service to the criminal justice system. All of these efforts require the cooperation and willingness of different professionals within the criminal justice system to work well together. Those of us who apply science and technology to the investigation of crimes have a duty to do our best for the criminal justice system we serve.

Acknowledgments

With each new edition, we write to our many friends and colleagues in the forensic science community throughout the world and ask them to share cases for a new edition while we continue to use interesting and informative cases from earlier editions. The following are those who graciously answered our request for cases, although we were unable to use all the material submitted.

The names are listed alphabetically:

Maj. Gen. Hassan Ahmed Al-Obaidly, Qatar Forensic Laboratory Dept., Doha, Qatar; Myriam Azoury, Division of Identification and Forensic Science, Jerusalem, Israel; Richard Bisbing LLC, Chicago, IL; Robert Blackledge, El Cajon, CA; Dr. John DeHaan, Fire-Ex Forensics, Inc., Vallejo, CA; Bridget Fleming, Forensic Science Ireland, Dublin, Ireland; Sandra Enslow, Los Angeles County Sheriff's Department, Los Angeles, CA; Ken Goddard, US Fish & Wildlife Forensics Laboratory, Ashland, OR; Tony Grissim, Leica Geosystems part of Hexagon, Monterey, CA; Mike Grubb, San Diego County Sheriff's Crime Laboratory, San Diego, CA; Dwane Hilderbrand, Forensic ITC Services, Scottsdale, AZ; Kimmo Himberg, Police University College, Tampere, Pirkanmaa, Finland; Edward Hueske, Forensic Training & Consulting, LLC, Palestine, TX; Ragnar Jónsson and Björgvin Sigurðsson, Reykjavik Metropolitan Police, Crime Scene and Forensic Unit, Reykjavik, Iceland; Major General Khamis, Dubai Police, Dubai, UAE; John Lentini, Scientific Fire Analysis, LLC, Islamorada, FL; Dr. Laura Liptai, Bio Medical Forensics, Moraga, California; Dr. Fuad Tarbah, Dubai Polic, Dubai, UAE; Tsadok Tsach, Division of Identification and Forensic Science, Jerusalem, Israel; Dr. Sheila Willis, Forensic Science Ireland, Dublin, Ireland; Wendy van Hilst, Forensic Crime Scene Dept., Politie Nederland, Amsterdam, The Netherlands; Ray Wickenheiser and Ronald Stanbro, New York State Police, Albany, NY; and Richard Wilabee (ret.), Los Angeles County Sheriff's Department, Los Angeles, CA.

Appreciation also goes to Dr. Kevin Parmelee, who reviewed portions of the manuscript and assisted in preparing companion PowerPoint slides and a test bank of questions to serve as teaching aids for educators who use the text.

We also wish to thank our editor, Mark Listewnik who was most patient with us in realizing the publication of this 9th edition. Vijay Bose from Deanta Global, our project manager, was instrumental in getting this book through the production process.

We cannot thank our wives enough, Susan and Deena, for their support and encouragement throughout this long project.

Finally, thank you to the Almighty for his continued blessings that He bestows on us and our families each and every day.

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About the Authors

Barry A.J. Fisher served as the Crime Laboratory Director for the Los Angeles County Sheriff's Department, a position he held from 1987 until his retirement in 2009. He began his career in criminalistics with the Sheriff's crime lab in 1969 and worked in a wide variety of assignments.

Barry is a member of many professional organizations. He is a Distinguished Fellow and past president of the American Academy of Forensic Sciences and was awarded the Academy's highest award, the Gradwohl Medallion. He served as president of the International Association of Forensic Sciences, president of the American Society of Crime Laboratory Directors, and a past-chairman of the American Society of Crime Laboratory Directors—Laboratory Accreditation Board.

Fisher has served as a member of several editorial boards: the *Journal of Forensic Sciences*, the *Journal of Forensic Identification*, *Forensic Science Policy and Management*, and the *McGraw-Hill Encyclopedia of Science and Technology*. He is a co-author of two other books: *Forensics Demystified* and *Introduction to Criminalistics: The Foundation of Forensic Science*. He has lectured throughout the United States, Canada, England, Australia, Singapore, France, Israel, Japan, China, Turkey, Portugal, and the United Arab Emirates on forensic science laboratory practices, quality assurance, and related topics.

Since retiring in 2009, Fisher has consulted for the United Nations Office on Drugs and Crime, the United States Department of Justice, International Criminal Investigative Training Program (ICITAP), and Analytic Services Inc., a not-for-profit institute that provides studies and analyses to aid decision-makers in national security, homeland security, and public safety.

Barry is a native New Yorker and received his Bachelor of Science degree in chemistry from the City College of New York. He holds a Master of Science degree in chemistry from Purdue University and an MBA from California State University, Northridge. Barry and his wife, Susan, live in Indio, California. He has two married sons and eight grandchildren.

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David R. Fisher is currently Director of the Forensic Science program at the New Jersey Institute of Technology (NJIT). The program is the first undergraduate forensic science degree program in the State of New Jersey. Prior to joining NJIT, David was a criminalist for 17 years in the Department of Forensic Biology at the Office of Chief Medical Examiner (OCME) in New York City. In that position, he worked on thousands of criminal cases including homicides, sexual assaults, and property crimes. He has testified in court and in the grand jury as an expert witness in forensic biology and DNA on numerous occasions. After the events of 9/11, he aided in the identification of victims of the World Trade Center terrorist attack. He is also a Medical Investigator with the Disaster Mortuary Operational Response Team (DMORT) under the National Disaster Medical System (NDMS).

David is board certified in General Criminalistics by the American Board of Criminalistics and is a Fellow in the American Academy of Forensic Sciences. He is also a Special Member of the Vidocq Society which provides pro bono expert assistance to the law enforcement community on solving their cold case homicides. In addition, he is a member of the Council of Forensic Science Educators and the New Jersey Association of Forensic Scientists. He received his Bachelor of Science degree in biochemistry and cell biology from the University of California at San Diego (UCSD) and a Master of Science degree in Forensic Science from the John Jay College of Criminal Justice of the City University of New York (CUNY). David, his wife Deena, and their three children live in New Jersey.

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Part I

The Crime Scene

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Chapter 1

Introduction

Crime scene investigation and forensic science have taken a dramatic turn in the past two decades. The entertainment industry has capitalized on the public's interest in crime scene investigation-based entertainment that features a heavy dose of science and technology. In 2000, the TV show *CSI: Crime Scene Investigation* was launched, followed by two spinoffs and a host of other shows of the same genre, such as *Dexter*, *Bones*, *and NCIS*. In addition, numerous documentaries on Netflix, Amazon Prime Video, and Hulu about actual criminal cases involving forensic evidence have raised questions about crime scene investigation and forensic science, making the public aware of its strengths and limitations.

In 1992, the Innocence Project began to demonstrate that errors in some cases resulted in exonerations of innocent people and that forensic science played a role in some of these wrongful convictions. As a result of this media attention, public awareness of the profession's shortcomings, and several government reports, many policymakers are paying closer attention to crime scene investigation and forensic science than ever before. These factors including a significant amount of lobbying by the **Consortium of Forensic Science Organizations** (CFSO)* resulted in a study authorized by the United States Congress published in 2009 by the National Academy of Sciences (NAS), *Strengthening Forensic Science in the United States: A Path Forward*.†

The **NAS Report** made 13 recommendations which are summarized as follows:

1. Create an independent federal forensic agency—the National Institute of Forensic Science (NIFS).
2. Establish standard terminology to be used in lab reports and testimony, as well as the minimum information that should be included.
3. Support and fund peer-reviewed scientific research on forensic disciplines.
4. Maximize independence of forensic labs.
5. Encourage research to minimize bias and sources of human error.
6. Set standards for forensic best practices.
7. Require accreditation and certification.
8. Require quality assurance and quality control.
9. Establish a national code of ethics for all forensic science disciplines.
10. Students should be encouraged to pursue graduate studies to improve and develop applicable research methodologies in forensic science. Continuing legal education programs for law students, practitioners, and judges should also be established and supported.

* The CFSO (www.thecfso.org) is an association of forensic science professional organizations together representing over 20,000 members across the United States.

† The National Research Council of the National Academies issued the report "Strengthening Forensic Science in the United States: A Path Forward" (www.ojp.gov/pdffiles1/nij/grants/228091.pdf).

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11. The coroner system should be eliminated, and funds should be provided to establish a medical examiner system. All medicolegal autopsies should be performed or supervised by a board-certified forensic pathologist.
12. The government should launch a new effort to achieve nationwide interoperability for fingerprint data.
13. Congress should provide funding to bring the Centers for Disease Control, FBI, forensic scientists, and crime scene investigators together to develop roles as first responders in counterterrorism preparedness.

NAS reports are advisory and have no force of law. While the report has been disseminated widely and has been cited in many court cases, only some of the recommendations made, however, have been adopted by the forensic science community.

Since the release of the NAS report, several states have established forensic science commissions, such as the ones in Virginia, Texas, Delaware, New York, and Arizona, for example.* These commissions were established to develop minimum standards for all public forensic laboratories within the respective states and to provide administrative oversight to the forensic laboratories in order to improve the quality and delivery of forensic services. They also monitor forensic laboratory compliance with accreditation standards and require lab representatives to appear regularly before the commissions to answer questions.

In 2013 the federal government created a partnership between the Department of Justice (DOJ) and the National Institute of Science and Technology (NIST) to create the National Commission on Forensic Science (NCFS).† In 2014, NIST created the **Organization of Scientific Area Committees** (OSAC),‡

> an initiative by NIST and the DOJ to strengthen forensic science in the United States. The organization is a collaborative body of more than 500 forensic science practitioners and other experts who represent local, state, and federal agencies; academia; and industry. NIST has established OSAC to support the development and promulgation of forensic science consensus documentary standards and guidelines, and to ensure that a sufficient scientific basis exists for each discipline (Figure 1.1)

OSAC maintains a repository of technically sound published standards for forensic science.§ These written documents (some of which are existing standards published by Standards Development Organizations like ASTM, NIST, and ISO) define minimum requirements, best practices, standard protocols, and other guidance to help improve consistency within and across forensic science disciplines, ensure confidence in the accuracy, reliability, and reproducibility of lab results, and positively increase the impact of admissibility and expert testimony in courts of law. As of Feb 2022, the OSAC Registry contains 78 standards. The OSAC also maintains a comprehensive lexicon¶ of forensic science terms and definitions to help establish consistency and understanding among stakeholders as to the way various terms are used. While OSAC is built on a consensus-based organizational structure, it has no authority to enforce standards. It does, however, promote the adoption of its Registry by accrediting bodies that audit participating forensic science service providers for compliance.

In 2016, under the Obama Administration, the **President's Council of Advisors on Science and Technology** (PCAST) issued a report that found a general lack of adequate scientific studies to establish the validity of many kinds of forensic science. PCAST made a variety of recommended actions to strengthen forensic science and promote its more rigorous use in the courtroom (Figure 1.2).** PCAST concluded that two gaps needed to be addressed: (1) greater clarity

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* Although only ten states and the District of Columbia currently have statutorily created forensic science commissions, many more states have DNA commissions or informal advisory boards or are considering forming commissions. State commissions vary significantly in their functions. The following are some of the states with commissions or advisory boards: Forensic Science Board—VA Dept of Forensic Science (www.dfs.virginia.gov/about-dfs/forensic-science-board/), Texas Forensic Science Commission (www.txcourts.gov/fsc/), DE Forensic Science Commission (forensics.delaware.gov/resources/index.shtml?dc=forensic-science), New York State Commission on Forensic Science (www.criminaljustice.ny.gov/forensic/aboutofs.htm), and the Arizona Forensic Science Advisory Committee (www.azag.gov/criminal/azfsac).

† After three years of operation, the DOJ decided not to reauthorize the NCFS (www.justice.gov/archives/ncfs).

‡ The mission of The Organization of Scientific Area Committees for Forensic Science (www.nist.gov/osac) is to strengthen the nation's use of forensic science by facilitating the development of technically sound standards and encouraging their use throughout the forensic science community.

