JonBenet Ramsey: Who Did It?

Patsy and John Ramsey were in the upper crust of Boulder, Colorado, society. In the span of five short years, John had built his computer company into a billion-dollar corporation. In addition to financial success, the Ramseys also had a beautiful 6-year-old daughter, JonBenet.

Just after five a.m. on December 26, 1996, Patsy Ramsey awoke and walked downstairs to her kitchen. At the foot of the staircase, she found a two-and-a-half-page note saying that JonBenet had been kidnapped. The note contained a ransom demand of $118,000. When the police arrived to investigate, it was quite apparent to all that JonBenet was missing.

In retrospect, some serious mistakes were made in securing the crime scene—the Ramsey household. Initially, the police conducted a cursory search of the house, but failed to find JonBenet. The house was not sealed off; in fact, four friends along with the Ramsey pastor were let into the home and allowed to move about at will. John was permitted to leave the premises unattended for one and a half hours. One hour after his return, John and two of his friends searched the house again. This time John went down into the basement, where he discovered JonBenet’s body. He removed a white blanket from JonBenet and carried her upstairs, placing the body on the living room floor.

The murder of JonBenet Ramsey remains as baffling a mystery today as it was on its first day. Ample physical evidence supports the theory that the crime was committed by an outsider, as well as the competing theory that JonBenet was murdered by someone who resided in the Ramsey household. Perhaps better care at securing and processing the crime scene could have resolved some of the crime’s outstanding questions.
CHAPTER 2

Physical Evidence and the Crime Scene

As automobiles run on gasoline, crime laboratories “run” on physical evidence. Physical evidence encompasses any and all objects that can establish that a crime has been committed or can link a crime and its victim or its perpetrator. But if physical evidence is to be used effectively to aid the investigator, its presence first must be recognized at the crime scene. If all the natural and commercial objects within a reasonable distance of a crime were gathered so that the scientist could uncover significant clues from them, the deluge of material would quickly immobilize the laboratory facility. Physical evidence achieves its optimum value in criminal investigations only when its collection is performed with a selectivity governed by the collector’s thorough knowledge of the crime laboratory’s techniques, capabilities, and limitations.

Forthcoming chapters will discuss methods and techniques available to forensic scientists to evaluate physical evidence. Although current technology has given the crime laboratory capabilities far exceeding those of past decades, these advances are no excuse for complacency on the part of criminal investigators. Crime laboratories do not solve crimes; only a thorough and competent investigation conducted by professional police officers will enhance the chances for a successful criminal investigation. Forensic science is, and will continue to be, an important element of the total investigative process, but it is only one aspect of an endeavor that must be a team effort. The investigator who believes the crime laboratory to be a panacea for laxity or ineptness is in for a rude awakening.

Forensic science begins at the crime scene. If the investigator cannot recognize physical evidence or cannot properly preserve it for laboratory examination, no amount of sophisticated laboratory instrumentation or technical expertise can salvage the situation. The know-how for conducting a proper crime-scene search for physical evidence is not beyond the grasp of any police department, regardless of its size. With proper training, police agencies can ensure competent performance at crime scenes. In many jurisdictions, police agencies have delegated this task to a specialized team of technicians. However, the techniques of crime-scene investigation are not difficult to master and certainly lie within the bounds of comprehension of the average police officer.
Not all crime scenes require retrieval of physical evidence, and limited resources and personnel have forced many police agencies to restrict their efforts in this area to crimes of a more serious nature. Once the commitment is made to process a crime site for physical evidence, however, certain fundamental practices must be followed.

**Securing and Recording the Crime Scene**

In order to be useful to investigators, evidence at a crime scene must be preserved and recorded in its original condition as much as possible. Failure to protect a crime scene properly or record its details accurately may result in the destruction or altering of evidence, or hinder the search for the perpetrator by misleading investigators about the facts of the incident.

**Secure and Isolate the Crime Scene**

The first officer arriving on the scene of a crime must preserve and protect the area as much as possible. Of course, first priority should be given to obtaining medical assistance for individuals in need of it and to arresting the perpetrator. However, as soon as possible, extensive efforts must be made to exclude all unauthorized personnel from the scene. As additional officers arrive, measures are immediately initiated to isolate the area. (See Figure 2–1.) Ropes or barricades along with strategic positioning of guards will prevent unauthorized access to the area.

Sometimes the exclusion of unauthorized personnel proves more difficult than expected. Violent crimes are especially susceptible to attention from higher-level police officials and members of the press, as well as

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**FIGURE 2-1**  The first investigators to arrive must secure the crime scene and establish the crime-scene perimeter. Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com
by emotionally charged neighbors and curiosity seekers. Every individual who enters the scene has the potential to destroy physical evidence, even if by unintentional carelessness. To exercise proper control over the crime scene, the officer protecting it must have the authority to exclude everyone, including fellow police officers not directly involved in processing the site or in conducting the investigation. Seasoned criminal investigators are always prepared to relate horror stories about crime scenes where physical evidence was rendered totally valueless by hordes of people who trampled through the site. Securing and isolating the crime scene are critical steps in an investigation, the accomplishment of which is the mark of a trained and professional crime-scene investigative team.

Once the scene has been secured, a lead investigator starts evaluating the area. First, he or she determines the boundaries of the scene, and then establishes the perpetrator’s path of entry and exit. Logic dictates that obvious items of crime-scene evidence will first come to the attention of the crime-scene investigator. These items must be documented and photographed. The investigator then proceeds with an initial walk-through of the scene to gain an overview of the situation and develop a strategy for systematically examining and documenting the entire crime scene.

**Record the Scene**

Investigators have only a limited amount of time to work a crime site in its untouched state. The opportunity to permanently record the scene in its original state must not be lost. Such records not only will prove useful during the subsequent investigation, but also are required for presentation at a trial in order to document the condition of the crime site and to delineate the location of physical evidence. Photography, sketches, and notes are the three methods for crime-scene recording (see Figure 2–2). Ideally all three should be employed; however, personnel and monetary limitations often

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**FIGURE 2–2** The finding of an evidential cigarette butt at the crime scene requires photographing it, making a sketch showing its relation to the crime scene, and recording the find in field notes. *Courtesy Police Science Services, Niles, Ill.*
prohibit the use of photography at every crime site. Under these circumstances, departmental guidelines will establish priorities for deploying photographic resources. However, there is no reason not to make sketches and notes at the crime scene.

**Photography**  
The most important prerequisite for photographing a crime scene is for it to be unaltered. Unless injured people are involved, objects must not be moved until they have been photographed from all necessary angles. If objects are removed, positions changed, or items added, the photographs may not be admissible as evidence at a trial, and their intended value will be lost. If evidence has been removed or moved prior to photography, the fact should be noted in the report, but the evidence should not be reintroduced into the scene in order to take photographs.

