

Chapter 1

Introduction

CHAPTER OVERVIEW

- Forensic science is the application of science to criminal and civil laws that are enforced by police agencies in a criminal justice system.
- The development of crime laboratories in the United States has been characterized by rapid growth accompanied by a lack of national and regional planning and coordination.
- The technical support provided by crime laboratories can be assigned to five basic services: the physical science unit, the biology unit, the firearms unit, the document unit, and the photography unit.
- Some crime laboratories may offer optional services such as toxicology, fingerprint analysis, voiceprint analysis, crime scene investigation, and polygraph administration.
- A forensic scientist must be skilled in applying the principles and techniques of the physical and natural sciences to the analysis of evidence that may be recovered during a criminal investigation.
- An expert witness evaluates evidence based on specialized training and experience.
- Forensic scientists train law enforcement personnel in the proper recognition, collection, and preservation of physical evidence.
- The *Frye v. United States* decision set guidelines for determining the admissibility of scientific evidence into the courtroom. To meet the *Frye* standard, the evidence in question must be “generally accepted” by the scientific community.
- In the case of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, the U.S. Supreme Court ruled that trial judges were responsible for the admissibility and validity of scientific evidence presented in their courts.
- Special forensic science services available to the law enforcement community include forensic psychiatry, forensic odontology, and forensic engineering.

LEARNING OBJECTIVES

1. Distinguish between forensic science and criminalistics.
2. Describe the organization and services of a typical comprehensive crime laboratory in the criminal justice system.
3. Explain how physical evidence is analyzed and presented in the courtroom by the forensic scientist, and how admissibility of evidence is determined in the courtroom.
4. Explain the role and responsibilities of the expert witness and what specialized forensic services, aside from the crime laboratory, are generally available to law enforcement personnel.

LECTURE OUTLINE

DEFINITION AND SCOPE OF FORENSIC SCIENCE

HISTORY AND DEVELOPMENT OF FORENSIC SCIENCE

Literary Roots

Important Contributors to Forensic Science

- **Teaching Note:** Challenge your students to come up with mnemonics or tricks to help remember the important figures in forensic science. For example: Walter **Mc**Mrone was a **Micro**scopist.

CRIME LABORATORIES

Crime Labs in the United States

International Crime Labs

- **Teaching Note:** Be sure to cover the differences between a state and local forensic laboratory. Students should understand what the local analysts normally do compared to what the state analysts can do.

ORGANIZATION OF A CRIME LABORATORY

The Growth of Crime Laboratories

Future Challenges

Types of Crime Laboratories

Services of the Crime Laboratory

Basic Services Provided by Full-Service Crime Laboratories

Optional Services Provided by Full-Service Crime Laboratories

- **Teaching Note:** Discuss how the crime laboratory is organized and what departments or sections are usually in the lab, including serology, trace evidence, fingerprint examiner, and so forth.

FUNCTIONS OF THE FORENSIC SCIENTIST

Analysis of Physical Evidence

- **Teaching Note:** If you have stories of cases or interesting work you or someone you know has done in the field, share them! Draw your students in by discussing what types of evidence is analyzed.

Providing Expert Testimony

Furnishing Training in the Proper Recognition, Collection, and Preservation of Physical Evidence

OTHER FORENSIC SCIENCE SERVICES

Forensic Psychiatry

Forensic Odontology

Forensic Engineering

Forensic Computer and Digital Analysis

Exploring Forensic Science on the Internet

General Forensics Sites

LIST OF CHANGES / TRANSITION GUIDE

This chapter has been expanded to cover the discussion of the reliability and controversy surrounding forensic bite mark comparison.

ADDITIONAL ASSIGNMENTS AND CLASS ACTIVITIES

Demonstrations and Lecture-Starters

Deductive Reasoning Exercise: The Deadly Picnic. This exercise challenges students to critically analyze evidence and emphasizes the importance of thorough observation and note taking at the crime scene.