§ OSAC Registry (www.nist.gov/osac/osac-registry). The OSAC Registry serves as a trusted repository of high quality, science-based standards and guidelines for forensic practice.

¶ https://lexicon.forensicosac.org/.

** "Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods."

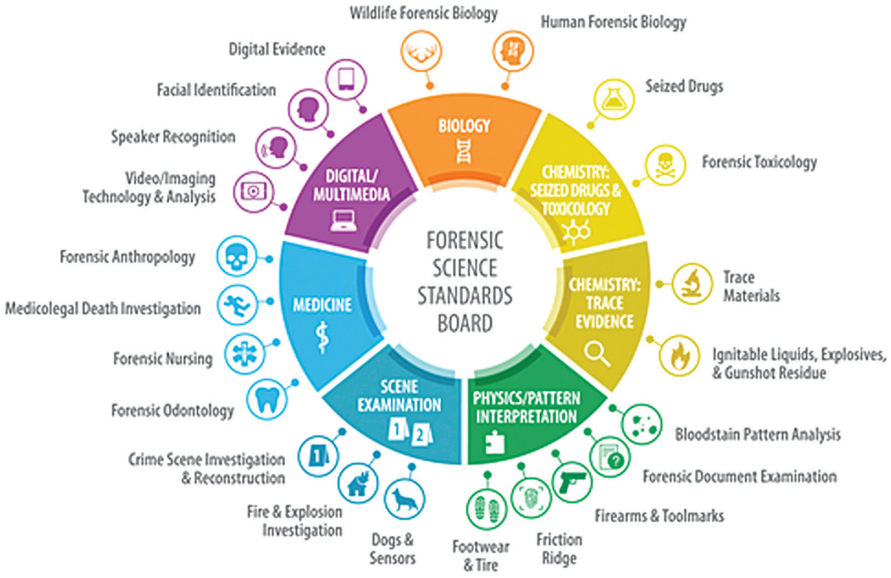
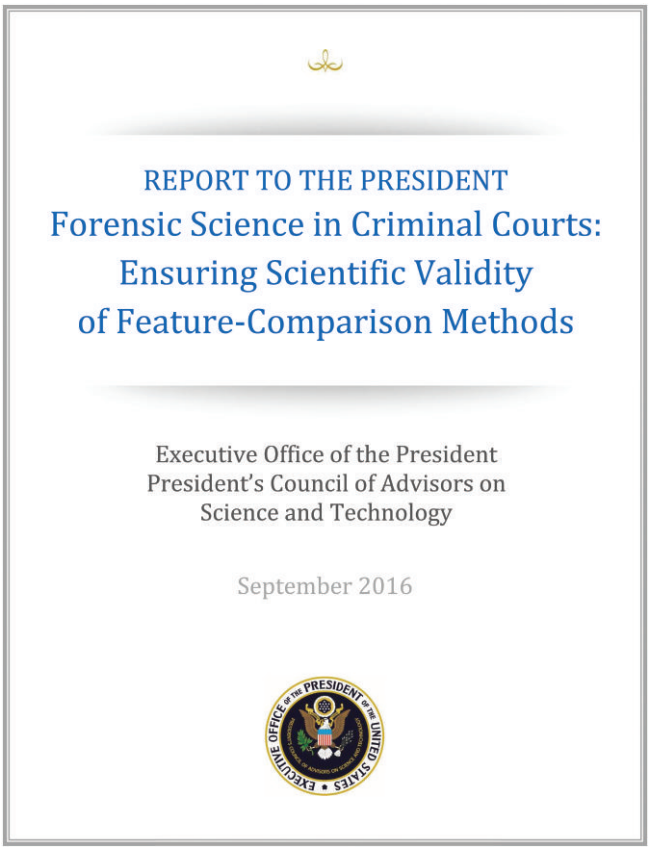


Figure 1.1 OSAC members and affiliates make up a multi-level organization consisting of a Forensic Science Standards Board, seven Scientific Area Committees (SAC), (The Scene Examination SAC consists of the following subcommittees: Crime Scene Investigation & Reconstruction, Fire & Explosion Investigation, and Dogs & Sensors.) and 22 discipline-specific subcommittees. These experts work together to draft and evaluate forensic science standards via a transparent, consensus-based process that allows for participation by all stakeholders. (*National Institute of Standards and Technology.*)


REPORT TO THE PRESIDENT

Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods

Executive Office of the President
President's Council of Advisors on Science and Technology

September 2016

Figure 1.2 The PCAST report asserted that many forms of forensic pattern-matching evidence presently lack foundational validity.

about the scientific standards needed for the validity and reliability of forensic methods and (2) the need to evaluate forensic methods to determine whether or not they have been scientifically established to be valid and reliable.

As noted in these two major reports and by the OSACs, forensic science plays a critical role in the investigation and adjudication of crimes in our criminal justice system. But before science can be brought to bear on evidence, it must be recognized and collected in an appropriate manner at crime scenes. The crime scene investigator, therefore, plays a crucial role in any forensic science testing of evidence recovered from a crime scene.

Webster's Dictionary defines evidence as "something legally submitted to a tribunal to ascertain the truth of a matter." Police investigators deal with evidence on a daily basis. Their ability to recognize, collect, and use evidence in criminal investigations determines to a large degree their success as investigators as well as the outcome of the case.

Evidence can be divided into two broad types: (1) testimonial evidence and (2) real, or physical, evidence. **Testimonial evidence** is evidence given in the form of statements made under oath, or affirmation, usually in response to questioning. Physical evidence is any type of evidence with an objective existence, that is, anything with size, shape, and dimension.

Physical evidence can take any form. It can be as large as a house or as small as a fiber. It can be as fleeting as an odor or as obvious as the destructive results at the scene of an explosion. The variety of physical evidence that may be encountered in an investigation is infinite. Physical evidence may also be considered either direct evidence (evidence that supports a conclusion of fact without inference) or circumstantial evidence (evidence that requires an inference to connect it to a conclusion of fact).

What is the value of physical evidence and why should police investigators concern themselves with an understanding of the uses and ways to collect physical evidence?

Physical evidence can prove a crime has been committed or establish key elements of a crime.

Proof of sexual assault requires showing nonconsensual sexual intercourse. In an alleged rape case, the victim's torn clothing, bruises, and vaginal tearing may be sufficient to prove nonconsensual intercourse.

In another example, arson investigators dispatched to the scene of a suspicious fire collected some burned carpeting. Later analysis proved that gasoline was present in the carpet, proving that the fire was intentionally set.

Case Review

On October 18, 2013, at approximately 8 pm, the Santa Sophia Catholic Church, located in Spring Valley, California, was intentionally set on fire. The fire resulted in over $200,000 worth of damage. A forensic evidence technician was called to the scene to assist the Bomb/Arson Unit. Over 20 items of evidence were collected at the scene of the fire (Figure 1.3a-d).

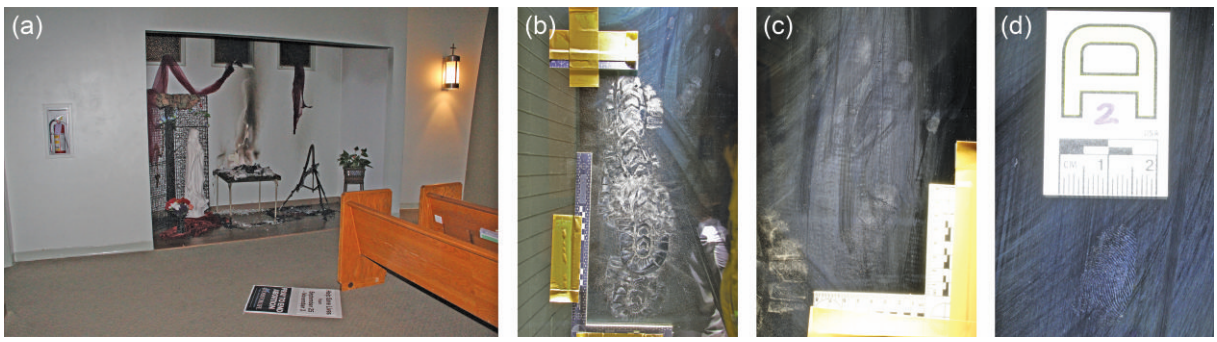


Figure 1.3 (a) Photo of the church fire. (b) Of the most significant items of evidence was a boot print left by the suspect as he tried to kick in a glass window and (c) a latent handprint. That same day, the suspect was identified through a database match to a fingerprint (d) he left on the window. At arrest, the suspect was found to be wearing boots with a similar pattern to that found on the window. The boot impression would later be positively identified as having been caused by one of the boots the suspect was wearing at the time of the arrest. Multiple items from inside the church, believed to be used to set the fires, were processed for latent prints. The suspect was also identified through prints developed on those items. The suspect ultimately pled guilty and was sentenced to 28 years in state prison. (*Courtesy of Mike Grubb, San Diego County Sheriff's Crime Laboratory, San Diego, CA.*)

Physical evidence can place the suspect in contact with the victim or with the crime scene.

A suspect was apprehended shortly after an alleged murder in the victim's home. A bloody fingerprint at the crime scene after a search of the **Integrated Automated Fingerprint Identification System** (IAFIS) ended up matching the suspect. The suspect was at a loss to explain how his fingerprint made it inside the victim's house (Figure 1.4).

Physical evidence can establish the identity of persons associated with the crime.

Every cautious burglar knows not to leave fingerprints at the crime scene, so it was not surprising to find in the trash at the scene surgical gloves that were used when handling the safe. The identity of the burglar was established by developing latent fingerprints inside the latex gloves (Figure 1.5).

Physical evidence can exonerate the innocent.

An eight- and nine-year-old brother and sister accused an elderly neighbor of child molestation. They claimed that the man gave each of them pills that made them feel drowsy and then he molested them. The investigator had a physician examine the children, and blood and urine specimens were collected for a toxicology screen. The analyses of the blood and urine specimens were negative. When presented with this information, the children confessed that they had fabricated the entire story because they disliked their neighbor.

Physical evidence can corroborate the victim's testimony.

A motorist picked up a female hitchhiker. She claimed that he pulled a knife and attempted to rape her. During the struggle, the woman's thumb was cut before she managed to escape. She related her story to the police and the suspect was eventually arrested. During the interrogation, the suspect steadfastly proclaimed his innocence. The investigator noted a small quantity of dried blood on the suspect's left jacket lapel. He claimed the blood came from a shaving mishap. The investigator submitted the jacket along with blood samples from the suspect and the

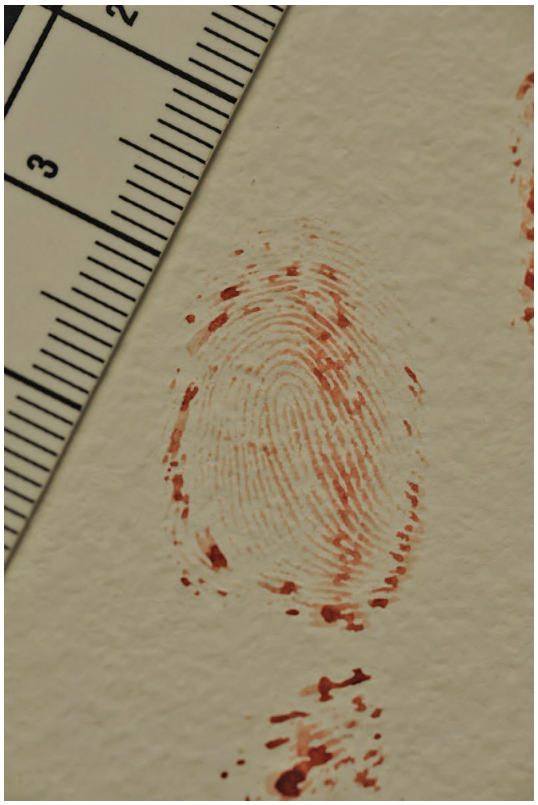


Figure 1.4 A patent fingerprint in blood. Patent prints are those fingerprints that are easily visible without the use of powders, alternate light sources, or chemicals.