Each crime scene should be photographed as completely as possible. This means that the crime scene should include the area in which the crime actually took place and all adjacent areas where important acts occurred immediately before or after the commission of the crime. Overview photographs of the entire scene and surrounding area, including points of exit and entry, must be taken from various angles. If the crime took place indoors, the entire room should be photographed to show each wall area. Rooms adjacent to the actual crime site must be similarly photographed. If the crime scene includes a body, photographs must be taken to show the body’s position and location relative to the entire scene. Close-up photos depicting injuries and weapons lying near the body are also necessary. After the body is removed from the scene, the surface beneath the body should be photographed.

As items of physical evidence are discovered, they are photographed to show their position and location relative to the entire scene. After these overviews are taken, close-ups should be taken to record the details of the object itself. When the size of an item is significant, a ruler or other measuring scale may be inserted near the object and included in the photograph as a point of reference.

The digital revolution promises to bring enhanced photographic capabilities to the crime scene. For example, individual images of the crime scene captured with a digital camera can be stitched together electronically to reveal a near three-dimensional panoramic view of the crime scene (see Figure 2–3). With the aid of a computer, any area of the scene captured digitally can be enhanced and examined in fine detail.

The use of videotape at crime scenes is becoming increasingly popular because the cost of this equipment is decreasing. The same principles used in crime-scene photographs apply to videotaping. As with conventional photography, videotaping should include the entire scene and the immediate surrounding area. Long shots as well as close-ups should be taken in a slow and systematic manner. Furthermore, it is desirable to have one crime-scene investigator narrate the events and scenes being taped while another does the actual shooting.

While videotaping can capture the sounds and scenes of the crime site with relative ease, the technique cannot at this time be used in place of still photography. The still photograph remains unsurpassed in the definition of detail it provides to the human eye.

**Sketches**  
Once photographs have been taken, the crime-scene investigator sketches the scene. The investigator may have neither the skill nor the time to make a polished sketch of the scene. However, this is not required
**rough sketch**
A sketch, drawn at the crime scene, that contains an accurate depiction of the dimensions of the scene and shows the location of all objects having a bearing on the case.

**finished sketch**
A precise rendering of the crime scene, usually drawn to scale.

during the early phase of the investigation. What is necessary is a **rough sketch** containing an accurate depiction of the dimensions of the scene and showing the location of all objects having a bearing on the case.

A rough sketch is illustrated in Figure 2-4. It shows all recovered items of physical evidence, as well as other important features of the crime scene. Objects are located in the sketch by distance measurements from two fixed points, such as the walls of a room. It is important that distances shown on the sketch be accurate and not the result of a guess or estimate. For this reason, all measurements are made with a tape measure. The simplest way to designate an item in a sketch is to assign it a number or letter. A legend or list placed below the sketch then correlates the letter to the item’s description. The sketch should also show a compass heading designating north.

Unlike the rough sketch, the **finished sketch** in Figure 2-5 is constructed with care and concern for aesthetic appearance. When the finished sketch is completed, it must reflect information contained within the rough sketch in order to be admissible evidence in a courtroom. Computer-aided drafting (CAD) has become the standard method for reconstructing crime scenes from rough sketches. The software, ranging from simple, low-cost programs to complex, expensive ones, contains pre-drawn intersections, roadways, buildings, and rooms onto which information can be entered (see Figure 2-6). A generous symbol library provides a variety of images that can be used to add intricate details such as blood spatters to a crime-scene sketch. Equipped with a zoom function, computerized sketching can focus on a specific area for a more detailed

**FIGURE 2–3** Individual images (top) are shown before being electronically stitched together into a single panoramic image (bottom). Individual photographs should be taken with about a 30 percent overlap. Courtesy Imaging Forensics, Fountain Valley, Calif., www.imagingforensics.com
CASE 10-789-96
301 N. CENTRE ST.
OCT. 6, 1996 11:40 PM
HOMICIDE

VICTIM: LESTER W. BROWN
INVESTIGATOR: SGT. A.A. DUFFY
ASS'T BY: PLT. R.W. HICKS

picture. The CAD programs allow the user to select scale size so that the final product can be produced in a size suitable for courtroom presentation.

**Notes** Note taking must be a constant activity throughout the processing of the crime scene. These 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 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. The note taker must keep in mind that
this written record may be the only source of information for refreshing one’s memory months, perhaps years, after a crime has been processed. The notes must be sufficiently detailed to anticipate this need. Tape-recording notes at a scene can be advantageous—detailed notes can be taped much faster than they can be written. Another method of recording notes is to narrate a videotape of the crime scene. This has the advantage of combining note taking with photography. However, at some point the tape must be transcribed into a written document.

Key Points

• Physical evidence includes any and all objects that can establish that a crime has been committed or can link the crime and its victim or its 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 the perpetrator left it.

Dealing with Physical Evidence

After the lead detective has conducted a preliminary walk-through, a more thorough search for physical evidence begins. Once found, physical evidence must be collected and stored in a way that preserves its integrity for forensic comparison and analysis. As a result, law enforcement officials have developed specific procedures for finding, collecting, and transporting physical evidence that preserve its evidentiary value.
Conduct a Systematic Search for Evidence

The search for physical evidence at a crime scene must be thorough and systematic. For a factual, unbiased reconstruction of the crime, the investigator, relying on his or her training and experience, must not overlook any pertinent evidence. Even when suspects are immediately seized and the motives and circumstances of the crime are readily apparent, a thorough search for physical evidence must be conducted at once. Failure in this, even though it may seem unnecessary, can lead to accusations of negligence or charges that the investigative agency knowingly “covered up” evidence that would be detrimental to its case.

The investigator in charge assigns the personnel responsible for searching a crime scene. Except in major crimes, or when the evidence is very complex, a forensic scientist is usually not needed at the crime scene; his or her role appropriately begins with the submission of evidence to the crime laboratory. As has already been observed, some police agencies have trained field evidence technicians to search for physical evidence at the crime scene. They have the equipment and skill to photograph the scene and examine it for the presence of fingerprints, footprints, tool marks, or any other type of evidence that may be relevant to the crime.

Considerations in Searching the Crime Scene  How one conducts a crime-scene search will depend on the locale and size of the area, as well as on the actions of the suspect(s) and victim(s) at the scene. When possible, one person should supervise and coordinate the collection of evidence. Without proper control, the search may be conducted in an atmosphere of confusion with needless duplication of effort. Evidence collectors may subdivide the scene into segments and search each segment individually, or the search may start at some outer point and gradually move toward the center of the scene in a circular fashion (see Figure 2–7). The areas searched must include all probable points of entry and exit used by the criminals.

