Chapter 3

Crime Reconstruction

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1. Introduction

Have you ever wondered how the great fictional detectives of literature, such as Hercules Pierot, Sherlock Holmes, Mrs. Marple, etc., were able to "solve" crimes quickly, yet it takes so long for the police to do the same? The authors, of course, can write and shape things as they want, whereas the police have to work under specific rules. The authors can create "clues" that are used by the sharp minds of their detectives to eliminate the innocent and identify the guilty and to reconstruct what happened. Law enforcement must find and recognize clues. The authors have studied human behavior and the environments in which they live so they are able to point out those things that are out of the ordinary. They use the logical extension of the clues that they have created to develop the story. Similarly, law enforcement has studied the behavior of criminals and the environment in which they work. They use the same logical exten- sion of the clues to develop a theory (or a story) about the crime. This is crime reconstruction.

Not all law enforcement personnel can do crime reconstruction. It must be someone who is a keen observer, understands science, recognizes evidence, and can apply critical thinking* and logic. The criminalist, forensic scientist, or

*Critical thinking is a purposeful, reflective, and goal-directed activity that aims to make judgments based on evidence rather than conjecture. It is based on the principles of science and the scientific method. Critical thinking is a reasoned, interactive process that requires the development of strategies that maximize human potential. (Old Dominion University, School of Nursing faculty minutes, 1997).

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scientific investigator uses "clues," critical thinking, and logic in the process of crime reconstruction. Crime reconstruction can be defined as the logical analysis of the physical evidence and other facts into the formulation of a theory regarding the actions that took place in the commission of a crime. Henry Lee* pointed out that it is not just the physical evidence that is incorporated into forming a theory. "Reconstruction not only involves the scientific scene analysis, interpretation of scene pattern evidence, and laboratory examination of physical evidence, but also involves systematic study of related information and the logical formulation of a theory" *(1)*.

The process of crime reconstruction is not an easy one because we are dealing with human action and are trying to tell details of what happened at a particular time in the past. There may not be a full picture: we can sequence events, but we cannot tell what happened in between those events. As Dr. John Thornton† stated, "Recognize that the physical evidence may not tell the whole story of what happened, but only isolated bits of the whole story. The entire landscape provided by the physical evidence may in fact be akin to looking at a tapestry from the back side" (Thornton, J., personal communication, May 1998).

Whoever approaches the crime scene, either in person or through documentation, must be able to understand that the entire story may not be revealed.

Reconstructionists must have an understanding of how things work. They must be able to use both inductive and deductive logic in their analysis of the crime. Inductive logic is used to formulate a theory. If the theory is true, then deductions can be made regarding what happened. However, one must be careful in making deductions, because the theory must prove to be true. The testing of the theory is done by the "scientific method." Usually, after more than one theory is postulated, the scientific method is then applied to eliminate the impossible.

2. *The Scientific Method*

Crime reconstruction is the observation of the results of an act or action then postulation of the cause of those results. In the scientific world this is not unusual. Phenomena are observed. The scientist postulates or forms a hypothesis about what caused the phenomena, then designs experiments to test the

*Dr. Henry Lee was the Director of the Connecticut State Police Crime Laboratory, Commissioner of the State Police, and Professor of Criminalistics at the University of New Haven. He is now the director of the Lee Institute for Forensic Science in West Haven, CT.

†Dr. John Thornton is a retired Professor of Criminalistics at the University of California, Berkeley.

hypothesis. If the experiments fail, a new hypothesis is formed and more testing is done until the experiments work thereby supporting the hypothesis with data. Therefore, this hypothesis is only as valid as the experiments. Another experiment along a different approach could prove this to be an inaccurate hypothesis.

This same scientific method approach is used in crime reconstruction. We form a theory about the crime and then test that theory or hypothesis against the physical evidence found at the scene or developed through laboratory experiments. If an item of physical evidence is contrary to the theory, then that theory must be abandoned and a new theory is formulated. Again, a hypothesis may prove not to be valid, but it needs to be presented so that it may be tested.