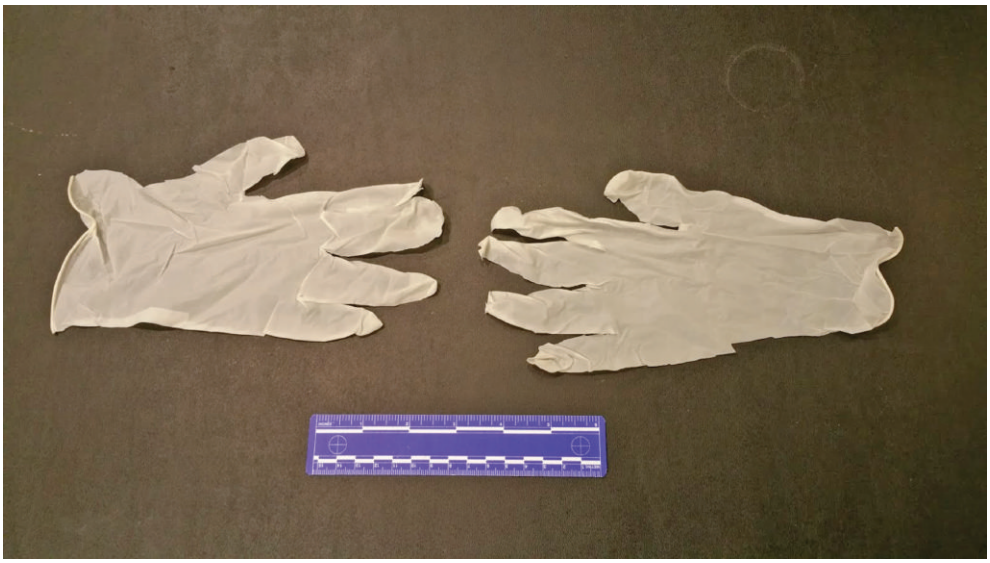


Figure 1.5 Latex gloves left behind at the scene were cut open to develop the latent fingerprints inside the gloves. Latent prints are those fingerprints that are hidden or invisible and need powders, light, and/or chemicals in order to visualize them.

victim to the crime laboratory. The DNA results indicated that the blood on the jacket came from the victim. The physical evidence was instrumental in obtaining a conviction for attempted rape.

A suspect confronted with physical evidence may make admissions or even confess.

Dogfighting still occurs from time to time in parts of the United States. Blood found on a suspect's shirt was species tested and determined to be canine. The suspect, who first claimed the blood was his own, made a full admission when confronted by the evidence.

Physical evidence is more reliable than eyewitnesses to crimes.

Psychological experiments have shown that observations made by test subjects in simulated violent crimes are sometimes inaccurate after the event. Volunteers in a psychological test were witnesses to staged assaults. After the mock crimes, they were asked to detail their observations in writing. The study showed that the mind fills in gaps of physical features. If a portion of a physical characteristic was not seen or did not make sense, the subjects made up descriptions that seemed reasonable. This behavior occurs subconsciously; subjects are not aware that it is taking place. People simply report what they believe they have seen. This in turn has sometimes led to wrongful convictions due to mistaken identity.*

The CSI Effect

The so-called "CSI Effect" has prejudiced the public's notion of the role of physical evidence in criminal cases.

> The CSI Effect refers to the phenomenon in which jurors hold unrealistic expectations of forensic evidence and investigation techniques, and have an increased interest in the discipline because of the influence of CSI-type television shows. This effect includes raising the state's burden of proof because of jury expectations that forensic evidence should always be discussed at trial, and the belief forensic evidence is never wrong.†

Moreover, forensic science is perceived by most of the public to be unbiased and not subject to manipulation. If scientific testing is used to evaluate and characterize physical evidence, jurors are often inclined to believe that the police

* The Innocence Project (www.innocenceproject.org) has worked towards the exonerations of many wrongfully convicted individuals from mistaken eyewitness testimony through the use of post-conviction DNA typing.

† Monica Robbers, 2008.

investigation was properly conducted.* In contrast to the "CSI Effect," a large percentage of the population also views forensic science skeptically as seen in cable news satire shows such as *Last Week Tonight with John Oliver*.†

Negative evidence—the absence of physical evidence—may provide useful information and even stop defense arguments at the time of trial.

In an insurance fraud case, the victim claimed his home was burglarized. No evidence of forced entry could be found and eventually the fraud was discovered. It is important to remember, however, as Carl Sagan is purported to have said, "the absence of evidence, is not evidence of absence!"

CLASSIFICATION AND INDIVIDUALIZATION OF PHYSICAL EVIDENCE

Some investigators may think that every item of physical evidence can be directly associated with a specific person, place, or thing and believe that it is possible to link that evidence to a unique source. This is not the case. Although some may argue that certain types of physical evidence may come from one and only one source, physical evidence is mostly only associated with a class or group and rarely to a unique, sole source. Very few kinds of physical evidence can be individualized or said to be uniquely associated with another item of evidence.

Most physical evidence found at crime scenes can be classified. By classification, we mean that an item of evidence shares a common source. Such items can be placed into groups with all other items having the same properties or class characteristics. Examples of this type of physical evidence include fabric from a mass-produced item of clothing or automobile paint from a specific make and model.

The difference between **individualization** (or a statement explicitly stating uniqueness) and **classification** can be understood by using a hypothetical case. Consider a blue-colored cotton fiber found at the scene of a burglary. A suspect wearing a torn blue cotton shirt is apprehended. All the tests conducted at the crime laboratory on the evidence fiber and exemplar fibers from the shirt show that they cannot be differentiated. Can it be concluded that the blue cotton fiber found at the scene came from the torn blue cotton shirt worn by the suspect? No! The best that can be stated in this example is that the fiber could have come from the shirt in question or any other one manufactured with similar blue cotton fibers. The item has been classified as a blue cotton fiber and can only be placed into a class of all other similar blue cotton fibers.

A follow-up question for the expert testifying about the identification of the fibers (which is often not asked) is to inquire about the significance of finding this evidence. Can anything be stated about the fact that the evidence was found? Stating this another way, suppose that blue cotton fibers are routinely found on random people. How might this factor impact a jury versus fibers that are rarely found?

Contrast the fiber evidence with a pieced-together broken plastic comb. One can easily conclude the broken pieces originally came from one and only one source because of the pieces' unique shape and jigsaw puzzle fit (Figure 1.6a-c).

In the case of fingerprints or firearms evidence, such a simple calculation is not yet possible since we do not know the probability of each mark occurring or whether the marks are independent of one another. Intuitively, the examiner may conclude that finding so large a number of seemingly random events must make the comparison unique to a single source. Studies are underway to attempt to use statistics on pattern evidence which may allow the examiner to give numerical values with their conclusion. By attaching a statistical number to a conclusion, such as a likelihood ratio, juries will be in a better position to decide how much weight to give an item of evidence.‡

Physical evidence can corroborate testimony, place a subject at a scene, and be useful in a variety of ways as an interrogation tool. It also provides valuable information for juries to assist them in their deliberations.

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* Recent high profile cases involving police misconduct with racial overtones as well as errors made in crime labs may have lessened the CSI Effect.

† An episode of *Last Week Tonight with John Oliver* (www.youtube.com/watch?v=ScmJvmzDcG0) highlights many of the problems with forensic science, including how forensic science can be surprisingly unscientific.

‡ The Center for Statistics and Applications in Forensic Evidence (CSAFE) (https://forensicstats.org) is a publicly funded research center that seeks to apply proven statistical and scientific methods to improve the accuracy of the analysis and interpretation of forensic evidence. They are working on developing best practices to apply statistical methods in the evaluation of pattern evidence.

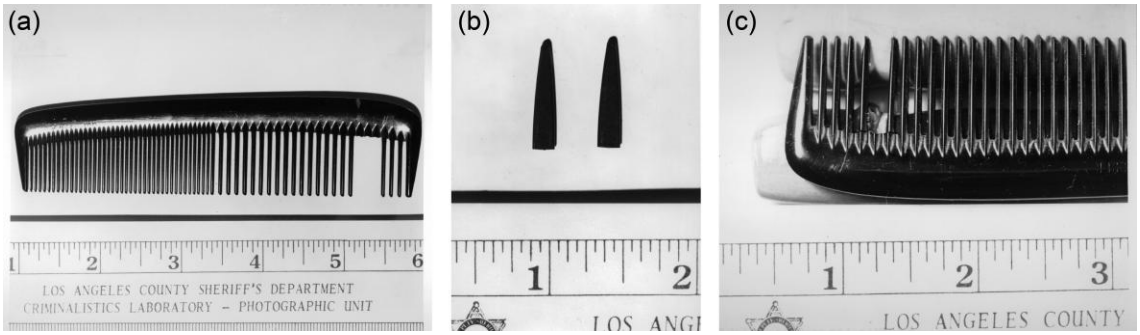

Figure 1.6 This case is an example of a physical match or jigsaw match. A comb (a) with three missing teeth was found in the suspect's possession. Two plastic teeth (b) found at the crime scene were (c) fitted exactly to the comb. (*Courtesy of Los Angeles County Sheriff's Department.*)

Historically, when sufficient markings are present on pattern evidence (e.g., fingerprints, firearms evidence, footwear evidence, tire impressions, and tool marks), practitioners would offer a conclusive opinion that the known and questioned item came from a common source to a reasonable degree of scientific certainty.* Use of the term *scientific certainty*, however, has been repudiated by the U.S. Department of Justice. The question ultimately comes down to how an expert witness might express a level of confidence that a known specimen and questioned item of evidence are connected.

IMPORTANT CONSIDERATIONS IN CRIME SCENE INVESTIGATIONS

In addition to the "how-to" elements of crime scene investigation, several other issues need to be discussed. These represent a philosophical approach to the subject and should be considered an integral part of forensic science and forensic identification.

Forensic scientists, crime scene specialists, and investigators are the individuals whose jobs apply science and technology to solving criminal acts. They hold an important place in the criminal justice system. Their skill and knowledge in the criminal investigation may establish the innocence or guilt of a defendant. Professional ethics and integrity are essential to their effort.

The National Academy of Science report "*Strengthening Forensic Science in the United States: A Path Forward*" contains a significant number of recommendations concerning practitioners and laboratory institutions. Among the recommendations is that public forensic science laboratories should be independent of or autonomous within law enforcement agencies and that a national code of ethics should be established.

At the present time, most forensic practitioners work primarily in law enforcement or prosecution agencies. Partly as a result of the NAS report, there has been some limited movement towards independence from police agencies. This change is not yet widely adopted. Some have argued that separating forensic science laboratories from law enforcement or prosecuting agencies would eliminate the perception of bias.

TEAMWORK

An essential element in crime scene investigation is teamwork. The investigation of criminal acts involves scores of people who often work for different agencies. This system was purposefully designed so that no one person or entity

* In 2016, the United States Attorney General issued a directive from the Department of Justice instructing forensic scientists working in federal laboratories and United States Attorneys to refrain from using the phrase "reasonable degree of scientific certainty" when testifying. The National Commission on Forensic Science (NCFS) also issued a statement that "it is the view of the NCFS that the scientific community should not promote the use of this terminology. Additionally, the legal community should recognize that medical professionals and other scientists do not routinely use 'to a reasonable scientific certainty' when expressing conclusions outside of the courts since there is no foundational scientific basis for its use. Therefore, legal professionals should not require that forensic testimony be admitted conditioned upon the expert witness testifying that a conclusion is held to a 'reasonable scientific certainty,' a 'reasonable degree of scientific certainty,' or a 'reasonable degree of [discipline] certainty,' as such terms have no scientific meaning and may mislead jurors or judges when deciding whether guilt has been proved beyond a reasonable doubt."

can operate independently. As such, turf issues will always arise, and it is important to remember to "stay in one's lane" as best as possible. In addition, as we move towards larger and more complex criminal justice systems, we are more likely to be dealing with people who are faceless voices at the other end of the phone.