The Facts of the Case

Centerville police discovered the body of a 36-year-old white male (later identified as Gaven Brooks) in a field about twenty miles north of town. Mr. Brooks's body was discovered at 7:30 p.m. on Friday, October 11. He was found lying face-up on a yellow, queen-size sheet. According to autopsy reports, one fatal gunshot to the back of the head ended Mr. Brooks's life. Scientists estimate that death occurred at about 4:20 p.m. As investigators scanned the crime scene, they made the following notes:

- Paper plates filled with partially eaten fried chicken, deviled eggs, potato salad, and chocolate cake were located near Mr. Brooks's body.
- An open bottle of red wine and two partially filled glasses of wine were found next to the yellow sheet.
- A recently smoked cigarette butt was found near the sheet.
- Shoeprints from the road to the field were those of a male, size 10, and a female, size 5. The only shoeprints from the field back to the road were those of a female, size 5.
- Car tracks of the same wheel base and tread pattern as Mr. Brooks's automobile were found at the road. The car was not found at the scene.
- Mr. Brooks's car was found abandoned in an empty parking lot in downtown Centerville.

Investigators believe that a female friend of Mr. Brooks was responsible for his demise. After questioning family and friends, it was discovered that the deceased had frequent social outings with six women who live in or near Centerville. The women's names are Rita, Lauren, Gail, Janice, Elaine, and Peggy. Investigators gathered the following information about the six women:

- Janice works full-time as a caterer.
- Elaine and Gail are schoolteachers.
- Rita's mother says Rita arrived home in her own car at about 5 p.m.
- Peggy and Elaine live together in a two-bedroom apartment in downtown Centerville.
- Gail lives in a nearby town called Jordan.
- Elaine and Janice are very petite women—they wear size 4 jeans.
- Gail and Peggy are smokers.
- Rita's father owns a gun shop.
- Elaine attends a 5-p.m. yoga class in downtown Centerville every Friday afternoon and has not missed a class in two years.
- Peggy is deathly allergic to grapes.
- Lauren works at a chemical supply house.
- Rita lives in a country house about thirty miles west of Centerville.
- Gail is a vegan.
- Rita is a florist.

- Janice doesn't know how to drive.
- Elaine and Gail hate the color yellow.
- Lauren played center for a semiprofessional basketball team five years ago. She has red hair and is six feet, one inch tall.

Based on the preceding information, students must determine who murdered Mr. Brooks and the general facts of the case.

The Solution

The general facts of the case are that Mr. Brooks and one of the women took his car on a picnic north of Centerville. After dining, Mr. Brooks was killed by his female companion, who then drove back to town and abandoned his car. Based on the evidence, the murderer is Elaine. At least one piece of evidence eliminates every other suspect. Peggy is deathly allergic to grapes, so she would not have drunk the wine. Lauren is obviously a tall woman, so the shoe prints found in the field are too small to be hers. Janice does not know how to drive, so she could not have driven the car back to town by herself. Doubt may fall on Rita, who has no alibi until half an hour after the murder was committed. However, she would not have enough time to drive the twenty miles to Centerville, abandon the car there, then drive an additional thirty miles home and still arrive by 5:00. That leaves Gail and Elaine as possible suspects. Gail might fit the profile because she is a smoker and a cigarette butt was found near the body. However, there is no indication of the sex of the person who smoked the cigarette, so this alone is not sufficient proof. Moreover, Gail is a vegan, so she would not have eaten the chicken or deviled eggs. Elaine has the alibi that she was at a 5:00 aerobics class, but the class is in downtown Centerville, where the car was abandoned. This means that she would have had time to commit the murder and still make the class on time. Because all other suspects have been eliminated, Elaine must be the murderer.

Questions

1. How does the textbook define forensic science?
2. Why is Mathieu Orfila considered "the father of forensic toxicology"?
3. What was Francis Galton's principal contribution to forensic science?
4. How did Calvin Goddard advance the science of firearms examination?
5. What is Locard's exchange principle?
6. What major advance in forensic science did the state of California undertake in 1972?
7. How does the British system of forensic laboratories differ from that of the United States?
8. How has the emergence of the "fee-for-service" system affected the practice of forensic science in Great Britain?
9. List three reasons for the unparalleled growth of crime laboratories in the United States since the 1960s.
10. Describe how the structure of the U.S. federal government has affected the organization of crime labs in the United States.
11. List three main reasons for the wide variation in total services offered by crime labs in different communities.