What to search for will be determined by the particular circumstances of the crime. Obviously, the skill of crime-scene investigators at recognizing evidence and searching relevant locations is paramount to successful processing of the crime scene. While training will impart general knowledge for conducting a proper crime-scene investigation, ultimately the investigator must rely on the experience gained from numerous investigations to formulate a successful strategy for recovering relevant physical evidence at crime scenes. For example, in the case of homicide, the search will center on the weapon and any type of evidence left as a result of contact between the victim and the assailant. The cross-transfer of evidence, such as hairs, fibers, and blood, between individuals involved in the crime is particularly useful for linking suspects to the crime site and for corroborating events that transpired during the commission of the crime. During the investigation of a burglary, efforts will be made to locate tool marks at the point of entry. In most crimes, a thorough and systematic search for latent fingerprints is required.

Vehicle searches must be carefully planned and systematically carried out. The nature of the case determines how detailed the search must be. In hit-and-run cases, the outside and undercarriage of the car must be examined with care. Particular attention is paid to looking for any evidence resulting from a cross-transfer of evidence between the car and the victim—including blood, tissue, hair, fibers, and fabric impressions. Traces of paint or broken glass may be located on the victim. In cases of homicide, burglary, kidnapping, and so on, all areas of the vehicle, inside and outside, are searched with equal care for physical evidence.
Collect Physical Evidence

Physical evidence can be anything from massive objects to microscopic traces. Often, many items of evidence are obvious in their presence, but others may be detected only through examination in the crime laboratory. For example, minute traces of blood may be discovered on garments only after a thorough search in the laboratory; the presence of hairs and fibers may be revealed in vacuum sweepings or on garments only after close laboratory scrutiny. For this reason, it is important to collect possible carriers of trace evidence in addition to more discernible items. Hence, it may be necessary to take custody of all clothing worn by the participants in a crime. Each clothing item should be handled carefully and wrapped separately to avoid loss of trace materials.

Critical areas of the crime scene should be vacuumed and the sweepings submitted to the laboratory for analysis. The sweepings from different areas must be collected and packaged separately. A portable vacuum cleaner equipped with a special filter attachment is suitable for this purpose (see Figure 2–8). Additionally, fingernail scrapings from individuals who were in contact with other individuals may contain minute fragments of evidence capable of linking the assailant and victim. The undersurface of each nail is best scraped with a dull object such as a toothpick to avoid cutting the skin. These scrapings will be subjected to microscopic examination in the laboratory.

The search for physical evidence must extend beyond the crime scene to the autopsy room of a deceased victim. Here, the medical examiner or coroner carefully examines the victim to establish a cause and manner of death.
death. Tissues and organs are retained for pathological and toxicological examination. At the same time, arrangements must be made between the examiner and investigator to secure a variety of items that may be obtainable from the body for laboratory examination. The following are to be collected and sent to the forensic laboratory:

1. Victim’s clothing
2. Fingernail scrapings
3. Head and pubic hairs
4. Blood (for DNA typing)
5. Vaginal, anal, and oral swabs (in sex-related crimes)
6. Recovered bullets from the body
7. Hand swabs from shooting victims (for gunshot residue analysis)

Once the body is buried, efforts at obtaining these items may prove difficult or futile. Furthermore, a lengthy delay in obtaining many of these items will diminish or destroy their forensic value.

Many police departments have recently purchased and equipped “mobile crime laboratories” (see Figure 2–9) for their evidence technicians. However, the term mobile crime laboratory is a misnomer. These vehicles carry the necessary supplies to protect the crime scene; photograph, collect, and package physical evidence; and develop latent prints. They are not designed to carry out the functions of a chemical laboratory. Crime-scene search vehicle would be a more appropriate but perhaps less dramatic name for such a vehicle.

**Procedures for Collecting and Packaging Physical Evidence**

Physical evidence must be handled and processed in a way that prevents any change from taking place between the time it is removed from the crime scene and the time it is received by the crime laboratory. Changes can arise through contamination, breakage, evaporation, accidental scratching or bending, or loss through improper or careless packaging.
The integrity of evidence is best maintained when the item is kept in its original condition as found at the crime site. Whenever possible, evidence should be submitted to the laboratory intact. Blood, hairs, fibers, soil particles, and other types of trace evidence should not normally be removed from garments, weapons, or other articles that bear them. Instead, the entire object should be sent to the laboratory for processing.

Of course, if evidence is adhering to an object in a precarious manner, good judgment dictates removing and packaging the item. If evidence is found adhering to a large structure, such as a door, wall, or floor, common sense must be used; remove the specimen with a forceps or other appropriate tool. In the case of a bloodstain, one may either scrape the stain off the surface, transfer the stain to a moistened swab, or cut out the area of the object bearing the stain.

Each different item or similar items collected at different locations must be placed in separate containers. Packaging evidence separately prevents damage through contact and prevents cross-contamination.
**Tools for Evidence Collection**  The well-prepared evidence collector arrives at a crime scene with a large assortment of packaging materials and tools, ready to encounter any type of situation. Forceps and similar tools may be used to pick up small items. Unbreakable plastic pill bottles with pressure lids are excellent containers for hairs, glass, fibers, and various other kinds of small or trace evidence. Alternatively, manila envelopes, screw-cap glass vials, or cardboard pillboxes are adequate containers for most trace evidence encountered at crime sites. Ordinary mailing envelopes should not be used as evidence containers because powders and fine particles will leak out of their corners.

Small amounts of trace evidence can also be conveniently packaged in a carefully folded paper, using what is known as a “druggist fold.” This consists of folding one end of the 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 to produce a closed container that keeps the specimen from falling out.

Although manila envelopes, pillboxes, or sealable plastic bags (see Figure 2–10) are good universal containers for most trace evidence, two frequent finds at crime scenes warrant special attention. If bloodstained materials are stored in airtight containers, the accumulation of moisture may encourage the growth of mold, which can destroy the evidential value of blood. In these instances, wrapping paper, manila envelopes, or paper bags are recommended packaging materials (see Figure 2–11). All items of clothing must be air-dried and placed individually in separate paper bags to ensure constant circulation of air through them. This will prevent the formation of mold and mildew. On the other hand, charred debris recovered from the scene of a suspicious fire must be sealed in an airtight container to prevent the evaporation of volatile petroleum residues. New paint cans or tightly sealed jars are recommended in such situations.

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**FIGURE 2–10**  (a) Manila evidence envelope, (b) metal pillboxes, (c) sealable plastic evidence bag. **Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com**
A detailed description of the proper collection and packaging of various types of physical evidence will be discussed in forthcoming chapters; additionally, most of this information is summarized in the evidence guide found in Appendix I.

**Maintain the Chain of Custody**

Continuity of possession, or the *chain of custody*, must be established whenever evidence is presented in court as an exhibit. This means that every person who handled or examined the evidence must be accounted for. Failure to substantiate the evidence’s chain of custody may lead to serious questions regarding the authenticity and integrity of the evidence and the examinations of it. Adhering to standard procedures in recording the location of evidence, marking it for identification, and properly completing evidence submission forms for laboratory analysis are 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.