In everyday life, an effect is frequently observed from which we can conclude or surmise what happened. For example, a broken vase on the floor with cat footprints in the dust on the table near where the vase was previously sitting may be observed. The obvious conclusion is that the cat pushed the vase off the table. This is putting the clues together to explain an event. If, however, the dog's teeth marks are in the tablecloth on which the vase had been sitting, a different conclusion would be reached and the cat exonerated.

The following is an example of an observation and the application of scientific methodology: we see a ball of clay sitting on the floor and we observe that the clay is flat on one side. We hypothesize that the clay ball was dropped onto the floor because there is nothing above the ball from which it could have fallen. Therefore, our hypothesis appears to be true.

We can now also determine more about the incident. We can measure the flattened area and weigh the clay. Then we make balls out of the same type of clay and the same weight. We drop them from various heights and compare the size of the flattened areas until we find one that matches. We then theorize about how far the clay fell. That is a simple experiment to determine a cause from the effect.

To complicate this experiment, we see a second ball of clay sitting near the wall. We see a "greasy" spot* on the wall above it with two flattened sides. We form the hypothesis that one was side was flattened by throwing the ball against the wall, and the other side was flattened by falling to the floor. We can tell which side was flattened first by application of logic. If the ball is on the floor then it must have fallen there after it hit the wall. We note which flattened area is touching the floor, then we can compare our previously collected measurements with our measurements to the height of the greasy spot. We have

*Hypothesis: the greasy spot was caused by the clay. The reader is encouraged to design an experiment that would test this hypothesis.

sequenced the events. Now we measure the flattened area that was not on the floor. This flattened area may have been changed or altered when the ball fell to the floor. Therefore, our measurement may be of an area of flattening *plus an area that should have existed*.

To test the hypothesis, we project clay against the wall until we produce a flattened side of the same size as the second measured area. By measuring the velocity at which each ball struck the wall we can now say how fast the original ball was traveling when it hit the wall. We must consider any other factors that might affect the results. For example, if the temperature was considerably different between the time of the events and the experiments, then the conclusions we reached are not valid because the physical properties of the clay are changed by temperature.

These experiments sound simple; however, as illustrated, many factors must be considered in even these simple experiments. The reconstructionist must be able to design and conduct the same types of experiments with blood drops, bullets, and other types of physical evidence. In the above experiment, data was available after the first set of experiments that could be used to determine the cause in subsequent events without having to redo the experiments. "Crime reconstruction requires a broad base of knowledge regarding forensic science and an ability to determine the cause from the effect" *(2)*.

In the scientific method we cannot establish absolutes. The array of solutions we start with are eliminated to the most logical. Alternative solutions involving aliens, ghosts, and other outlandish creatures or events are not even considered. The alternatives can be considered falsehoods. "Falsification is the central concept behind the scientific method. Consequently, when developing a reconstructive analysis the reconstructionist develops an hypothesis that he or she will attempt to disprove. If the hypothesis is falsified the reconstructionist can opine that this hypothesis (or theory of the crime) is not conceivable or compatible with the evidence submitted and analyzed. The scientific method appears very similar to the writings of Sir Arthur Conan Doyle when he stated, 'You eliminate the impossible, then whatever is left, however improbable, is the truth'" *(3,4)*.*

3. Types of Evidence Examined

In the past few years, there has been a great emphasis on training law enforcement personnel to recognize and interpret bloodstain evidence. At this time, bloodstains are probably the most common type of evidence examined for

*The quote from AC Doyle in *The Adventure of the Beryl Coronet* reads: "Eliminate the impossible, then whatever is left, however improbable, is the truth."

a reconstruction. However, the entire crime scene must be examined and all the evidence taken into account. Errors in reconstruction occur when only one evidence type is examined. A "holistic" approach must be followed, accounting for all the evidence in the case. Nothing can be ignored or "sorted out" as is done in some departments for efficiency and expediency.