For any complex system to work, teamwork is essential. Each element of the criminal investigation—uniformed officer, detective, crime scene specialist, forensic scientist, forensic pathologist, photographer, prosecutor, defense attorney, plus all the other vital players in the "system"—must work cooperatively with the other stakeholders to make the entire process work.

No one element or person is more important than any other person or element. Each person has a vital role to play, and each portion of the case must be accomplished in a responsible, professional, and timely manner to make every component function properly. Everyone working on a case should feel that he or she is essential to the successful resolution of an investigation. Each must feel empowered to do what needs to be done, if only for the sake of justice. Prima donnas have no place in this process!

PROFESSIONAL DEVELOPMENT

Crime scene investigation, forensic identification, and forensic science require continuing education and networking with other professionals. It is unthinkable, for example, that a physician, dentist, accountant, or lawyer would not maintain ongoing study through professional conferences and continuing education. This is equally true in the forensic science profession.

Law enforcement agencies employ most crime scene investigators and forensic science professionals. Many police agencies fund continuing education in their annual budgets. This economic commitment is essential to the ongoing professionalism of practitioners and is used for professional association dues, professional conferences, workshops, and other continuing education.

For those engaged in crime scene investigation work, it is worthwhile to join a professional organization. The **International Association for Identification** (IAI)* is one of the oldest professional associations of its kind. It was founded in 1915. For those pursuing a career in crime scene work, the IAI is an excellent organization to help maintain competency in this field. The IAI publishes the *Journal of Forensic Identification* and holds an annual conference that brings colleagues together to attend workshops and technical presentations and to exchange information. The IAI is worthy of consideration for membership for any serious practitioner. In addition, the IAI offers crime scene certification at four different levels: Crime Scene Investigator, Crime Scene Analyst, Crime Scene Reconstructionist, and Senior Crime Scene Analyst. Each certification requires a rigorous testing process with a minimum passing score of 75%. Certification can also be obtained in the following disciplines: bloodstain pattern analysis, footwear, forensic art, forensic photography and imaging, forensic video, latent print, and tenprint fingerprint. Obtaining certification is beneficial because it: 1) measures quality, 2) enhances credibility, 3) introduces a degree of peer standardization, and 4) enhances consumer confidence. However, not all certifying programs are to be trusted. Persons considering a board certifying program are encouraged to evaluate them critically. A program that does little more than require the payment of a fee should raise questions.

Another association for crime scene investigators to consider is the **Association for Crime Scene Reconstruction**.† The association was founded in 1991 with a group of professionals in Oklahoma and Texas who investigated crime scenes and performed forensic analyses and comparisons on evidence from crime scenes. They saw a need for an organization that would encompass an understanding of the whole crime scene and the necessity of reconstructing that scene in order to better understand the elements of the crime and to recognize and preserve evidence.

Training and continuing education are important for all practitioners within the criminal justice system: uniformed officers, detectives, crime scene investigators, forensic scientists, prosecutors, defense attorneys, and judges. Continuing education and attendance at professional association seminars and workshops are essential to professional competency and professional development. To demonstrate this point, one should ask themselves, "Would I consider going to a physician, dentist, accountant, lawyer, or another professional who does not periodically attend continuing

* www.theiai.org/.
† www.acsr.org/.

education classes to keep up his or her professional competency?" Funds for professional development should be considered a priority in all law enforcement organizations that conduct forensic science testing and crime scene investigation. It cannot be overstated enough that we all need to stay up to date with our field. Practitioners should also be willing to give back to the profession by teaching, giving papers or talks at conferences, or organizing a workshop.

ISO/IEC 17020 ACCREDITATION

While many crime laboratories in the United States are accredited, most Crime Scene Units that are not part of a crime lab lack accreditation. The leadership of law enforcement agencies needs to seek out and obtain accreditation for CSI units. The accreditation that is most appropriate for CSI falls under **ISO/IEC 17020—accreditation for forensic inspection services**. The **International Organization for Standardization** (ISO) specifies requirements for the operation of bodies performing forensic inspection under ISO/IEC 17020. (ISO is an independent, non-governmental international organization that brings together experts to develop voluntary, consensus-based relevant standards to ensure that products and services are reliable and of good quality.) An important difference between inspection agencies and testing laboratories is that many types of inspection involve professional judgment to determine acceptability against general requirements, which is why the inspection body needs to be competent to perform the task. ISO/IEC 17020 consists of eight sections: scope, normative references, terms and definitions, general requirements, structural requirements, resource requirements, process requirements, and management system requirements. The **ANSI National Accreditation Board** (ANAB) forensic accreditation program offers forensic-specific requirements in areas where ISO/IEC 17020 is general. ANAB is the longest established provider of accreditation based on ISO standards for forensic agencies in the United States. Any Crime Scene Unit or CSI service provider seeking ANAB accreditation must demonstrate conformance to the ISO/IEC 17020 conformity assessment, as well as the applicable ANAB accreditation requirements, additional requirements where applicable, and the CSU/CSI service provider's own documented management system.* It is recommended that all agencies performing crime scene investigations seek and maintain accreditation. Just like no one would undergo surgery in a non-accredited hospital, the public demands that their CSU/CSI service providers meet basic accreditation standards in order to assure the acceptability of results.

ISO/IEC 17043 ACCREDITATION

ISO/IEC 17043 specifies the requirements for the competence of providers of proficiency tests and for the development and operation of proficiency tests. When a forensic lab or crime scene unit administers proficiency tests to its laboratory analysts or investigators, they should ensure that the proficiency test provider is accredited under ISO/IEC 17043. ANAB also offers accreditation to ISO/IEC 17043 standards along with supplemental accreditation requirements for forensic science proficiency test providers.

LEGAL CASES REGARDING FORENSIC SCIENCE

Crime scene investigation and forensic science operate within a legal framework. Thus, it is not surprising that a number of cases or legal rulings define some of the aspects of forensic science and crime scene investigation. The goal of any criminal investigation is not only to figure out what happened and who did it but also to bring the wrongdoer to justice. Since the final stop in a criminal investigation is in the courts, regulations, rules, legal precedents, and case law must be taken into consideration throughout the investigation. The following is a review of some of the case law and rules of evidence that deal with forensic evidence:

- ***Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923)**. Frye is one of the earliest cases in the United States to address the notion of admissibility of expert testimony. Expert testimony is used to help jurors understand complex issues generally beyond a lay person's knowledge. The Frye case dealt with the polygraph and whether its results were

* The ANAB Directory of Accredited Organizations (http://search.anab.org/) shows the latest forensic inspection agencies and crime scene units that are accredited in crime scene investigation.

admissible. The court made the following statement in its opinion which sums up its ruling: "Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone, the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs." Polygraph evidence was held to be inadmissible in this case. The Frye Rule essentially lays out the notion of general acceptance within the *relevant scientific community*. Frye is still the standard in a number of States and has been modified in Federal cases by the Federal Rules of Evidence, specifically Rule 702.

- ***Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993)**. In Daubert, the U.S. Supreme Court modified the way courts view expert testimony. The Court ruled that the trial judge serves in the capacity of gatekeeper and decides what expert evidence may be admissible. Daubert also expands the requirements for admissibility beyond general acceptance and adds the notion of reliability. (The Daubert standard, however, is not used in all states.)
- ***Federal Rules of Evidence Rule 702*** codifies Daubert and other later cases into the Federal Rules.

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

Different states use one or more of the above standards to govern the admissibility of expert scientific testimony. Some have adopted the federal rules while others continue to follow Frye, and still others have adopted a hybrid version. These legal issues are of interest to lawyers and judges who must deal with them in evidentiary hearings.

- ***Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999)** was a United States Supreme Court case that applied the Daubert standard to expert testimony from a non-scientist, specifically a tire failure expert. In a unanimous decision, the court determined that a federal trial judge's "gatekeeping" applies not only to "scientific" testimony but to all expert testimony.
- ***Melendez-Diaz v. Massachusetts*, 129 S.Ct. 2527 (2009)** is a decision by the U.S. Supreme Court that determined that a forensic analyst's lab report is prepared for use in criminal prosecution and is subject to the confrontation clause of the 6th Amendment. The 6th Amendment of the U.S. Constitution gives the defendant the right to confront his/her accuser. The question considered in Melendez-Diaz was whether lab reports constitute testimony and, therefore, require the analyst who wrote the report to testify in court about their findings. The court concluded that the expert who wrote the lab report must testify as the witness for the State against the defendant to give the defendant the ability to examine the witness concerning the work he did in the case.
- ***Bullcoming v. New Mexico*, 131 S. Ct. 62 (2010)** followed the *Melendez-Diaz* case. The question presented in *Bullcoming* was whether the confrontation clause permitted the prosecution to introduce a forensic laboratory report containing a testimonial certification—made to prove a particular fact—through the in-court testimony of another scientist who did not sign the certification or perform or observe the test reported in the certification. The Supreme Court held that surrogate testimony of that order does not meet the constitutional requirement. The accused's right is to be confronted with the analyst who made the certification, unless that analyst is unavailable at trial and the accused had an opportunity, pretrial, to cross-examine that particular scientist. This case has significant ramifications, particularly in cases where the original expert and the evidence are no longer available for re-examination. Consider an old serial murder case that occurred many years prior. The pathologist who performed the autopsy might no longer be available and the deceased's remains are buried. The question to be determined is how evidence in such a case might be presented. Whether the confrontation clause permits the prosecution to introduce the testimony of a forensic analyst through the in-court testimony of a supervisor remains to be seen.
- ***Brady v. Maryland*, 373 U.S. 83 (1963)**. Brady requires the prosecution to provide material evidence to the defense which may exculpate the defendant. Brady material readily adapts itself to forensic evidence and may become an issue in criminal proceedings. What is required under Brady? Prosecutors are required to disclose to the defense evidence favorable to a defendant that is either exculpatory or impeaching and is material to either guilt or punishment. Evidence is "favorable" to the defendant if it either helps the defendant or hurts the prosecution. In *Strickler v. Greene* (1999) 527 U.S. 203, 280–281, the United States Supreme Court stated:

> In Brady, this Court held "that the suppression by the prosecution of evidence favorable to an accused upon request violates due process where the evidence is material either to guilt or to punishment, irrespective of the good faith or bad faith of the prosecution." Brady v. Maryland, supra, 373 U.S. at 87. We have since held that the duty to disclose such evidence is applicable even though there has been no request by the accused, [*United States v. Agurs* (1976) 427 U.S. 97, 107] and that the duty encompasses impeachment evidence as well as exculpatory evidence, [*United States v. Bagley* (1985) 473 U.S. 667, 676]. Such evidence is material "if there is a reasonable probability that had the evidence been disclosed to the defense, the result of the proceeding would have been different." Id at 682; see also [*Kyles v. Whitley* (1995) 514 U.S. 419, 433–434].

Prosecutors must determine what Brady evidence there may be *before* trial. The definition of "material evidence" is generally provided in the context of an appeal from a conviction. Evidence is material if there is a reasonable probability that the result of the proceeding would have been different had the evidence been disclosed. A reasonable probability of a different outcome is shown where suppression undermines confidence in the outcome. Such evidence must have a specific, plausible connection to the case, and must demonstrate more than minor inaccuracies. Exculpatory evidence is evidence favorable to the defendant and material to the issue of guilt or punishment. Impeachment evidence is also included under Brady. Examples of possible impeachment evidence of a material witness include:

1. Pending criminal charges.
2. Parole or probation status of the witness.
3. Evidence contradicting a prosecution witness' statements or reports.
4. Evidence undermining a prosecution witness' expertise (e.g., inaccurate statements).
5. A finding of misconduct by a Board of Rights or Civil Service Commission, that reflects on the witness' truthfulness, bias, or moral turpitude.
6. Evidence that a witness has a reputation for untruthfulness.
7. Evidence that a witness has a racial, religious, or personal bias against the defendant individually or as a member of a group.
8. Promises, offers, or inducements to the witnesses, including a grant of immunity.