12. Describe the basic duties of the physical science unit in a crime lab and give three examples of the type of work performed by a physical science unit.
13. In addition to the physical science unit, what four units typically are found in full-service crime labs? List at least one function performed by each of these units.
14. List two optional units found in most crime labs and give at least one example of the type of work done by each.
15. List the main functions of the forensic scientist.
16. What important principle was established in the case of *Frye v. United States*?
17. How did the court's ruling in the case of *Daubert v. Merrell Dow Pharmaceuticals, Inc.* affect the admissibility of scientific evidence in federal courts?
18. How does the testimony of an expert witness differ from the testimony of a lay witness?
19. List two ways in which a forensic odontologist can assist in criminal investigations.

Answers to Questions

1. Forensic science is the application of science to criminal and civil laws that are enforced by police agencies in a criminal justice system.
2. Orfila published the first scientific treatise on the detection of poisons and their effects on animals.
3. Galton undertook the first definitive study of fingerprints and developed a methodology of classifying them for filing.
4. Goddard was the first to use a comparison microscope to analyze bullets to determine whether they were fired from the same gun.
5. Locard's exchange principle states that whenever two objects come into contact with one another, there is exchange of materials between them. When this happens during the commission of a crime, the cross-transfer of evidence can connect the suspect to his or her victim.
6. In 1972 California began creating an integrated network of state-operated forensic laboratories consisting of regional and satellite facilities.
7. In contrast to the American system of independent government laboratories, Britain and Wales have privatized their forensic science services.
8. The fee-for-service concept has encouraged the creation of a number of private laboratories that make their services available to police and defense alike.
9. First, Supreme Court decisions in the 1960s required police to place greater emphasis on securing scientifically evaluated evidence and all but eliminated confessions as a routine investigative tool. Second, the dramatic increase in U.S. crime rates led to a greater need for scientific examination of criminal evidence. Third, the advent of DNA profiling led to a need for crime labs to expand their staffs and modernize their facilities to meet the demands of DNA technology.
10. The federal system of government emphasizes the importance of retaining local control over important matters such as criminal prosecution. This has led to the growth of many local and state crime laboratories and precluded the creation of a national system. In addition, the federal government has no single law enforcement or investigative agency that has unlimited jurisdiction throughout the country.

11. Three main reasons for the wide variation in total services offered by crime labs are variations in local laws, different capabilities and functions of the organization to which a laboratory is attached, and budgetary and staffing limitations.
12. The physical science unit applies principles and techniques of chemistry, physics, and geology to the identification and comparison of crime scene evidence. Three examples of the type of work performed by the physical science unit are drug identification, soil and mineral analysis, and examination of trace physical evidence.
13. The biology unit performs DNA profiling of dried bloodstains and other biological material, compares hairs and fibers, and identifies and compares botanical materials such as wood and plants. The firearms unit examines firearms and ammunition of all types, examines garments and other objects in order to detect firearms discharge residues, and examines crime scene evidence to approximate the distance from a target at which a weapon was fired. The document examination unit studies questioned documents to ascertain their authenticity and/or source; analyzes paper and ink; and examines indented writings, obliterations, erasures, and burned or charred documents. The photography unit examines and records physical evidence, uses specialized photographic techniques to make invisible information visible to the naked eye, and helps prepare photographic exhibits for courtroom presentation.
14. The toxicology unit examines body fluids and organs to determine the presence or absence of drugs and poisons, determines the alcoholic consumption of individuals, trains operators in the use of field instruments, and maintains and services such instruments. The latent fingerprint unit processes and examines evidence for latent fingerprints. The polygraph unit administers and interprets the results of polygraph tests. The voiceprint analysis unit analyzes sound recordings to connect voiceprints to particular criminal suspects. The crime scene investigation unit dispatches specially trained personnel to the crime scene to collect and preserve physical evidence that will later be processed at the crime laboratory.
15. The main functions of the forensic scientist include analyzing physical evidence; providing expert testimony; and furnishing training in the proper recognition, collection, and preservation of physical evidence.
16. *Frye v. United States* established the principle that questioned procedures, techniques, or principles must be “generally accepted” by a meaningful segment of the relevant scientific community before they are admissible as evidence at trial.
17. In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, the Supreme Court asserted that “general acceptance” is not an absolute prerequisite to the admissibility of scientific evidence under the Federal Rules of Evidence. According to the Court, the Rules of Evidence assign to the trial judge the task of ensuring that an expert’s testimony rests on a reliable foundation and is relevant to the task at hand.
18. A lay witness must give testimony on events or observations that arise from personal knowledge. This testimony must be factual and, with few exceptions, cannot contain the personal opinions of the witness. By contrast, the expert witness evaluates evidence that the court lacks the expertise to do, and thus must express his or her personal opinion as to the significance of the findings. The views expressed are accepted only as representing the expert’s opinion and may later be accepted or ignored in jury deliberations.
19. Forensic odontologists can use dental records such as X-rays, dental casts, and a photograph of a person’s smile to compare a set of dental remains and a suspected victim. A forensic odontologist can also compare bite marks left on a victim to the tooth structure of suspects.