Everything is evidence of something; the hard part is deciding whether or not that evidence is part of the crime. Some things are predictable, like the flattening of the clay in the earlier examples, whereas other things are unpredictable, such as damage done by insects or animals. Evidence can be transitory, such as the odor of cologne in a room, ice cubes in a glass, or footprints in sand on a windy day, or destroyed or altered by improper procedures in the investigation.

Blood drops (and raindrops) are almost perfect spheres. When the drop strikes a surface at an angle it will leave a teardrop shape, with the tail pointing in the direction of forward movement. (This phenomenon can be seen by observing the stains left by vehicles dripping oil or paint while traveling. The tail of the oil or paint points in the direction of traffic.) Reconstruction experts must conduct experiments to determine the striking angle that causes the particular shape of the drop. This is just one of several experiments that must be performed; they must have a good understanding of how various bloodstain patterns are produced and the role of bloodstains in crimes.

The same is true with firearms evidence. The reconstructionist must conduct or witness experiments that show how various evidence is produced. This includes, but is not limited to the following:

- Distance determinations from powder or lead residues at various angles and with different types of cartridges (calibers and manufacturers).
- The deflections of bullet paths caused by penetrating or perforating various materials.
- The shape and size of the holes made in various materials.
- Ricochet marks on various surfaces.
- The damage to the bullet from ricocheting.
- The path change by ricocheting, including left vs right twist.

The list could go on for a number of pages; reconstructionists should consult the literature for experiments performed by others for ideas on how to approach special problems.

The role of trace evidence in reconstruction is often overlooked. Hairs and fibers can show that a particular person was present. Trace evidence can show contact between the victim and suspect or the suspect and the environment of the crime including the path taken and some of the actions. These clues need to be incorporated into the reconstructive analysis. The problem in using this type of evidence is that it requires a crime laboratory analysis before it becomes

useful. The information is available for court purposes but is not present during the investigative phase.

The position of an item may be extremely important in determining its role in a crime. This is information that cannot be determined by looking at the object in the laboratory. This information must be documented and processed at the scene. Without information regarding the location of the item it may be of no value for reconstructive purposes. This information is true not only for crime reconstruction, but also for the reconstruction of human behavior by the archeologist as well.

> *The patterning of human behavior is key to the concept that the study of the spatial arrangement of artifacts can be used to infer the behavior from which they result. Because of this, the spatial context of artifacts, including their relationship with the natural environment, is more important than the artifact itself. Removing an artifact from its context destroys much of its potential to help reconstruct human behavior. (5)*

The "tag and bag" approach to the crime scene will destroy the potential that the crime reconstructionist uses to reconstruct recent human behavior. According to Ogle, "It is important to remember that crime scene reconstruction begins with a systematic, meticulous, and competent endeavor by the crime scene processing team" *(6)*. The reconstructionist must rely on documentation of the scene to establish these relationships. For example, the location of a gun may yield information regarding whether a death is a suicide, homicide, or an accident. Firing the weapon and comparing the test bullets with the fatal bullet can only show that the gun in question was the one responsible.

4. What Can Be Determined

The position and/or actions of the people involved in the incident can also be established through the physical evidence left behind or altered. The functional condition of an item also gives information. A bullet through a clock may stop its functioning at a specific time establishing when the shooting occurred.*

A reconstructionist was able to determine from the physical evidence left behind at the scene that an elderly man was lying when he called to say his wife had committed suicide with a shotgun. She was lying in front of the TV with a coat hanger bent to push the trigger. However, the shotgun was fully loaded.

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*The Far Side cartoon by Gary Larson showing several bullet holes in the clocks at a clock shop while the detective states he wishes there was some way to establish the time of death comes to mind.

The husband always reloaded after shooting and it did not occur to him that the gun's functionality would be checked.