- ***Maryland v. King*, 569 U.S. (2013)** is a Supreme Court decision that ruled that requiring a forensic DNA sample for arrestees supported by probable cause does not violate the 4th Amendment against unreasonable searches and seizures. According to the majority opinion, DNA collection serves "a well-established, legitimate government interest: the need of law enforcement officers safely and accurately to process and identify persons taken into custody." Not all states, however, allow for the collection of DNA samples from arrestees; several states have legislation forbidding this.

FUNDING

CSI and forensic science funding needs are often ignored until some major problem comes to light. Often inadequate funding goes along with inadequate oversight from the local criminal justice establishment. Quality and timely work have a price tag; inadequate funding has consequences. Parent organizations must remember to fund staff and support operations in addition to line units. Failure to provide adequate funding to ensure quality work and timely lab service is indefensible. The damage done when failures in the forensic science delivery system occur can be horrific. The citizens of a democracy have a right to expect that justice is administered fairly, impartially, and in an expedient manner.

MENTAL HEALTH

A word on mental health and psychological first aid is in order. The nature of the work that CSIs do can take its toll on even the most experienced and seasoned investigator. Many CSI units have made it mandatory that all crime scene personnel speak to a counselor after processing a "difficult" scene. CSI leadership should make an effort to establish a culture where no one should feel embarrassed about seeking help from a therapist, counselor, or EAP program. Besides training in Crime Scene Investigation, unit heads should also offer training in psychological first aid so that team members can spot warning signs when a co-worker should be offered help. Many CSIs have been known

to suffer from alcohol/drug abuse, post-traumatic stress disorder (PTSD), and a host of other mental health issues because they did not seek help early on. Investigators should be made aware of where they can seek help and that it will not have a negative effect on them professionally. It is also important that all CSIs take time off when needed and have enough time for rest and relaxation. Having CSIs that are overworked and stressed out can compromise the effective processing of a crime scene.

COGNITIVE BIAS

Psychologists have studied a problem that affects the reliability of conclusions in many fields, including forensic science. Cognitive bias concerns the ways in which perceptions and opinions can be modified by elements other than those applicable to the decision at hand. Cognitive bias includes "contextual bias," where individuals are influenced by irrelevant information; "confirmation bias," where examiners interpret information, or look for new evidence that conforms to pre-existing beliefs or opinions; and "avoidance of cognitive dissonance," where individuals will not accept new information that is inconsistent with their initial conclusion. A goal of forensic science is to minimize bias. One area that has been discussed in forensic science is linear sequential unmasking so the examiner has no or very limited extraneous information about the nature of the material being tested. Itiel Dror*,†,‡ has been a leader in the effects of bias in forensic science. In one study, Dror showed how latent fingerprint examiners' conclusions can be influenced by knowledge about other forensic examiners' decisions (a form of confirmation bias). Dror has published extensively in this area, and forensic practitioners should be aware of his work.

THE FUTURE

Crime scene investigation and forensic science are complex processes that will continue to be essential components of the criminal justice system and public safety. All stakeholders must keep them strong and vibrant.

The following chapters will cover the most current and up-to-date techniques and methods of crime scene investigation. It is incumbent for all CSIs and investigators to ensure that the appropriate scientific techniques and principles are used to bring out the truth in criminal investigations. CSIs cannot settle for the status quo; they must continuously strive to use the most innovative and advanced methodologies to support the criminal justice system in its search for truth and justice.

Further Reading

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Chapter Questions

1. Define the term evidence.

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† Dror, Itiel E., David Charlton, and Alisa E.Péron. "Contextual information renders experts vulnerable to making erroneous identifications." *Forensic Science International* 156.1 (2006): 74–78.
‡ Dror, Itiel E., and Jeff Kukucka. "Linear sequential unmasking–expanded (LSU-E): A general approach for improving decision making as well as minimizing noise and bias." *Forensic Science International: Synergy*, 3 (2021).

2. Give examples of testimonial vs. real evidence.
3. Which of the following pieces of evidence would be more probative in associating the defendant to the victim in a murder trial?
   a) A fiber found on the defendant's jacket when he was arrested that is similar to those from the carpet at the crime scene.
   b) A bloodstain found on the defendant's jacket that subsequently matches the victim's DNA profile.
   c) A hair found on the defendant's jacket that is similar to those of the victim's dog.
   d) Eyewitness testimony of a neighbor who saw someone matching the defendant's build at the scene.
4. What two recommendations did the PCAST report address?
5. Name three things that physical evidence can accomplish.
6. What is the difference between classification and individualization?
7. All of the following can be part of a criminal investigation, except the:
   a) CSI.
   b) forensic scientist.
   c) Prosecutor.
   d) defense attorney.
   e) none of the above.
8. The forensic practitioner's sole obligation is to serve the aims of _____
   a) Justice.
   b) their agency.
   c) the victim.
   d) the prosecutor.
9. Name two professional organizations for Crime Scene Investigation.
10. The IAI certifies crime laboratories.
    a) True
    b) False

Chapter 2

First on Scene and Crime Scene Personnel

Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as silent evidence against him. Not only his fingerprints or his footprints but his hair, the fibers from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen he deposits or collects—all these and more bear mute witness against him. This is evidence that does not forget. It is not confused by the excitement of the moment. It is not absent because human witnesses are. It is factual evidence. Physical evidence cannot be wrong; it cannot perjure itself; it cannot be wholly absent. Only its interpretation can err. Only human failure to find it, study, and understand it, can diminish its value.

Paul L. Kirk* (Figure 2.1)

THE FIRST OFFICER AT THE SCENE

Crime scenes are dynamic, rapidly changing environments. The first officers to arrive on the scene must be concerned with countless details. Their major tasks are to protect the crime scene. To a great extent, the success of the investigation and, perhaps, any chance for a successful resolution of the case hinges on actions and steps taken by the first officers to arrive at the crime scene.

Consider the crime scene as a snapshot of what occurred in the final moments of a crime. The scene is the place from which much of the physical evidence associated with the crime is obtained. It provides investigators with a starting point for the inquiry to determine the identities of the suspect and victim and to piece together the circumstances of what happened during the crime. Physical evidence found at the scene can be the key to the solution of the crime. The first officer's most important task at the scene is to prevent the destruction or diminished value of potential evidence that may lead to the apprehension of the suspect and the ultimate resolution of the crime. The responsibility of the first uniformed officers at the scene can never be minimized. What these officers do or don't do, whether innocent or intentional, may have serious ramifications in the course of the investigation.

Some police agencies have very specific policies for uniformed personnel concerning their duties and responsibilities at the crime scene. First responders should be familiar with their duties and responsibilities and execute these

* Paul L. Kirk, 1902–1970, was a microchemist and a leader in the field of criminalistics. He was a professor at the University of California, Berkeley for 43 years. Through his work at Berkeley, Kirk began to develop a more structured and scientific approach to criminalistics and in 1937, was selected to head the criminology program at Berkeley. Eight years later, he established a major in technical criminology. Kirk wrote the groundbreaking textbook *Crime Investigation*. In addition, he consulted on many criminal cases, including the well-known murder trial of Sam Sheppard.

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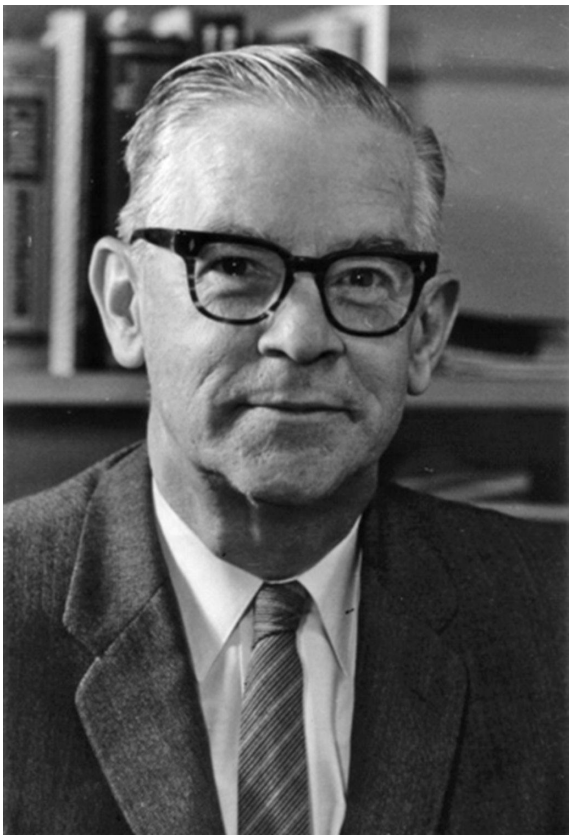

Figure 2.1 Professor Paul L. Kirk. The highest honor in the criminalistics section of the American Academy of Forensic Sciences is the Paul L. Kirk Award. (*Photograph from https://en.wikipedia.org/wiki/Paul_L._Kirk.*)

tasks to the best of their ability. Superior officers and training officers should monitor the performance of both new and experienced uniformed personnel. Police agencies should understand the importance of ongoing training and continuing education, not only for investigative and technical personnel but also for first responder personnel as well. The duties of the first officer to arrive at the crime scene are the same, no matter what his/her rank, and remain the same regardless of the seriousness of the crime. The first responder at the scene must assume that the suspect left clues or physical evidence behind. The first responder's actions or inactions must not be allowed to destroy or change anything at the scene. Information developed from evidence left at the scene may help to reconstruct the crime or reveal the identity of the suspect.

Common sense strongly suggests that a crime scene will yield useful information. No one can enter a location without changing it in some way, either by bringing something into it or by removing something from it. The notion of an individual coming in contact with a scene and changing it in some way is known as the **Locard Exchange Principle**, named after the French forensic scientist, Edmond Locard (1877–1966). A popular restatement of this principle may be summarized as: *every contact leaves a trace*. Although changes to a crime scene may be extremely small, the course of an investigation may well hinge on their detection. Therefore, the first officer's action or inaction may affect the future of the investigation (Figure 2.2).

Naturally, the general rule of protecting the crime scene cannot be applied in every case. The resources of the crime scene unit as well as the nature of the crime must be taken into account. Petty thefts and other misdemeanors will not receive the same in-depth investigation as a homicide case or a major terrorist incident. Some police agencies may arbitrarily set a lower limit to the property value lost in a burglary as a way to determine the scope of their investigation. Some police agencies, for example, employ small Evidence Collection Teams for property crimes and full Crime Scene Units for larger, violent crimes against people.

Figure 2.2 Edmond Locard, French forensic scientist (1877–1966). (*Photograph from https://locardslab.com/2014/11/18/scientist-spotlight-edmond-locard/.*)

At first glance, the actions to be taken by the first officer on the scene may seem simple and not well beyond the scope of routine police duties. Some further examination of these duties will show that this is not the case.

First responders should not approach the scene in haste. All movements should be calm and deliberate. Officers should expect the worst and take the position that it is better to be overly cautious and remember the popular adage: *if something can go wrong, it will!* Approaching the assignment with an open mind helps an officer avoid carelessness and false moves that may prove to be disastrous.

Some errors committed in the protection and examination of the crime scene may never be set right. The eventual success of the investigation may be dependent on the preventative and preliminary measures taken by the first officer to arrive at the crime scene. Unfortunately, there are too many examples of how an omission or a mistake on the part of the first responder proved fatal to the investigation. It is often the small things that cause these problems. For example, using a toilet at the scene and then flushing it may wipe away an important fingerprint, or using a drinking glass on a kitchen counter or smoking at a scene are simple, unintended examples that may result in important evidence being contaminated or destroyed.

In a difficult situation, the officer may be faced with a dilemma that requires quick analysis of the circumstances and the taking of appropriate steps. However, if the basic rule of always anticipating the worst and taking extensive rather than minimal precautions is followed, the most serious errors can usually be avoided. Remember, it is always better to explain in court why you did do something, than why you didn't.

Because conditions and situations can vary greatly from one crime scene to another, it is not possible to set hard and fast rules to govern all situations. However, certain guidelines can be established. These are mainly applicable to homicide cases and other serious crimes because it is in these cases that the officer is faced with the most difficult tasks and the actions taken to have the most far-reaching consequences.