SUGGESTED ANSWERS TO END-OF-CHAPTER ASSIGNMENTS

Review Questions

1. Forensic science
2. Sherlock Holmes
3. Anthropometry
4. Francis Henry Galton
5. Leone Lattes
6. Walter McCrone
7. Albert Osborn
8. Hans Gross
9. Edmond Locard
10. Edmond Locard
11. Los Angeles
12. California
13. Regional
14. Drug
15. The Federal Bureau of Investigation; the Drug Enforcement Administration; the Bureau of Alcohol, Tobacco, Firearms, and Explosives; the U.S. Postal Service
16. Federal, state, county, municipal
17. Trace evidence
18. Biology
19. Firearms
20. Toxicology
21. Crime scene investigation
22. *Frye v. United States*
23. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*
24. True
25. *Coppolino v. State*
26. Expert witness
27. True
28. False
29. Training
30. True
31. Melendez-Diaz

Application and Critical Thinking

1. There are a range of possible answers to this question. Under the British fee-for-service model, government budgets might limit the number and type of laboratory tests police and prosecutors may request. On the other hand, if they must pay fees for crime lab services, police and prosecutors may be more careful about the types of evidence they submit. The fact that the U.S. model allows investigators to submit a theoretically unlimited amount of evidence for examination means that it might encourage police to spend more time and resources than are necessary to investigate a case. Under a fee-for-service model, police must be more efficient in their investigations. However, this can be a drawback in cases in which initial tests prove inconclusive and more extensive methods of examination are needed.
2. The note would be examined by the document examination unit; the revolver would be examined by both the firearms unit and the latent fingerprint unit; the traces of skin and blood would be examined by the biology unit.
3. Again, this question could have several answers, which might include greater expertise in crime scene investigation, using the skills of experts in several areas of criminalistics, and reducing the workload on patrol officers.
4. On appeal, the defense raised the question of whether a new test that has not been generally accepted by the scientific community is admissible as evidence in court. The court rejected the appeal, arguing that “general acceptance,” as stated in *Frye v. United States*, is not an absolute prerequisite to the admissibility of scientific evidence.
5. C, A, G, E, B, F, D
6. A=Toxicology, B=Drugs, C=Biology, D=Computer and Digital, E=Biology, F=Criminalistics, G=Anthropology, H=Document Examination, I=Computer and Digital, J=Toxicology, K=Fingerprint, L=Criminalistics, M=Firearms.

Chapter 2

The Crime Scene

CHAPTER OVERVIEW

- Physical evidence includes any and all objects that can establish that a crime has been committed or can link crime and victim or victim and perpetrator.
- Forensic science begins at the crime scene, where investigators must recognize and properly preserve evidence for laboratory examination.
- The first officer to arrive must secure the crime scene.
- Investigators record the crime scene by using photographs, sketches, and notes, and make a preliminary examination of the scene as it was left by the perpetrator.
- The search pattern selected at a crime scene depends on the size and location of the scene and the number of collectors participating in the search.
- Many items of evidence may be detected only through examination at the crime laboratory. For this reason, it is important to collect possible carriers of trace evidence, such as clothing, vacuum sweepings, and fingernail scrapings, in addition to more discernible items.
- Each item of physical evidence collected at a crime scene must be placed in a separate appropriate container to prevent damage through contact or cross-contamination.
- Investigators must maintain the chain of custody, which is a record for denoting the location of the evidence.
- Proper standard/reference samples, such as hairs, blood, and fibers, must be collected at the crime scene and from appropriate subjects for comparison purposes in the laboratory.
- The removal of any evidence from a person or from the scene of a crime must be done in accordance with appropriate search and seizure protocols.