All items of physical evidence should be carefully packaged and marked upon their retrieval at crime sites. This should be done with the utmost care to avoid destroying their evidential value or restricting the number and kind of examinations to which the criminalist may subject them. If at all possible, the evidence itself should be marked for identification. Normally, the collector’s initials and the date of collection are inscribed directly on the article. However, if the evidence collector is unsure of the necessity of marking the item itself, or has doubts as to where to mark it, it is best to omit this step. Where appropriate, the evidence is to be tagged for identification.

Once an evidence container is selected for the evidence, whether a box, bag, vial, or can, it also must be marked for identification. A minimum record would show the collector’s initials, location of the evidence, and date of collection. If the evidence is turned over to another individual for care or delivery to the laboratory, this transfer must be recorded in notes and other appropriate forms. In fact, every individual who possesses the evidence must maintain a written record of its acquisition and disposition. Frequently, all of the individuals involved in the collection and transportation of the evidence may be requested to testify in court. Thus, to avoid
confusion and to retain complete control of the evidence at all times, the chain of custody should be kept to a minimum.

Obtain Standard/Reference Samples

The examination of evidence, whether soil, blood, glass, hair, fibers, and so on, often requires comparison with a known standard/reference sample. Although most investigators have little difficulty recognizing and collecting relevant crime-scene evidence, few seem aware of the necessity and importance of providing the crime lab with a thorough sampling of standard/reference materials. Such materials may be obtained from the victim, a suspect, or other known sources. For instance, investigation of a hit-and-run incident might require the removal of standard/reference paint from a suspect vehicle. This will permit its comparison to paint recovered at the scene.

The presence of standard/reference samples greatly facilitates the work of the forensic scientist. For example, hair found at a crime scene will be of optimum value only when compared to standard/reference hairs removed from the suspect and victim. Likewise, bloodstained evidence must be accompanied by a whole-blood or buccal swab standard/reference sample obtained from all relevant crime-scene participants. The quality and quantity of standard/reference specimens often determine the evidential value of crime-scene evidence, and these standard/reference specimens must be treated with equal care.

Some types of evidence must also be accompanied by the collection of substrate controls. These are materials close to areas where physical evidence has been deposited. For example, substrate controls are normally collected at arson scenes. If an investigator suspects that a particular surface has been exposed to gasoline or some other accelerant, the investigator should also collect a piece of the same surface material that is believed not to have been exposed to the accelerant. At the laboratory, the substrate control is tested to ensure that the surface on which the accelerant was deposited does not interfere with testing procedures. Another common example of a substrate control is a material on which a bloodstain has been deposited. Unstained areas close to the stain may be sampled to determine whether this material can interfere with the interpretation of laboratory results. Thorough collection and proper packaging of standard/reference specimens and substrate controls are the mark of a skilled investigator.

Submit Evidence to the Laboratory

Evidence is usually submitted to the laboratory either by personal delivery or by mail shipment. The method of transmittal is determined by the distance the submitting agency must travel to the laboratory and the urgency of the case. If the evidence is delivered personally, the deliverer should be familiar with the case, to facilitate any discussions between laboratory personnel and the deliverer concerning specific aspects of the case.

If desired, most evidence can be conveniently shipped by mail. However, postal regulations restrict the shipment of certain chemicals and live ammunition and prohibit the mailing of explosives. In such situations, the laboratory must be consulted to determine the disposition of these substances. Care must also be exercised in the packaging of evidence in order to prevent breakage or other accidental destruction while it is in transit to the laboratory.

Most laboratories require that an evidence submission form accompany all evidence submitted (see Figure 2–12). This form must be properly
FIGURE 2–12 An example of a properly completed evidence submission form. Courtesy New Jersey State Police

completed. Its information will enable the laboratory analyst to make an intelligent and complete examination of the evidence. Particular attention should be paid to providing the laboratory with a brief description of the case history. This information will allow the examiner to analyze the specimens in a logical sequence and make the proper comparisons, and it will also facilitate the search for trace quantities of evidence.

The particular kind of examination requested for each type of evidence should be delineated. However, the analyst will not be bound to adhere strictly to the specific tests requested by the investigator. During the examination new evidence may be uncovered, and as a result the complexity
of the case may change. Furthermore, the analyst may find the initial requests incomplete or not totally relevant to the case. Finally, a list of items submitted for examination must be included on the evidence submission form. Each item is to be packaged separately and assigned a number or letter, which should be listed in an orderly and logical sequence on the form.

**Key Points**

- The search pattern selected at a crime scene depends on the size and locale 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, 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 Murder Scene: Death and Autopsies**

Unfortunately, the most important piece of evidence at many crime scenes is the dead body of a victim. When foul play is suspected, a victim’s corpse is subjected to the same kind of intense physical analysis as any other piece of evidence. This task falls primarily to a forensic pathologist, often aided by the skills of specialists including forensic anthropologists and forensic entomologists. In its broadest sense, forensic pathology involves the study of medicine as it relates to the application of the law, particularly criminal law. In practice, this most often involves the investigation of sudden, unnatural, unexplained, or violent deaths.

**Role of the Forensic Pathologist**  Typically, forensic pathologists, in their role as medical examiners or coroners, must answer several basic questions: Who is the victim? What injuries are present? When did the injuries occur? Why and how were the injuries produced? The primary role of the medical examiner is to determine the cause of death. If a cause cannot be found through observation, an **autopsy** is normally performed to establish the cause of death. The manner in which death occurred is classified into five categories: natural, homicide, suicide, accident, or undetermined, based on the circumstances surrounding the incident.

Frequently, medical examiners must perform autopsies if a death is deemed suspicious or unexplained. The cause of death may not always be what it seems at first glance. For example, a decedent with a gunshot wound and a gun in his hand may appear to have committed suicide. However, an autopsy may reveal that the victim actually died of suffocation and
the gunshot wound occurred after death to cover up the circumstances surrounding the commission of a crime.

**Estimating Time of Death**

After a human body expires, it goes through several stages of decomposition. A medical examiner can often estimate the time of death by evaluating the stage of decomposition in which the victim was found. Immediately following death, the muscles relax and then become rigid. This condition, *rigor mortis*, manifests itself within the first twenty-four hours and disappears within thirty-six hours.

Another condition occurring in the early stages of decomposition is *livor mortis*. When the human heart stops pumping, the blood begins to settle in the parts of the body closest to the ground. The skin appears dark blue or purple in these areas. The onset of this condition begins immediately and continues for up to twelve hours after death. The skin does not appear discolored in areas where the body is restricted by either clothing or an object pressing against the body. This information can be useful in determining whether the victim’s position was changed after death.

Other physical and chemical changes within the body also help approximate the time of death. *Algor mortis* is the process by which the body temperature continually cools after death until it reaches the ambient or room temperature. The rate of heat loss is influenced by factors such as the location and size of the body, the victim’s clothing, and weather conditions. Because of such factors, this method can only estimate the approximate time period since death. As a general rule, beginning about an hour after death, the body loses heat at a rate of approximately 1–1 1/2°F per hour until the body reaches the environmental temperature.