Many of these items of evidence cannot be packaged and brought to the laboratory for examination. That is, you could not package the relationship of the bloodstain above a kitchen drawer to the knife drawer or the footprint impression in the carpet or the location of blood streaks on the wall. This information must be carefully documented and recorded in sketches and photographs and the items must be accurately measured so their positions can be reflected in the sketches.

The evidence clues can tell us information about the sequence of events and establish direction. For example, the bloody footprints on the floor of a prison hallway establishes the direction the victim was going and the direction from which he was coming. The sequence of events is simple logic: he was stabbed, then he staggered down the corridor. This is a simple example of establishing sequence and directions; most crime scenes will have some evidence that will provide information regarding the sequence of events, but it may not always be this simple.

The position of a shooter can be established by tracing back the bullet paths and/or by the location of the cartridge casings. This technique was used in a crime scene where a driver of a car was shot by his jealous girlfriend. She said she accidentally fired the gun about 3 ft from the car. The gun she used was a .25 automatic. The ejection of the cartridge casing from this gun is to the right rear. The cartridge casing was found in the passenger's seat. Therefore, it can be concluded that she reached inside the vehicle through the passenger window to fire the weapon. Her position was established through the analysis of the physical evidence, i.e., the location of the casing and the trajectory of the bullet.

Reconstruction evidence may not necessarily be present at the scene, but may take the form of inferred or derived conclusions. This inferred evidence is frequently used to establish the apparent motive. The empty wallet lying beside the body, the jewelry removed from the open drawer, the photo missing from a frame all are motive evidence. Their absence is the clue; we infer that they existed. Shadow patterns are another example of inferred evidence. The lack of a portion of the blood spray behind the victim of a shotgun blast shows that something was removed after the shot. The shape of this void may also yield information. We also expect a blood spray to be present on the item if it is located.

5. *Tying it All Together*

Simply utilizing the scientific method to determine certain activities or facts from the clues is not reconstruction. Logic and critical thinking must be

applied to the separate events or facts that have been determined. At this point the alternatives must be considered. The theories of the detectives, the attorneys, the witnesses, the suspect, and, if living, the victim must be tested against the established events or facts.

The reconstructionist must take facts from different areas to determine if there is a connection. One fact will affect the way in which another could have happened. Critical thinking is applied to these facts. However, one must be cautious in this approach to reconstruction. It is easy to go too far and say things that cannot be supported. This may be acceptable in the investigative phase, but not in court where each and every point must be explained and supported by the evidence. The following shows how extensive the reconstruction can be:

On Christmas night two women were found shot in a bloody scene in a suburban neighborhood. The scene had several types of physical evidence, including shoeprints, blood, and clothing. The male suspect had a bloodstain pattern and a bullet hole with gunpowder residue surrounding only one half of the hole. He also had makeup under this hole and on his forearm and near the bloodstain. The autopsies showed both victims had been shot, one of them three times, the other only once.

Based on examination of the evidence it was determined that one of the women had taken a bath, and was getting dressed when the suspect entered the bedroom and hit her with a baseball bat. She was incapacitated, but, because of a three-quarter-in. skull thickness, she was not killed. The suspect then grabbed the other woman, held her in a headlock and put the gun to her temple catching a fold of his coat when he shot her. He let her fall to the floor and caught the first woman approaching the door. He shot her in the neck; as she fell he shot her in the cheek and in the eye.

He then removed his coat and proceeded to arrange the bodies into a "crucifixion" pose. The arms outstretched and the feet crossed. He then went to the bathroom, relieved himself, and washed. He put on his coat and left the house. He disposed of the weapon before his mother told him to go to the police because he had blood on his coat. The case did not go to trial as the defendant pled guilty.

6. *Why Reconstruct the Crime?*

Ogle, a criminalist, wrote in a book on evidence collection, "Crime scene reconstruction is one of the major purposes for the collection of physical evidence" *(6)*. The question is: Why is this so important?