LEARNING OBJECTIVES

1. Describe the various measures taken while securing, recording, and searching the crime scene.
2. Describe proper techniques for packaging common types of physical evidence.
3. Understand the concept of chain of custody.
4. Relate what steps are typically required to maintain appropriate health and safety standards at the crime scene.
5. Understand the implications of relevant U.S. Supreme Court decisions in conducting a crime scene investigation.

LECTURE OUTLINE

PROCESSING THE CRIME SCENE

Securing and Isolating the Crime Scene

Recording the Crime Scene

- **Teaching Note:** Be sure to cover the importance of protecting the crime scene from the very beginning. Too many critical things can be disturbed or destroyed if people are walking through the scene. Discuss how to control the scene and document who goes in and out.

Conducting a Systematic Search for Evidence

COLLECTING AND PACKAGING PHYSICAL EVIDENCE

- **Teaching Note:** Stress the importance of packaging evidence at a crime scene correctly. If cross-contamination, loss, transfer, or destruction of evidence occurs at the scene, then no amount of skill by a laboratory examiner can fix the compromised evidence.

MAINTAINING THE CHAIN OF CUSTODY

- **Teaching Note:** In explaining the chain of custody, elaborate on the responsibility that comes with having crime-scene evidence in one's possession.

Obtaining Standard/Reference Samples

Submitting Evidence to the Laboratory

ENSURING CRIME-SCENE SAFETY

LEGAL CONSIDERATIONS AT THE CRIME SCENE

- **Teaching Note:** Emphasize the legal consideration of proper evidence-handling. Bring up famous evidence mishap cases, like the O.J. Simpson and the Jon Benet Ramsey cases.

ADDITIONAL ASSIGNMENTS AND CLASS ACTIVITIES

Demonstrations and Lecture-Starters

Mock Crime Scene.

A mock crime scene can be set up in a classroom. Students are encouraged to become familiar with proper packaging and handling of common types of physical evidence. Emphasize preparation and use of the druggist fold. All pertinent information should be recorded in a notebook. Sketches may be made of the crime scene. A crime scene sketch kit, which includes an excellent instructional manual on sketching, is available from Sirchie Finger Print Laboratories, 100 Hunter Place, Youngsville, NC 27596.

Crime Scene Sketch.

Materials:

Graph paper

Notepad

Rulers

Tape measure/meter sticks

Mock crime scene

Procedure:

You have been introduced to the appropriate steps to process a crime scene. An important part of this process is surveying the scene and taking diligent notes of it. You must also create a sketch of the scene. With a partner or small group, you must create a sketch of the scene presented to you and keep notes of what evidence you find. In your sketch you must provide an accurate

depiction of the entire scene with dimension measurements, as well as location measurements for all pieces of physical evidence.

Follow-Up Questions:

1. Why is it important to take diligent notes when processing the crime scene?
2. What is the chain of custody?
3. Why do we sketch the crime scene as well as take photographs of it?

Questions

1. How does the textbook define physical evidence?
2. What is the first critical step in crime scene investigation? Why is this step so important?
3. List the three methods of crime scene recording.
4. What is the most important prerequisite for photographing a crime scene? Why is this so critical?
5. What is a rough sketch and what information must it accurately reflect?
6. What information must be included in any notes taken at the crime scene?
7. Besides the crime scene itself, what locations must investigators search?
8. What items from deceased victims must be collected and sent to a forensic laboratory?
9. What is the main objective in collecting and packaging physical evidence?
10. What is the best way to maintain the integrity of evidence that is collected and submitted to the crime laboratory?
11. Why is it important to package items of physical evidence in separate containers?
12. Why should ordinary mailing envelopes not be used for packaging physical evidence?
13. Describe a druggist fold and explain why it is a superior way to package small amounts of trace evidence.
14. Why should bloodstained evidence not be stored in airtight containers? What is the best way to store such evidence?
15. Define *chain of custody* and explain why maintaining a proper chain of custody is important. What are the possible consequences of failing to maintain a proper chain of custody?
16. What is a standard/reference sample and why is it important to the criminalist?
17. What is a substrate control and why is it important?
18. Why is it important to include a brief description of the case history on an evidence submission form?
19. What two diseases have sensitized the law enforcement community to the potential health hazards that can exist at crime scenes? Name three basic types of protective clothing that investigators use to guard against contamination by infectious materials at a crime scene.
20. List four situations in which a warrantless search may be justified.