CRIME SCENE DOS AND DON'TS*

Do	Don't
• Limit access to the crime scene by using crime scene tape and a major incident log. • Attempt to identify possible routes used by the suspect. • Note original conditions at the crime scene. • Record changes in conditions especially concerning your activities (or EMTs/paramedics). • Protect evidence from adverse environmental conditions. • Conduct all non-CSI tasks outside the tape (coffee drinking, smoking, talking on a cell phone). • Record the location of the evidence before moving it. • Package trace evidence (paint, glass, etc.) first into bindles and then into individual larger envelopes. • Keep an open mind as to what might be evidence. • Be aware that you are a potential source of contamination. • Take photographs of items at 90° with and without L - scales (right angle scales). • Call expert personnel to crime scenes for detailed or difficult collection or documentation. • Take photographs of all aspects of crime scenes: perspective shots, mid-range shots, and close-ups. • Establish an area for garbage outside of the crime scene.	• Permit unnecessary personnel to enter the crime scene. • Use routes possibly used by the suspect. • Assume others will note original conditions, etc. • Fail to document any changes or contamination at the scene. • Allow evidence to be compromised by the elements. • Eat or use any facilities or the phone within the crime scene. • Remove items and package them without documentation. • Package trace evidence together in a bundle. • Ignore items that appear out of place or are difficult to explain. • Touch anything unnecessarily. • Photograph items without scales. • Assume that the expert can always answer the questions from non-expert collections or documentation. • Not change gloves in between handling different items of evidence. • Limit your photographs to overalls and item locations.

RECORDING THE TIME

Precise notations of the time are very important in an investigation. Noting the time is important when checking a suspect's story and can be helpful in other circumstances as well. Therefore, the first officer at the scene should write down arrival times and other times that may turn out to be significant. Notation should be made of the time that the crime was committed, the time that the officer was first called, the time of arrival at the scene, and so on. Such notations lend precision and credibility to the officer's statement if testifying in court becomes necessary. Keeping track of the time spent at the scene also maintains a chronological record of the way things were done during the crime scene investigation. These notes will prove invaluable when specific details about the investigation are needed as the case proceeds. This information can be recorded into case management software on a tablet or laptop at the crime scene, or in an officer's notebook.

WHEN A SUSPECT IS FOUND AT THE SCENE

The first thing an officer must do when entering a scene is to render it safe, as the suspect may still be on location. Officers should always remember that their safety is of paramount importance! The first officer to arrive at a crime scene may need to arrest or detain a suspect. The police officer must use common sense in taking whatever measures are necessary to protect the scene. If it is not possible to hold the suspect at the scene or in the police vehicle, and if a backup officer is unavailable, a possible alternative might be to find a reliable person to protect the scene until other officers arrive. The first officer must instruct such persons on how to guard the scene because he or she likely will be inexperienced in this.

The first officer should also be aware that the longer the suspect remains at the crime scene, the greater the possibility becomes for changing or contaminating the crime scene. The suspect could remove evidence, leave new evidence, or even gain information by observing details at the scene. The suspect (if known) should be searched and removed from the location as quickly as possible.

* This list was originally developed by Ron Linhart and Elizabeth Devine, LA County Sheriff's Crime Laboratory.

INJURED PERSON ON THE SCENE

Saving lives is the priority and takes precedence over all other considerations. If an injured person is on the scene, first aid should be administered immediately even if it means valuable evidence may be lost or destroyed. If first aid to the injured is not immediately essential, the officer should note the victim's position on a simple sketch, and with a photo. The officer should note how the victim is lying or sitting, the position of the hands, arms, and legs, the condition of clothes, and so on. It is also important to notice if the victim's hands have anything in them such as hairs, fibers, etc. Using a smartphone camera may help in this endeavor.

When paramedics or emergency medical personnel arrive, the officer should—without interfering in their work—instruct them how to enter the scene without disturbing it unnecessarily. Observing the movements of medical personnel and noting whether any objects were moved is also required. (Paramedics should be instructed to dispose of all medical equipment like gloves, gauze, etc. outside of the crime scene.)

If civilian emergency medical personnel transport the injured person, a police officer should accompany the victim. An alert investigator may hear an important word or accusation or what might be equivalent to a dying declaration that might be the key to the entire case. In one case, a dying woman uttered the name of her assailant. This vital information fell on the untrained, inattentive ears of the civilian emergency medical personnel, and no amount of interviewing could sharpen their recall.

The officer should arrange for proper removal and custody of the victim's clothing. Sometimes when the hospital is contacted to obtain the victim's garments, the clothing has been wadded into a hopeless mess after being cut from the body. Representatives of police agencies should make periodic visits to local hospitals to instruct medical personnel in the proper handling of evidence. The medical profession's lack of interest in and knowledge about evidence is challenging, considering the broad range of their training and the media's attention to criminal investigations.

ENTERING THE SCENE PROPER

After making sure the scene is safe and rendering aid to any victims, the officer should attempt to form a hypothesis of what happened as quickly as possible. This assessment will likely be the basis for subsequent actions. When entering the scene proper, or the focal point of events, the officer must proceed with extreme caution and concentrate his/her attention on possible evidence that may be found on doors, doorknobs, light switches, floors, ceiling, etc.

An effort must be made to observe details, particularly those that are fleeting, and to take contemporaneous written or electronic notes on such points as:

- Doors—open, closed, or locked? On which side was the key?
- Windows—open or closed? Were they locked?
- Lights—on or off? Which lights were on?
- Shades, shutters, or blinds—open or closed?
- Odors—cigarette smoke, gas, gun powder, perfume, decomposition, etc.?
- Signs of activity—meal preparation, dishes in the sink, house clean or dirty, etc.?
- Date and time indicators—mail, newspapers, dates on milk cartons, stopped clocks, spoiled foods, items that should have been hot or cold but were at room temperature.

Nothing at the crime scene should be moved unless necessary. The crime scene should remain as close as possible to its original state until the crime scene unit arrives. If it becomes necessary to remove any object because others may disturb it, the officer should consider the possibility that the item may have fingerprints or DNA present and act accordingly. Before any object is moved, its location should be recorded and photographed. The exact original position of an object at a scene may become important later on in the case.

Under no circumstances should anyone be allowed to wander about the crime scene simply to satisfy his or her curiosity. There have been many instances where first officers arrived at the scene and wandered about the scene leaving fingerprints, trace evidence, and DNA on a variety of surfaces. Such carelessness cannot be tolerated. These activities are all the more problematic when senior officers or department brass show up out of curiosity to see what is going on.

Those at the crime scene should refrain from using the toilet, avoid turning on water faucets, eating, drinking, smoking, or using towels at the scene. The suspect may have used these objects—i.e., a towel could have been used to wipe a bloodstained weapon. The rule is simple: the first officer at the crime scene should not touch anything unless necessary or unless she is charged with the responsibility of processing the scene for physical evidence. Any first officer to arrive at a scene should consider it an embarrassment if their fingerprints or DNA are found and identified at the crime scene due to their sloppiness.

First officers should realize that the lead investigator might call on them later to account for their movements at the crime scene. This may be necessary for the investigating officer to get a better idea of the original condition of the crime scene or to explain seemingly out-of-place items at the scene.

Sometimes, the victim or a relative may attempt to clean up the scene—perhaps to put everything in proper order for when the police arrive or perhaps to try to conceal something. Cleaning might serve as a psychological need to put things back in their proper place. If a cleanup is in progress when the officer arrives, it should be stopped. If the cleanup has been completed or the officer suspects that is the case, a detailed inquiry should be made to determine the original condition of the scene. It may be possible to recover material or undamaged items that were thrown out or discarded.*

PROTECTING THE INTEGRITY OF THE SCENE

As soon as possible after arriving, the officer should take steps to protect the scene from anyone not directly involved with the investigation, including other officers, supervisors, command personnel, the press, curiosity seekers, and family members. This is no easy task and sometimes requires some ingenuity because, initially, there may not be enough personnel to protect the crime scene.

Protecting the crime scene is an ongoing activity. Uniformed officers should remain posted at the scene. The victim's family, the public, and the press should be kept away from the crime scene proper (Figure 2.3). Fellow officers, especially command officers, who have no business visiting the crime scene, are a more serious problem. In highly publicized crimes, superior officers often exhibit a desire to see (or perhaps tour might be a better term) the scene. This should be avoided. A simple solution is to have a sign-in log so anyone who enters or leaves the crime scene is accounted for. An alternative is to set up a command post with a pot of coffee and donuts to help keep unnecessary persons away. A remote video camera could be set up inside the command post to allow superiors to have a visual inspection of the crime scene without actually entering it. Another possibility to discourage officers from visiting a scene is to let them know that there is a possibility they could be called to testify down the road. Sometimes it may be necessary to inform superiors politely that the scene is active and their presence might compromise findings and interfere with collecting physical evidence.

Simply locking a door or stringing rope or commercially available yellow crime scene tape around the perimeter can secure the crime scene. If these measures do not suffice, first responders may resort to using vehicles, boards, or furniture gathered from another area away from the scene to help keep curiosity seekers out. Even with devices such as police barricades, yellow crime scene tape, and ropes, officers may still need to take an active role in keeping unauthorized people away. In addition, with today's drone technology, another area of concern is the crime scene being filmed from above. In these instances, it might be necessary to set up a temporary tent to protect the outdoor crime scene from unauthorized drone photography. However, this might be difficult to do in a large outdoor area.

The extent of any protective measures must be decided on a case-by-case basis. As a general rule, if the scene is indoors, the barricade should include the central scene and, where possible, the probable entry and exit paths used by the suspect. In this regard, it is important to focus attention on potential evidence on the ground outside a window, in rooms through which the suspect had to pass, in stairways, and/or entrances.

* In some cases CSIs might need to contact the local garbage company to track down the approximate location where a garbage truck dumped its waste at the landfill in order to locate a probative piece of evidence such as a murder weapon.

Figure 2.3 The press may show up at crime scenes to report on a big story. As long as they do not interfere with the investigation or cross the police line, they should be allowed to stay as it is their 1st amendment right.

If the location is outdoors, an ample area should be roped off to include the paths taken by the suspect to and from the crime scene. Sometimes, critical evidence may be found on or near a route leading to or away from the scene. It is important to search paths carefully. In some cases, before the arrival of the police, onlookers trample the crime scene.

In open areas, barricades can be set up only if an officer is stationed outside the perimeter to guard them. The protection of the scene in open areas merely requires that the officer not walk around aimlessly inside or immediately outside the roped-off area. Limiting movements permits later accountability for the officer's tracks.

The first officer should remain at the scene whenever possible. Leaving the supervision of the crime scene to persons other than police officers should only be done in exceptional circumstances. Protective measures at the scene should be taken as early as possible to prevent valuable, often vital evidence from being destroyed. It is also important that barricades be sufficiently extensive from the beginning of the investigation. Sometimes, a sufficient area around the crime scene is not protected early enough in the investigation.

When large outdoor areas are to be protected, officers may use police cadets, police reserves, auxiliary police, or others who can be trusted to assume responsibility for protecting the scene.

DEAD PERSON ON THE SCENE

If the first officer on the scene can establish certain signs of death, such as clear rigor mortis, odor, lividity, beginning decomposition, and so forth, the body is not to be touched or removed until a detailed examination can be made. Once the first officer at the crime scene has established that the victim is dead and has made a cursory inspection of the crime scene, superiors must be notified regarding the nature of the case. The officer's cell phone should be used for this purpose rather than a police radio because it is not uncommon for the press and other news sources to monitor police radio frequencies using scanners. The phone at the scene should not be used.

SUMMONING THE MEDICAL EXAMINER

Whether the medical examiner should be contacted at this point of the investigation is often a matter of local custom. Some agencies, by agreement with the medical examiner's office, first wait for the investigating officers to arrive and

begin their investigation. Notification of death may be made at this time, with an estimate of the time the medical examiner or **Medicolegal Death Investigator** (MLI)* should arrive. This can save the medical examiner's staff time by not having to wait needlessly at the scene until the police have completed their portion of the investigation. Policies should be arranged with the medical examiner's office on such callout matters.