Another approach helpful for estimating the time of death is to determine potassium levels in the ocular fluid (fluid within the eye, also known as the vitreous humor). After death, cells within the inner surface of the eyeball release potassium into the ocular fluid. By analyzing the amount of potassium present at various intervals after death, the forensic pathologist can determine the rate at which potassium is released into the vitreous humor and use it to approximate the time of death. During the autopsy, other factors may indicate the time period in which death occurred. For example, the amount of food in the stomach can help estimate when a person’s last meal was eaten. This information can be valuable when investigating a death.

**Forensic Anthropology: Skeletal Detectives**

Forensic anthropology is concerned primarily with the identification and examination of human skeletal remains. Bones are remarkably durable and undergo an extremely slow breakdown process that lasts decades or even centuries. Because of their resistance to rapid decomposition, skeletal remains can provide a multitude of individual characteristics. An examination of bones may reveal their sex, approximate age, race, and skeletal injury (see Figure 2–13). For example, a female’s bone structure differs from a male’s, especially within the pelvic area because of a woman’s childbearing capabilities.

This area of expertise is not limited just to identification, however. A forensic anthropologist may also help create facial reconstructions to identify skeletal remains. With the help of this technique, a composite of the victim can be drawn and advertised in an attempt to identify the victim. Forensic anthropologists are also helpful in identifying victims of a mass disaster such as a plane crash. When such a tragedy occurs, forensic anthropologists can help identify victims through the collection of bone fragments.
The worst serial killer in America calmly admitted his guilt as he led investigators to a crawl space under his house. There, John Wayne Gacy had buried twenty-eight young men, after brutally raping and murdering them in cold blood. Because no identification was found with the bodies, the police were forced to examine missing-person reports for leads. However, these boys and men were so alike in age, race, and stature that police were unable to make individual identifications for most of the victims. Clyde Snow, the world-renowned forensic anthropologist from Oklahoma, was asked to help the investigators make these difficult identifications.

Snow began by making a thirty-five-point examination of each skull for comparison to known individuals. By examining each skeleton, he made sure each bone was correctly attributed to an individual. This was crucial to later efforts because some of the victims had been buried on top of older graves, mingling their remains. Once Snow was sure all the bones were sorted properly, he began his in-depth study. Long bones such as the femur (thigh bone) were used to estimate each individual’s height. This helped narrow the search when attempting to match the victims with the descriptions of missing people.

After narrowing the possibilities to missing people fitting the general description, investigators consulted potential victims’ hospital and dental records. Evidence of injury, illness, surgery, or other unique skeletal defects were used to make identifications. Snow also pointed out features that gave clues to the victim’s behavior and medical history. For example, he discovered that one of Gacy’s victims had an old fracture of his left arm, and that his left scapula (shoulder blade) and arm bore the telltale signs of a left-handed individual. These details were matched to a missing-person report and another young victim was identified.
For the most difficult cases, Snow called in the help of forensic sculptor and facial reconstructionist Betty Pat Gatliff. She used clay and depth markers to put the flesh back on the faces of these forgotten boys in the hopes that someone would recognize them after their photographs were released to the media. Her efforts were successful, but investigators found some families unwilling to accept the idea that their loved ones were among Gacy’s victims. Even with Gatliff’s help, nine of Gacy’s victims remain unidentified.

John Wayne Gacy. © Bettmann/CORBIS. All Rights Reserved

Forensic Entomology: Testimony from Insects

The study of insects and their relation to a criminal investigation is known as forensic entomology. Such a practice is commonly used to estimate the time of death when the circumstances surrounding the crime are unknown. After decomposition begins, insects such as blowflies are the first to infest the body. Their eggs are laid in the human remains and ultimately hatch into maggots or fly larvae (see Figure 2–14), which consume human organs and tissues. Forensic entomologists can identify the specific insects present in the body and approximate how long a body has been left exposed by examining the stage of development of the fly larvae.

These determinations are not always straightforward, however. The time required for stage development is affected by environmental influences such as geographical location, climate, and weather conditions. For example, cold temperatures hinder the development of fly eggs into adult flies. The forensic entomologist must consider these conditions when estimating the postmortem interval. Knowledge of insects, their life cycles, and their habits make entomological evidence an invaluable tool for an investigation (see Figure 2–15).

Key Points

- An autopsy is normally performed if a death is suspicious or unexplained.
- Rigor mortis occurs after death and results in the stiffening of body parts in the position they are in when death occurs. Livor mortis occurs after death and results in the settling of blood in areas of the body closest to the ground. Algor mortis refers to postmortem changes that cause a body to lose heat.
- Forensic anthropology is concerned primarily with the identification and examination of human skeletal remains.
- A forensic entomologist studies the development of insect larvae in a body to estimate time of death.

WebExtra 2.4
Patricia Cornwell’s Challenge
www.prenhall.com/hsforensics
CHAPTER 2

Eclosion: Adult Fly Emerges

Larva Stage III

Postfeeding

Puparium

Egg

Oviposition

Eclosion: Maggot Emerges

Larva Stage I

Larva Stage II

Larva Stage III

Early

Late

FIGURE 2–14 A scanning electron micrograph of two-hour-old blowfly maggots. Courtesy Science Photo Library

FIGURE 2–15 Typical blowfly life cycle from egg deposition to adult fly emergence. This cycle is representative of any one of the nearly ninety species of blowflies in North America. Courtesy E. P. Catts, Ph.D., deceased, and Neal H. Haskell, Ph.D., forensic entomology consultant, www.forensic-entomology.com
Chapter Summary

Physical evidence includes any and all objects that can establish that a crime has been committed or can link a crime and its victim or its perpetrator. Forensic science begins at the crime scene. Here, investigators must recognize and properly preserve evidence for laboratory examination. The first officer to arrive at the scene must secure the crime scene. Once the scene is secured, relevant investigators record the crime scene by using photographs, sketches, and notes. Before processing the crime scene for physical evidence, the investigator should make a preliminary examination of the scene as it was left by the perpetrator. The search for physical evidence at a crime scene must be thorough and systematic. The search pattern selected normally depends on the size and locale of the scene and the number of collectors participating in the search.

Physical evidence can be anything from massive objects to microscopic traces. Often, many items of evidence are clearly visible but others 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 different item or similar items collected at different locations must be placed in a separate, appropriate container. Packaging evidence separately prevents damage through contact and cross-contamination.

During the collection of evidence, the chain of custody, a record for denoting the location of the evidence, must be maintained. In addition, 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.

Several special forensic science services are available to the law enforcement community to augment the services of the crime laboratory when an investigation involves a sudden, unnatural, unexplained, or violent death. These services include forensic pathology, forensic anthropology, and forensic entomology.