Answers to Questions

1. Physical evidence is any object that can establish that a crime has been committed, or can link a crime and its victim or a crime and its perpetrator.
2. The first critical step in crime scene investigation is securing and isolating the crime scene. It is critical because anyone who enters a crime scene potentially could destroy physical evidence important to the investigation.
3. The three methods of crime scene recording are photography, sketches, and notes.
4. The most important prerequisite for photographing a crime scene is for the scene to be in an unaltered condition. If objects at the scene have been removed, added, or changed positions, the photographs may not be admissible as evidence at a trial, and their intended value will be lost.
5. A rough sketch is a draft representation of all essential information and measurements at a crime scene. A rough sketch must accurately depict the dimensions of the crime scene, as well as all recovered items of physical evidence and their exact locations.
6. Crime scene notes must include a detailed written description of the scene with the location of items of physical evidence recovered. They must also identify the time at which an item of physical evidence was discovered, by whom, how and by whom it was packaged and marked, and the disposition of the item after it was collected.
7. The areas searched must include all probable points of entry and exit used by the criminal(s).
8. The following items must be sent to the forensic laboratory: the victim's clothing, fingernail scrapings, head and pubic hairs, blood, any bullets recovered from the body, hand swabs (from shooting victims), and vaginal/anal/oral swabs (in sex-related crimes).
9. The main objective in collecting and packaging physical evidence is to prevent any change in the evidence between the time it is removed from the crime scene and the time it is received by the crime laboratory.
10. The integrity of evidence is best maintained when the item is kept in its original condition as found at the crime site.
11. Packaging evidence separately prevents damage through contact and cross-contamination.
12. Ordinary mailing envelopes should not be used as evidence containers because powders and fine particles will leak out of their corners.
13. A druggist fold consists of folding one end of a piece of paper over one-third, then folding the other end (one-third) over that, and repeating the process from the other two sides. After the paper is folded in this manner, the outside two edges are tucked into each other. A druggist fold produces a closed container that keeps the specimen from falling out.
14. Bloodstained materials should not be stored in airtight containers because the accumulation of moisture in such containers may encourage the growth of mold, which can destroy the evidential value of blood. In these instances, butcher paper, manila envelopes, and paper bags are recommended packaging materials.
15. The chain of custody is a list of all people who came into possession of an item of evidence. Maintaining a proper chain of custody is the best guarantee that the evidence will withstand inquiries of what happened to it from the time of its finding to its presentation in court. Failure to substantiate the evidence's chain of custody may lead to serious questions regarding the authenticity and integrity of the evidence and examinations of it.

16. A standard/reference sample is physical evidence whose origin is known, such as blood or hair from a suspect, which can be compared to crime-scene evidence. Standard/reference samples are important because they allow the criminalist to connect evidence found at the scene of a crime to the suspect and/or victim.
17. A substrate control consists of uncontaminated surface material close to an area where physical evidence has been deposited. A substrate control ensures that the surface on which a sample has been deposited does not interfere with the interpretation of laboratory tests.
18. Providing a case history allows the examiner to analyze specimens in a logical sequence and make the proper comparisons, and it also facilitates the search for trace quantities of evidence.
19. The spread of AIDS and hepatitis B have sensitized the law enforcement community to the potential health hazards that can exist at crime scenes. Three basic types of protective clothing recommended for investigators are latex gloves, shoe covers, and liquid-repellent coveralls.
20. A warrantless search may be justified in the following situations: (1) the existence of emergency circumstances; (2) the need to prevent the immediate loss or destruction of evidence; (3) a search of a person and property within the immediate control of the person, provided it is made incident to a lawful arrest; and (4) a search made by consent of the parties involved.