The medical examiner's office has legal jurisdiction over the body at the crime scene. Therefore, the body should not be moved or searched without the consent of the medical examiner or MLI. (In cases of suicide, any suicide note or letter belongs to the jurisdiction of the medical examiner, as well.)

On rare occasions, the first officer must take immediate steps to remove the body from the scene. In these situations, the officer must ensure that the deceased is placed on the stretcher in the same position in which the body was discovered, provided that circumstances permit. Limbs rigidly fixed in a certain position should not be straightened. If the victim is found face down, the body should remain in that position because lividity may change position and appearance, and trickles of blood may change direction.

If the rigidity of **rigor mortis**† must be broken to transport the body, the officer must make note of it, preferably with sketches and photographs showing the original position. Before the body is moved, its position should be documented, sketched, and photographed. The position of the head, arms, hands, knees, and feet must be shown on the sketch. The officer should also note the condition of the clothes and any bloody tracks that may be present. This can be extremely important in answering the question of whether the body had previously been moved. Blood may run while the body is being removed. A question may later arise about the source of this secondary flow of blood.

Postmortem lividity or **livor mortis** is another sign of death. It is caused by the settling of the blood in the lower portion of the body, causing a purplish red discoloration of the skin due to the action of gravity. The discoloration does not occur in the areas of the body that are in contact with the ground or another object. The presence of livor mortis can be used by forensic investigators to determine whether or not a body has been moved (for instance, if the body is found lying face down but the pooling is present on the deceased's back, investigators can determine that the body was originally positioned face up).

In cases of strangulation or hanging where unmistakable signs of death are observed, the first officer at the scene should do nothing to the body. If there is a danger that the rope might break, the officer may attempt to support the corpse, but it should not be cut down. If obvious signs of life are present, the officer must try to save the person.

Knots in ropes should not be untied, if possible. The knot may be typical of a certain occupation or skill level. The noose may be cut and the loose ends labeled appropriately. An alternative to labeling is to tie the ends back together with string or thread. If these materials are not available, the noose or rope should be placed so that the officer can later recall which ends belong together. In emergencies, the knot may be loosened somewhat and the noose pulled over the victim's head. It is also important to remember which end of the rope was anchored to a fixed object or pulled over a branch or beam. The direction of distorted surface fibers on the rope may indicate whether the victim was pulled up because it is always possible that hanging was staged to cover up a murder. It is important to consider that the suspect's DNA could be on any knots or areas of the ligature surrounding the knots.

FIREARMS AND AMMUNITION AT THE SCENE

The general rule is that any firearms or ammunition should be left until investigating personnel arrives. However, the recovery of weapons and ammunition may become necessary. If they may be inadvertently moved or lost during the removal of an injured person, or if the conditions are such that they cannot be properly protected, then they may be removed.

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* The medicolegal death investigator is responsible for the dead person, whereas law enforcement jurisdiction is responsible for the scene. The medicolegal death investigator performs scene investigations emphasizing information developed from the decedent and determines the extent to which further investigation is necessary.

† Rigor mortis is a recognizable sign of death that is caused by a chemical change in the muscles after death. The limbs of the corpse become stiff and difficult to move or manipulate. It begins after about three hours of death, reaches maximum stiffness after 12 hours, and gradually dissipates after about 72 hours.

When picking up pistols and revolvers, a pen or pencil should never be inserted into the barrel to lift the weapon as seen on TV. Dust, blood, particles of tissue, and other debris in the barrel may become dislodged. To move a gun, grasp the checkered surface of the grips with two gloved fingers or use the trigger guard. Before the weapon is moved, however, its position should be marked on a sketch and photographed. The position of bullets and cartridge casings may reveal the direction of the shot and possibly the location of the assailant. The positions of hammers and safeties should also be noted. Care should be taken not to disturb potential trace DNA evidence, or transfer DNA from another item.

If a weapon is found, it should be in the same condition in which it was recovered when delivered to a firearms examiner for examination. When the firearm is packaged for submission as evidence, a detailed description of what was done to it should be prepared and sent to the crime laboratory. The only acceptable change to the weapon would be to unload it. An investigator with firearms experience should render the weapon safe while wearing gloves before sending it to the crime lab.

WHAT TO DO UNTIL INVESTIGATING PERSONNEL ARRIVE

While waiting for investigators to arrive, the first officer on the scene should attend to the following:

- **Write down the names of witnesses and other persons who entered the scene.** This is important for the subsequent sorting of fingerprints and DNA and other clues found at the scene.
- **Note who was at the scene when the officer arrived.** This information can become particularly important if the crime had just occurred.
- **Establish basic facts.** A factual account of what happened is of great assistance to the detectives when they arrive because it helps them to decide on their next moves. However, the first officer should never undertake lengthy and detailed interrogations of witnesses, suspects, or victims that may damage later questioning or give rise to misleading suggestions in later statements. Furthermore, the officer cannot properly guard the scene if occupied with interrogations.
- **Keep the suspect and witnesses separated when possible.** Allowing the suspect and witnesses to talk may interfere with later questioning. Family members may be left in the care of neighbors when necessary, taking care that no alcoholic drinks or sedatives are administered. Remember that the dramatically grieving relative may be the prime suspect.
- **Instruct witnesses not to discuss the events.** This can prevent distortion or bias by suggestion. If possible, the principal witnesses should be separated. In relating events to one another, witnesses may distort each other's impressions to a point at which they believe that they saw things that they did not see or that never happened.
- **Do not discuss the crime with witnesses or bystanders.** This is also intended to prevent suggestion and distortion. Furthermore, circulating details of the crime may hinder the investigation.
- **Listen attentively, but unobtrusively.** An alert officer can often pick up information of vital importance to the investigation simply by being a good listener.
- **Protect evidence that is in danger of being destroyed.** During inclement weather such as rain or snow, divert water and cover tracks with boxes, cardboard, tents, etc. If the crowd of onlookers becomes large, it may become necessary to expand the protective measures at a given location to prevent the trampling of the evidence.

When the investigating officers arrive, the first officer should report all that has been learned and observed and the actions that were taken. This is very important to the evaluation and planning of the crime scene investigation. It is particularly important that reports be given to the extent to which the scene has been altered and whether objects have been disturbed or moved.

CONTINUED PROTECTION OF THE SCENE

When protecting the scene after the investigators have arrived, the officers detailed to protect it should act only on orders from the detective in charge. During the technical examination of the scene, it is the crime scene investigator who is in charge of the officers on security duty as well as of the scene proper.

No one should be allowed access to the crime scene without the lead investigator's permission, not even other investigators or superior officers. Command officers would render a fine service to their investigators if they would preserve the integrity of the crime scene with a passion and set an example for other officers by keeping out of the scene. Unfortunately, there are numerous instances of police officers on sightseeing tours through crime scenes. Sometimes they destroy more evidence than any group of laypeople could accomplish. Even experienced investigators are guilty of allowing these tours, especially in murder cases and other serious crimes.

News reporters sometimes arrive at the scene before investigators. People in the neighborhood usually call them or they may have heard a call on the police scanner. The first officers on the scene should not, under any circumstances, give information about the case to reporters. To inform the press is the responsibility of the police chief, sheriff, or public information officers designated by them. Officers should not favor one reporter or news agency by giving out information that may not be available to the competitors through prescribed channels. In dealing with reporters, officers should be neither curt nor nonchalant, but they should be firm, even when reporters are persistent. The officer should remember that reporters often give invaluable assistance in the investigation of major crimes by soliciting the public's help when needed.

CRIME SCENE PERSONNEL

Ideally, a crime scene unit should have the following personnel: a team leader, a photographer (who also keeps the photolog), sketch preparer, evidence custodian, and recovery personnel (searchers). In smaller agencies, or depending on the time of day/day of the week, it may not be possible to have all of these individuals respond to every crime scene. To this end, most crime scene units will cross-train all personnel in each of these areas so that each CSI can perform more than one of these functions when needed.

In addition, the crime scene unit should also have a list of specialty personnel who may need to be called upon on less frequent occasions: a forensic entomologist, botanist, forensic anthropologist, geologist, bomb technician, forensic engineer, cadaver dog handler, divers, HAZMAT team, and a locksmith. Agencies can sign intermittent contracts or have memorandums of understanding (MOUs) with these professionals since they are usually not full-time employees.

Case Review

In one of California's most notorious serial murder cases, an individual dubbed the "Night Stalker" by the press terrorized the Los Angeles area in the mid-1980s. Before his reign of terror ended, at least 13 people were viciously murdered and numerous others were assaulted. His murder spree ranged from San Francisco to Orange County. A regional task force was led by detectives from the Los Angeles County Sheriff's Department Homicide Bureau. Evidence of a satanic link—upside-down pentagrams were noted at early crime scenes and attributed to the assailant (Figure 2.4a and b). After his capture and during his trial, upside-down pentagrams were found on the dashboard of his car and in his holding cell.

The crime scene attributed to the "Night Stalker" started to show a grisly pattern: restraints (i.e., cords, belts, handcuffs, and thumb-cuffs) were found at many scenes as well as various tools that were used to bludgeon his victims. A characteristic shoe impression was linked to several crime scenes. The unusual shoe pattern was preserved through the use of photography, plaster casting, and tape lifts (Figure 2.4c and 2.4d). The shoe impressions were compared and found to have similar class characteristics to the Avia Aerobic, size 11½. After consultation with the owners of the Avia Company, it was determined that only one pair of size 11½ shoes was distributed in the Los Angeles area, of 97 pairs in the entire state. After a public official mentioned the existence of the shoe prints at a press conference, those prints stopped showing up at subsequent crime scenes, and the shoes were never recovered.

The Firearms and Latent Print sections of the Los Angeles County Sheriff's Department, Scientific Services Bureau, played an important part in the perpetrator's conviction. Rifling marks from bullets recovered at different scenes were compared. It was established that they were fired from the same handgun. This substantiated the initial hypothesis that the same individual committed these crimes. On the day of his arrest, items belonging to Richard Ramirez were seized from a local bus depot locker (Figure 2.4e). Among these items were a yellow

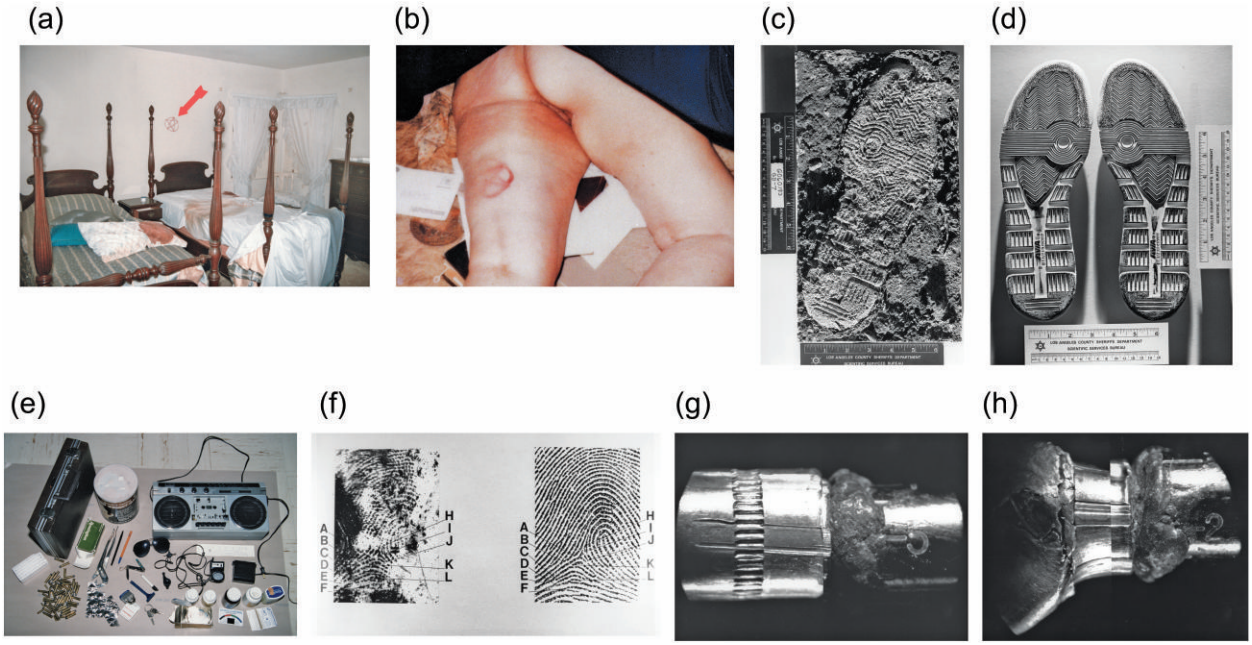

Figure 2.4 (a, b) Photos from murders attributed to the "Night Stalker" serial killer show evidence of a satanic link. (c, d) A characteristic shoe print was found at several of the crime scenes, but the shoes were never recovered. (e, f) Fingerprinting linked items found in a bus depot locker to Richard Ramirez. (g, h) Live ammunition from the bus locker matched expended cartridges found at four of the crime scenes. (*Courtesy Los Angeles County Sheriff's Department Scientific Services Bureau.*)

flashlight and live rounds of ammunition. A latent fingerprint (Figure 2.4f) on the flashlight was identified as belonging to Ramirez, thereby linking him to the recovered property. More importantly, the live rounds exhibited a magazine signature identical to markings on expended cartridges found at four of the crime scenes (Figure 2.4g and 2.4h).