Review Questions

Facts and Concepts

1. What is physical evidence? Give three examples of physical evidence that might be found at a crime scene.

2. What is the first step in processing a crime scene?

3. Why is it important to exclude onlookers from a crime scene?

4. Name three methods for recording a crime scene and list one unique advantage of each.

5. What is the most important prerequisite for photographing a crime scene?
6. If objects have been moved or removed from a crime scene, the investigator should
   a. replace them and photograph them in their original position.
   b. reconstruct the scene in the crime laboratory, then take a photo showing
      where the moved objects were originally located.
   c. note that the objects were moved, but do not reintroduce them to the crime
      scene.
   d. exclude those objects as possible pieces of evidence.

7. What areas should be photographed during a crime-scene investigation?

8. Name and describe the two kinds of sketches prepared for a crime scene.

9. What information must be included in written notes made at the crime scene?

10. Name three factors that influence how an investigator conducts a crime scene
    search.

11. List at least four pieces of evidence from a murder scene that must be collected
    and sent to the forensic laboratory. Why must these items be collected at the
    crime scene instead of later?

12. What is the most important consideration when handling and processing
    physical evidence?

13. What is the best way to maintain the integrity of physical evidence?

14. Describe the best way for an investigator to handle trace evidence found on
    articles collected at the crime scene. Name two exceptions to this general rule.

15. Describe a “druggist’s fold” and explain why it is a better way to store trace
    evidence than an ordinary mailing envelope.

16. Why should all items of evidence be placed in separate containers?

17. Name one type of evidence that should be stored in an airtight container and
    one type that should not be stored in such a container. Explain why each type
    of evidence should be stored (or not stored) in this way.

18. What is chain of custody and why is it important to maintain chain of custody?

19. What is a standard/reference sample? Why is collecting such a sample im-
    portant to the crime-scene investigator?

20. What is a substrate control and how is it used by the crime-scene investigator?

21. Which of the following is an example of a substrate control?
    a. a fingerprint found on a murder weapon
    b. floorboards from an arson scene that contain no trace of accelerants
    c. pieces of fiber adhering to a body discovered at a crime scene
    d. blood and skin found under the fingernails of a murder suspect

22. In what situations is an autopsy typically performed?

23. Define the terms *rigor mortis*, *livor mortis*, and *algod mortis* and explain how
    they are important to a forensic pathologist.

24. Which of the following methods is *not* used to approximate time of death?
    a. temperature of the body
    b. potassium level in the vitreous humor
25. What is forensic anthropology? List two ways in which a forensic anthropologist might identify a victim.

26. What does a forensic entomologist study to estimate time of death? Explain why such estimates are not always straightforward.

**Application and Critical Thinking**

1. Give at least three examples of how evidence might be destroyed by onlookers at a crime scene.

2. What important elements are missing from the following crime-scene sketch?

3. An investigator at a murder scene notes signs of a prolonged struggle between the attacker and victim. Name at least three types of physical evidence for which the investigator would likely collect standard/reference samples and explain why he or she would collect them.

4. Rigor mortis, livor mortis, and algor mortis are all used to help determine time of death. However, each method has its limitations. For each method, describe at least one condition that would render that method unsuitable or inaccurate for determining time of death.
5. What kind of forensic expert would most likely be asked to help identify human remains in each of the following conditions?
   a. a body that has been decomposing for a day or two
   b. fragmentary remains of a few arm bones and part of a jaw
   c. a skeleton that is missing the skull

**Case Analysis**

Investigators looking into the kidnapping and murder of DEA Special Agent Enrique Camarena and DEA source Alfredo Zavala faced several hurdles that threatened to derail their efforts to collect evidence in the case. These hurdles almost prevented forensics experts from determining the facts of the case and threatened to undermine the investigation of the crime. However, despite these obstacles, use of standard forensic techniques eventually enabled investigators to solve the case.

1. What were the main challenges facing investigators who were collecting evidence in the case? Give specific examples of these challenges.
2. Explain how investigators used reference samples to determine that the victims had been held at the residence located at 881 Lope De Vega.
3. Explain how investigators used soil evidence to determine that the victims’ bodies had been buried and later moved to the site where they were discovered.

**Virtual Crime Scene**

Search for clues at the scene of a murder. Once you’ve located the relevant evidence, you will need to collect the evidence for laboratory testing.

**Web Resources**

Forensic Science Resources (Links to CSI articles and sites; includes CSI bibliography)
www.tncrimlaw.com/forensic/f_crimescene.html

Crime Scene Investigation (Guidelines and articles on response, evidence collection, photography, and other topics)
www.crime-scene-investigator.net

Crime and Clues (Articles on crime-scene protection, processing, and reconstruction)
www.crimeandclues.com/crimescene.htm

Crime Scene Investigation: A Guide for Law Enforcement
www.ncjrs.gov/pdffiles1/nij/178280.pdf

Death Investigation: A Guide for the Scene Investigator
www.ncjrs.gov/pdffiles/167568.pdf

Forensic Entomology (Good general site for information on how entomology is used; includes information on equipment used by entomologists and how to handle and ship specimens)
www.forensic-entomology.com
On February 7, 1985, U.S. Drug Enforcement Agency (DEA) Special Agent (SA) Enrique Camarena was abducted near the U.S. Consulate in Guadalajara, Mexico. A short time later, Capt. Alfredo Zavala, a DEA source, was also abducted from a car near the Guadalajara Airport. These two abductions would trigger a series of events leading to one of the largest investigations ever conducted by the DEA and would result in one of the most extensive cases ever received by the FBI Laboratory. Throughout this lengthy investigation, unusual forensic problems arose that required unusual solutions. Eventually, numerous suspects were arrested, both in the United States and Mexico, which culminated in an 8-week trial held in U.S. District Court in Los Angeles, CA.

The Abduction

On February 7, 1985, SA Camarena left the DEA Resident Office to meet his wife for lunch. On this day, a witness observed a man being forced into the rear seat of a light-colored compact car in front of the Camelot Restaurant and provided descriptions of several of the assailants. After some initial reluctance, Primer Comandante Pavon-Reyes of the Mexican Federal Judicial Police (MFJP) was put in charge of the investigation, and Mexican investigators were assigned to the case. Two known drug traffickers, Rafael Caro-Quintero and Ernesto Fonseca, were quickly developed as suspects. A short time later at the Guadalajara Airport, as Caro-Quintero and his men attempted to flee by private jet, a confrontation developed between Caro-Quintero’s men, the MFJP, and DEA Agents. After some discussion, Caro-Quintero and his men were permitted to board and leave. It was later learned that a 6-figure bribe had been paid to Pavon-Reyes to allow this departure.