SUGGESTED ANSWERS TO END-OF-CHAPTER ASSIGNMENTS

Review Questions

1. Physical evidence
2. False
3. False
4. Excluded
5. True
6. First responding officer
7. Medical assistance
8. False
9. Log
10. True
11. Photography; sketching; notes
12. True
13. First responding officer
14. False
15. Notes
16. False
17. Unaltered
18. Close-up
19. False

20. Single lens reflex
21. Pixels
22. True
23. Overview; close-up
24. False
25. Standard operating procedures
26. Videotaping
27. Final sketch
28. Computer-aided design
29. Rough
30. Systematic
31. Physical evidence
32. False
33. False
34. Carriers
35. Is not
36. Separate
37. False
38. Is not
39. Air-dried
40. False
41. Chain of custody
42. Standard/reference
43. Unwarranted
44. Arson or fire

Application and Critical Thinking

1. While waiting for backup, you should summon medical assistance for the victim, take a statement from the victim, detain any suspects at the scene, establish the boundaries of the crime scene, and ensure no unauthorized personnel enter the crime scene.
2.
 - a) Grid or line search
 - b) Quadrant (zone) search
 - c) Spiral or line search
3. Officer Walter made a mistake by opening the window and airing out the house. He should have kept the window closed until an investigation team arrived. From the lack of blood or evidence of a struggle, he concluded that the murder occurred someplace else, and that the room containing the body was a secondary scene.
4. Officer Guajardo should not have removed the scrap of cloth until the photographer had

arrived and taken a picture of the evidence. He also should have put on latex gloves or used forceps or another tool to remove the scrap of cloth. Finally, he should have placed the cloth in a paper bag or other container where air could circulate, rather than in a sealed plastic bag where moisture could accumulate and cause mold to grow on the cloth.

5. Officer Gurney should have recorded his initials on the original seal and the date on which the evidence was sealed. The forensic scientist should have opened the package in a different place, not broken the old seal. The forensic scientist also should not have discarded the old seal.
6. The crime scene sketch does not contain dimensions of walls and objects or reference measurements for labeled objects. The sketch does show some case information, but it should be condensed in a title block.

Case Analysis

1. first challenge investigators faced was destruction of evidence. Mexican authorities autopsied the bodies twice before the corpses had been inspected, which likely destroyed potentially helpful evidence. Authorities also prevented forensic scientists from examining the corpses until the bodies had decomposed significantly. Mexican police removed all of the obvious evidence from the residence where the victims were held before allowing the FBI forensic team to enter the scene. Mexican authorities later seized a license plate found hidden at the scene and would not allow FBI agents to examine it or to conduct any further searches of the property. In addition, Mexican authorities destroyed much of the evidence that had been collected from the crime scene for “health reasons.” The second main challenge was contamination of crime scenes linked to the murders. The location where the bodies were discovered was not sealed by police, thus allowing both police officers and onlookers to contaminate the scene. Also, the residence at 881 Lope De Vega—where the victims were believed to have been killed—was cleaned and painted before forensics experts had a chance to examine it. In addition, Mexican federal police officers had been living in the residence since shortly after the time of the murders, further contaminating the scene.
2. Investigators collected reference samples of carpeting from the victims’ bodies, as well as bits of the victims’ clothing and the sheets in which the bodies were buried. The carpet samples matched samples taken from the residence at 881 Lope De Vega, where investigators suspected the victims were killed. The samples of burial sheet matched pillowcases found at the residence, and bits of clothing matching that worn by the victims were also found at the residence. In addition, hair and blood samples matching those of the victims were found in the residence at 881 Lope De Vega.
3. Investigators found that soil samples from the victims’ bodies did not match the soil from the area where the bodies were found. They also found no significant bodily fluids in the area where the bodies were found. This evidence suggested that the bodies originally had been buried elsewhere and later transported to the location where they were found. Investigators later compared soil samples from the victims’ bodies to samples taken from a park where the bodies of two Americans killed by drug traffickers had been discovered. Soil samples from the bodies of Camarena and Zavala exactly matched the soil found at the location where the Americans’ bodies were found.