Based on a latent fingerprint from a vehicle the Night Stalker had used in an assault in Orange County, California, he was identified as Richard Ramirez. A mug shot photograph was released to the press the following morning. That same morning, as newspapers were being distributed, Ramirez was on a bus returning to Los Angeles from Arizona. Within hours he was spotted and captured by citizens in East Los Angeles. Once in custody, he was positively identified as Richard Ramirez, alias the Night Stalker. Four years elapsed before Richard Ramirez was found guilty of all counts brought against him, which included 13 murders and 30 other felonies. He was sentenced to death and died in prison from lymphoma in 2013. In 2021, Netflix released the docuseries *Night Stalker: The Hunt for a Serial Killer*, detailing Ramirez's crimes and how he was ultimately captured.

Further Reading

Dutelle, Aric W. *An Introduction to Crime Scene Investigation*. Jones & Bartlett Learning, 2020.

LeMay, Jan. *CSI for the First Responder: A Concise Guide*. CRC Press, 2017.

Chapter Questions

1. Which of the following is a major task that the first responder must be concerned with?
   a. Calling for backup.
   b. Contacting their supervisor to apprise them of the situation.

c. Protecting the crime scene.
d. Arresting the suspect.

2. Which of the following principles is associated with processing crime scenes and is often summarized as "every contact leaves a trace"?
   a. Locard's Exchange Principle.
   b. Trace Evidence Principle.
   c. Kirk's Principle.
   d. First Officer's Principle.
3. Describe why it is important for the first responder to record the times associated with a crime scene investigation.
4. When entering a crime scene, the first responder should proceed with extreme caution and concentrate their attention to possible evidence at which locations?
5. What is the very first thing the first responding officer should do when arriving at a crime scene?
6. When is it appropriate for the first responding officer to move a piece of evidence?
   a. When the evidence is a gun.
   b. When he is charged with the responsibility of processing the scene for physical evidence.
   c. Only when the scene is secured.
   d. If the crime is serious such as a homicide.
7. You are called to the scene of a sexual assault that took place at a park. Describe how you would secure the scene.
8. What should be done until investigating personnel arrive at the crime scene?
9. Describe the proper procedure when dealing with multiple witnesses at the scene of a crime.
10. List five crime scene "dos" and five crime scene "don'ts."

Chapter 3

Documenting the Crime Scene

It is simply impossible to recall everything one observes at a crime scene. Documentation, therefore, is an essential component of effective crime scene investigation and is a must for subsequent legal proceedings.

Documenting the crime scene consists of several systematic steps: preparation & plan of action, note-taking, photography & videography, sketching, and 3-D scanning. The remaining steps of crime scene processing: detailed search, collection of evidence, final survey, and releasing of the scene will be discussed in the next chapter. Since it is impossible to recall all of the details observed while processing a crime scene, it is critical to memorialize what was done at the scene to refer back to at a later date. Information about who was at the scene, where the evidence was collected from, when did the first officer respond, and a host of other facts needs to be recorded. This chapter covers some of the best practices to follow when documenting and processing crime scenes.

PREPARATION AND PLAN OF ACTION

Crime scenes should be approached in a systematic, methodical way. Certain steps must be performed before others. Considerations about legal and scientific matters must be made when searching a crime scene. These details must be included in an action plan or method of approach before processing can begin.

General action plans should be readily available to crime scene investigators and should be included in written departmental procedures which define crime scene responsibilities. Standard Operating Procedures (SOPs) should detail what tasks are to be done, in what order, and by whom. It is impossible to anticipate every detail in a crime scene investigation; however, certain rules should dictate the responsibilities of uniformed officers, detectives, criminalists, and CSIs. In addition to the general SOPs that each Crime Scene Unit should have, case-specific requirements might require supplemental plans of action to address unique facts or circumstances about a particular case. This can be determined during the initial walk-through of the crime scene.

NOTE-TAKING

Of all the duties and responsibilities of crime scene investigation, perhaps the most important is contemporaneous note-taking. Note-taking is important for several reasons. It forces investigators to commit observations to writing and to keep a detailed, sequential record of everything observed and accomplished. Often, seemingly insignificant items found in an investigator's notebook turn out to be critical to an investigation later.

Some general points about notes and note-taking are:

1. Notes should be made as events unfold, i.e., in chronological order.
2. Notes should detail step-by-step actions.

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3. Notes should be complete and thorough.
4. Notes should be clearly and legibly written. Sloppy notes or those that do not clearly state the investigator's meaning will be subject to misinterpretation and/or cross-examination during trial.
5. Negative or unexpected conditions, e.g., the absence of bloodstains or a light that is found on should be noted.
6. The note-taker should be as specific as possible. If an item of evidence is to be located, a description such as "on the living room floor, 6 inches east of the west wall and 3 feet south of the north wall" should be used. Vague statements such as "near" or "to the left of" should be avoided.
7. Case notes, sketches, tape recordings, or photos should never be discarded or deleted, even if poor quality or unintended. They should be placed into a case folder or computer file and retained for as long as the department's policy requires.
8. The initial investigating officer should remember that some investigations may go on for years and future detectives will have to rely on the case notes made at the start of the investigation.

Digital audio recorders make it easy to take down information that can be transcribed later on; some investigators also use audio recording apps on their smartphones for this purpose. Investigators should remember that impromptu remarks from other officers at the scene, however, might later prove embarrassing.

Any notes taken at crime scenes should include the following information:

- Date and time the crime was first reported and type of crime.
- Location of the crime scene and a description of the area.
- Description of the crime or event leading up to the investigation.
- Name of the person who requested the crime scene investigation.
- Names of all officers, witnesses, investigators, and specialized personnel at the crime scene.
- Names of the persons who will be conducting the crime scene search, taking photographs, 3-D scans, sketches, and collecting evidence.
- Weather and lighting conditions at the time of the investigation.
- Description of the primary crime scene, including the location of the body and accompanying details.
- Description of the location, the surrounding houses, streets, community, and other landmarks.
- Description of the interior and exterior of the crime scene, including the type of residence, number of rooms, and windows.
- Description of the outside of the scene including the terrain, type of plants, soil, GPS coordinates, etc.
- The date and time the crime scene investigation was concluded.
- Any additional information required by department directives or SOPs.

These details represent only some of the many pieces of information that may be included in the investigator's notes. They do not represent all the possible information. Each CSU should have its own checklist. Meticulous note-taking is one of the keys to good police work and competent crime scene investigation.

CRIME SCENE PHOTOGRAPHY

The well-worn saying "a picture is worth a thousand words" certainly holds true with crime scene photography. No matter how well an investigator can verbally describe a crime scene, photographs can give the viewer a wealth of information about a scene that cannot easily be expressed in words.

Before a detailed examination of the crime scene is made or before any items are moved or even touched, the crime scene should be photographed. The photographs should be taken to clearly and accurately depict the scene as it was found, the paths taken by the suspect(s) to the scene, the point of entry, and the escape route taken. Detailed photographs should be taken of physical evidence in the condition in which it was found before any removal for "bagging and tagging."

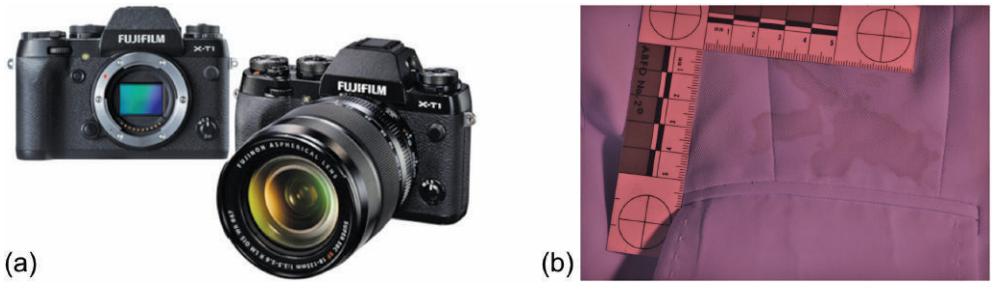

Figure 3.1 (a) The FujiFilm X-T1 Forensic IR Kit (This mirrorless camera is only offered to law enforcement/military entities and medical/scientific professionals that intend to use the camera for scientific purposes.) is one such camera. It offers technology to see light from the ultraviolet (UV), visible, and infrared (IR) portions of the light spectrum (380nm-1000nm). (b) The camera has the capability to capture bloodstains on black fabric, something that is usually difficult to see under normal lighting conditions.

Figure 3.2 (a) The Forenscope® mobile multispectral UV-VIS-IR forensic tablet is designed for CSI documentation. It has a 13 megapixel camera with macro and micro lenses. (b) Bloodstains viewed on a shirt under normal camera vs. ForenScope Camera. (*www.ForenScope.com*.)

Types of Cameras

The digital camera used most often by CSI's is the **digital single lens reflex** (DSLR) **camera**. Cameras today come in many makes and models with very high resolutions. The high-resolution capability allows pictures to be made into high-quality enlargements with little distortion or pixelation and allows examiners to resolve very fine details within the photograph. Photographic resolution is measured in pixels. Digital cameras with a resolution in the 12 megapixel and higher range yield excellent results. (If you want the best possible image quality, then a bigger sensor is more important than huge megapixel counts.) Proper forensic photography equipment minimally requires a DSLR camera with an interchangeable "normal" lens, barrier & bandpass filters, off-camera flash and sync cord, tripod, scale(s), protective case, storage media, 18% gray card, alternate light source (ALS), and spare batteries.* For some forensic applications, the ability to capture light from the ultraviolet (UV) and infrared (IR) portions of the light spectrum allows for outstanding detailed images of blood spatter, bruising, document forgery, tattoo identification, bone fragments, and gunshot residue (GSR) (Figure 3.1a and b). In addition, most high-quality cameras include GPS capability to indicate the location the photograph was taken. Many low-end digital "point and shoot" cameras also have good-quality resolution and are useful for many situations, however investigators who regularly photograph crime scenes typically use DSLR cameras. Smartphone cameras are useful when photos are necessary and professional digital photographic equipment is unavailable. Finally, there are mobile multispectral forensic tablets† that can produce high-quality images that are on par with digital photos from DSLR cameras (Figure 3.2a and b).

* B&H Photo (www.bhphotovideo.com/) is an online store that sells most forensic photographic equipment.

† The Forenscope® Tablet (https://forenscope.com/) can be used to capture body fluids, GSR, and other forensic evidence without filters and goggles.