The Investigation

During February 1985, searches of several residences and ranches throughout Mexico proved fruitless, despite the efforts of the DEA task force assigned to investigate this matter and the tremendous pressure being applied by the U.S. Government to accelerate the investigation. High-level U.S. Government officials, as well as their Mexican counterparts, were becoming directly involved in the case. It is believed that because of this “heat,” the Mexican drug traffickers and certain Mexican law enforcement officials fabricated a plan. According to the plan, the MFJP would receive an anonymous letter indicating that SA Camarena and Captain Zavala were being held at the Bravo drug gang’s ranch in La Angostura, Michoacan, approximately...
60 miles southeast of Guadalajara. The MFJP was supposed to raid the ranch, eliminate the drug gang, and eventually discover the bodies of SA Camarena and Captain Zavala buried on the ranch. The DEA would then be notified and the case would be closed. Thus, the Bravo gang would provide an easy scapegoat.

During early March, MFJP officers raided the Bravo ranch before the DEA Agents arrived. In the resulting shootout, all of the gang members, as well as one MFJP officer, were killed. However, due to a mix-up, the bodies of SA Camarena and Captain Zavala were not buried on the Bravo ranch in time to be discovered as planned. The individuals paid to do this job simply left them by the side of a road near the ranch. It was later learned that certain Mexican law enforcement officials were paid a large sum of money to formulate and carry out this plan in order to obstruct and prematurely conclude the investigation.

Shortly after this shootout, a passerby found two partially decomposed bodies, wrapped in plastic bags, along a road near the Bravo ranch. The bodies were removed and transported to a local morgue where they were autopsied. The DEA was then advised of the discovery of the bodies and their subsequent removal to another morgue in Guadalajara, where a second autopsy was performed.

On March 7, 1985, the FBI dispatched a forensic team to Guadalajara. They immediately proceeded to the morgue to identify the bodies and to process any evidence which might be present. After much bureaucratic delay from the local officials, they were finally allowed to proceed. The bodies were identified only as cadavers number 1 and number 2. It was apparent that each body had been autopsied and that both were in an advanced state of decomposition. Cadaver number 1 was quickly identified by the fingerprint expert as that of SA Camarena. Mexican officials would not allow the second body to be identified at this time; however, it was later identified through dental records as Captain Zavala.

The FBI forensic team requested permission to process the clothing, cordage, and burial sheet found with the bodies but the request was denied. However, they were allowed to cut small, “known” samples from these items and obtain hair samples from both bodies. Soil samples were also removed from the bodies and the clothing items.

A forensic pathologist from the Armed Forces Institute of Pathology was allowed to examine the body of SA Camarena. He concluded that SA Camarena’s death was caused by blunt-force injuries. In addition, SA Camarena had a hole in his skull caused by a rod-like instrument. SA Camarena’s body was then released to the American officials and immediately flown to the United States.

The next day, both FBI and DEA personnel proceeded to the Bravo ranch where the bodies were initially found. Because this site had been a completely uncontrolled crime scene, contaminated by both police personnel and onlookers, only a limited crime-scene search was conducted. It was immediately noted that there was no grave site in the area and that the color of the soil where the bodies had been deposited differed from the soil that had been removed from the bodies. Therefore, “known” soil samples from the drop site were taken to compare with soil removed from the victims. It was also noted that there were no significant body fluids at the “burial” site. This led the forensic team to conclude that the bodies had been buried elsewhere, exhumed, and transported to this site.

The MFJP officials were later confronted with the evidence that the bodies had been relocated to the Michoacan area. This was one of the factors which led to a new, unilateral MFJP investigation. As a result, several suspects, including State Judicial Police Officers, were arrested and
interrogated concerning the kidnapping of SA Camarena. Primer Comandante Pavon-Reyes was fired, and arrest warrants were issued for a number of international drug traffickers, including Rafael Caro-Quintero and Ernesto Fonseca.

In late March 1985, DEA Agents located a black Mercury Gran Marquis which they believed was used in the kidnapping or transportation of SA Camarena. The vehicle had been stored in a garage in Guadalajara, and a brick wall had been constructed at the entrance to conceal it. The vehicle was traced to a Ford dealership owned by Caro-Quintero. Under the watchful eye of the MFJP at the Guadalajara Airport, the FBI forensic team processed the vehicle for any hair, fiber, blood, and/or fingerprint evidence it might contain.

During April 1985, the MFJP informed the DEA that they believed they had located the residence where SA Camarena and Captain Zavala had been held. The FBI forensic team was immediately dispatched to Guadalajara; however, they were not allowed to proceed to the residence, located at 881 Lope De Vega, until an MFJP forensic team had processed the residence and had removed all of the obvious evidence. The DEA was also informed that since the abduction of SA Camarena, all of the interior walls had been painted, the entire residence had recently been cleaned, and that a group of MFJP officers were presently occupying, and thereby contaminating, the residence.

On the first day after the arrival of the FBI forensic team, they surveyed and began a crime scene search of the residence and surrounding grounds. [See Figure 1.] The residence consists of a large, two-story structure with a swimming pool, covered patio, aviary, and tennis court surrounded by a common wall. The most logical place to hold a prisoner at this location would be in the small outbuilding located to the rear of the main residence. This outbuilding, designated as the “guest house,” consisted of a small room, carpeted by a beige rug, with an adjoining bathroom. The entire room and bathroom were processed for hairs, fibers, and latent fingerprints. The single door into this room was made of steel and reinforced by iron bars. It was ultimately determined by means of testimony and forensic evidence that several individuals interrogated and tortured SA Camarena in this room. In addition, a locked bedroom, located on the second floor of the main house, was also processed, and the bed linens were removed from a single bed. Known carpet samples were taken from every room in the residence.

A beige VW Atlantic, which fit the general description of the smaller vehicle noted by the person who witnessed SA Camarena’s abduction, was parked under a carport at the rear of the residence. The VW Atlantic was also processed for hairs, fibers, and fingerprints.

On the second day, a thorough grounds search was conducted. As FBI forensic team members were walking around the tennis court, they caught a glimpse of something blue in one of the drains. Upon closer inspection, it appeared to be a folded license plate, at the bottom of the drain. However, a heavy iron grate covered the drain and prevented the plate’s immediate retrieval.

When one of the FBI Agents returned to the main house to ask the MFJP officers for a crowbar, they became extremely curious and followed the Agent as he returned, empty handed, to the tennis court. By this time, a second Agent had managed to remove the grate by using a heavy-wire coat hanger. The license plate was retrieved, unfolded and photographed. The MFJP officers, all of whom were now at the tennis court, became upset at this discovery, and one of them immediately contacted his superior at MFJP headquarters, who ordered them to secure the license plate until the
FIGURE 1  Diagram of the 881 Lope De Vega grounds. Camarena was held prisoner in the guest house.
Assistant Primer Comandante arrived on the scene. After his arrival approximately 20 minutes later, he seized the license plate and would not allow the Americans to conduct any further searches.

However, by this time, five very large plastic bags of evidence had been recovered and were placed in the rear of a DEA truck. The evidence was quickly transported to the DEA vault in the U.S. Consulate.

After negotiations between the United States and Mexico, the MFJP did allow a second, final search of the residence. On June 24, 1985, a forensic team returned and processed the four remaining rooms on the first floor of the main house.

By this point in the investigation, an associate of Rafael Caro-Quintero had been arrested and interrogated by the MFJP. He stated that the bodies of two Americans, Albert Radelat and John Walker, who had been abducted and killed by Mexican drug traffickers, were buried on the south side of La Primavera Park, a large, primitive park west of Guadalajara. The bodies of Radelat and Walker were located and recovered. Soil samples taken from the surface of an area near their graves were similar in most respects to the soil recovered earlier from the bodies of SA Camarena and Captain Zavala.

In September 1985, DEA personnel went to La Primavera Park and sampled an area approximately 2 feet below the surface near the same site. This sample matched the soil samples from SA Camarena and Captain Zavala almost grain for grain, indicating that this site was almost certainly their burial site before they were relocated to the Bravo ranch.

Later that fall, after further negotiations between the U.S. and the Mexican governments, permission was finally granted for an FBI forensic team to process the evidence seized by the MFJP forensic team from 881 Lope De Vega the previous April. The evidence consisted of small samples the MFJP had taken of SA Camarena’s burial sheet, a piece of rope used to bind SA Camarena, a portion of a pillowcase removed from bedroom number 3, a piece of unsoiled rope removed from the covered patio, and a laboratory report prepared by the MFJP Crime Laboratory. The remainder of the evidence had been destroyed for “health reasons.”

In January 1986, a drug trafficker named Rene Verdugo, who was considered to be a high-ranking member of the Caro-Quintero gang, was apprehended and taken to San Diego, where he was arrested by the DEA. He was then transported to Washington, D.C., where hair samples were taken. He refused to testify before a federal grand jury investigating the Camarena case. Later that year, DEA personnel obtained hair samples in Mexico City from Sergio Espino-Verdin, a former federal comandante, who is believed to have been SA Camarena’s primary interrogator during his ordeal at 881 Lope De Vega.

The Trial
In July 1988, the main trial of the murder, interrogation, and abduction of SA Camarena began in U.S. District Court in Los Angeles, CA. The forensic evidence presented in this trial identified 881 Lope De Vega as the site where SA Camarena had been held. The evidence also strongly associated two Mexican citizens, Rene Verdugo and Sergio Espino-Verdin, with the “guest house” at 881 Lope De Vega. Several types of forensic evidence were used to associate SA Camarena with 881 Lope De Vega: forcibly removed head hairs, found in the “guest house” and bedroom number 4, in the VW Atlantic and in the Mercury Gran Marquis, and two types of polyester rug fibers, a dark, rose-
FIGURE 2  Trial chart showing hair comparisons between known Camarena hairs and hairs recovered from 881 Lope De Vega.
FIGURE 3  Trial chart showing hair comparisons between known Camarena hairs and hairs recovered from the Mercury Gran Marquis.
colored fiber and a light-colored fiber. [See Figures 2 and 3.] Fabric evidence was also presented, which demonstrated the similarities of color, composition, construction, and design between SA Camarena’s burial sheet and the two pillowcases recovered from bedrooms number 3 and 5.

Based on this evidence associating SA Camarena and 881 Lope De Vega, the FBI Laboratory examiner was able to testify that SA Camarena was at this residence, as well as in the VW Atlantic and the Mercury Gran Marquis, and that he had been in a position such that his head hairs were forcibly removed. Captain Alfredo Zavala was also found to be associated with the “guest house” at 881 Lope De Vega. Light-colored nylon rug fibers, found on samples of his clothing taken at the second autopsy, matched the fibers from the “guest house” carpet.

A detailed model of the residence at 881 Lope De Vega was prepared by the Special Projects Section of the FBI Laboratory for the trial. [See Figure 4.]

Over 20 trial charts were also prepared to explain the various types of forensic evidence. These charts proved invaluable in clarifying the complicated techniques and characteristics used in the examination of the hair, fiber, fabric, and cordage evidence. [See Figure 5.]

**Conclusion**

The forensic pitfalls and problems in this case (i.e., destruction of evidence, contamination of crime scenes) were eventually resolved. In some cases, certain routine procedures had to be ignored or unconventional methods employed. However, in many instances, detailed trial testimony overcame the limitations of certain evidence, and eventually, almost all of the evidence introduced at the trial made a tremendous impact on the outcome of this proceeding. After an 8-week trial, conducted under tight security and involving hundreds of witnesses, all of the defendants were found guilty, convicted on all counts, and are currently serving lengthy sentences.
### CATEGORIES OF FORENSIC EVIDENCE
**IN CAMARENA CASE**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>TYPE OF EVIDENCE</th>
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</thead>
<tbody>
<tr>
<td><strong>Mercury</strong></td>
<td><strong>Carpet</strong></td>
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<tr>
<td></td>
<td><strong>Fibers</strong></td>
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<td></td>
<td><strong>Fabric</strong></td>
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<td></td>
<td><strong>Match</strong></td>
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<td></td>
<td><strong>Cordage</strong></td>
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<tr>
<td></td>
<td><strong>Match</strong></td>
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<td></td>
<td><strong>Tape</strong></td>
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<tr>
<td></td>
<td><strong>Match</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Misc.</strong></td>
</tr>
<tr>
<td><strong>VW Atlantic</strong></td>
<td><strong>Camarena</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Head Hair</strong></td>
</tr>
<tr>
<td><strong>Guest House</strong></td>
<td><strong>Zavala</strong></td>
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<tr>
<td></td>
<td><strong>Clothes</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Nylon</strong></td>
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<tr>
<td><strong>Bedroom #3</strong></td>
<td><strong>Camarena</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Blindfold</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Polyester</strong></td>
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<tr>
<td><strong>Bedroom #4</strong></td>
<td><strong>Camarena</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Blindfold &amp; Burial Sheet</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Polyester</strong></td>
</tr>
<tr>
<td><strong>Bedroom #5</strong></td>
<td><strong>Pillow Case Camarena</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Burial Sheet</strong></td>
</tr>
<tr>
<td><strong>Tennis Court</strong></td>
<td><strong>License Plate VW/Merc.</strong></td>
</tr>
<tr>
<td><strong>Camarena Burial Sheet</strong></td>
<td><strong>Camarena</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Head Hair</strong></td>
</tr>
<tr>
<td><strong>Source – Blindfold/Rope</strong></td>
<td><strong>Bedrooms</strong></td>
</tr>
<tr>
<td></td>
<td><strong>#3 and #4</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Polyester</strong></td>
</tr>
<tr>
<td><strong>Camarena Burial Cordage</strong></td>
<td><strong>Camarena</strong></td>
</tr>
<tr>
<td><strong>Zavala Clothing</strong></td>
<td><strong>Zavala</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Head Hair</strong></td>
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<tr>
<td></td>
<td><strong>Guest House</strong></td>
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<tr>
<td></td>
<td><strong>Nylon</strong></td>
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**FIGURE 5** Trial chart used to show the association of Camarena and Zavala with various locations.