Crimes are reconstructed for several reasons depending on the phase of the case. The investigation, the trial preparation, the defense preparation, the trial itself all can benefit from reconstruction. Knowing what happened makes the task of finding justice easier.

The first step is to determine if there is a crime or what crime has been committed. Because the edge of a piece of glass will indicate the direction of the force applied to it to break it out, this can be used to determine if a person broke the window from outside as in a burglary or from the inside for insurance fraud or just for attention. The discovery of bear hair on a cloth found on an elderly woman's porch showed it came from inside the house where there was a bearskin. It was not a "death threat" or an "alien invasion" as she suspected.

After a crime is established, crime reconstruction is used to aid in determining the what, who, when, how, and why of the crime. The reconstructionist becomes part of a team of persons involved in the investigation. The information developed in reconstruction is used by the following:

- Investigators conducting interviews to test the veracity of the statements.
- Criminal profilers in making a "profile" of the perpetrator.
- District Attorneys or Defense Attorneys to determine how to prepare and argue their cases in court.
- The Court in determining sentences.

The following case illustrates how the use of reconstruction would have saved the city and county from prosecuting the wrong person. Betty was in jail for 8 mo awaiting trial before the evidence was examined for reconstruction purposes.

Sue and Betty were competing for the same man's attention. Sue had been living with him, but now he had moved in with Betty. Sue claimed she was walking home from work when Betty and three other women came on her in their car. She was thrown to the sidewalk on her back, then flipped over and held by three of the women while Betty cut her shirt and back. She said she could feel the blood running down her back so she struggled until she could finally get up and get away.

Sue called the police with a report. It was 1.5 h before an officer arrived. He said she had about 20 cuts on her back that were still "dripping blood." Betty was charged with assault.

The photos showed very superficial cuts, more like scratches that could be self-inflicted. The shirt was cut only part way up the back, with jagged cuts at the top where the shirt was bunched up. Examination of the shirt revealed no blood on the inside back.

This case shows how physical evidence is used to determine the veracity of a statement. This is one of the more common uses of reconstruction. The stories told by the victim (if living), the suspect, and the witnesses should all be tested because, in some cases, there are fabricated stories that sound good but are false. The statement was made in this case by the alleged victim. The story does not agree with the physical evidence. The "victim" should be charged with filing a false report.

This case involves what is called a "staged crime scene." A staged crime scene is one in which the evidence is altered or created to shift the direction of the investigation *(7)*. When physical evidence is changed or created to direct the investigation toward a specific individual, as in this case, this type of staged crime scene is called a "frame." Usually, the evidence in a staged scene is altered to cover up the crime. The removal of a body from the house and dumping it in a remote area and cleaning the house is one of the most common cover-ups. This is almost always the act of someone living with the decedent.

If there is an idea how the crime was committed then the evidence can be easier to locate and identify. The reconstructionist at the crime scene will see relationships that can quickly lead to other evidence. For example, multiple blows to the head of a body indicate there should be blood cast off on the weapon. If there is no cast off blood nearby, then the beating did not occur at this location. A blood trail should lead to the original scene. If a scene is lacking a trail and cast-off blood stains, a reconstructionist would have to consider a "staged" crime scene or that the premise that there was a beating is incorrect. The wrong statement at the crime scene can send the investigation and conclusions completely off track.

A man had reportedly committed suicide by pouring gasoline on himself inside a house and igniting it. The reconstructionist was not at the crime scene but was presented with the facts later. The man had run from the hallway where the gasoline can was located into a bedroom, onto the bed, then jumped through a window before being overcome by the flames. In looking at the sketch of the house (floorplan) the reconstructionist asked where the heater was located. It was a floor heater right where the fire started. This was no suicide; it was an accident. When the fumes from the gasoline reached the pilot light on the gas heater, they caused the gasoline can to explode and saturated the arsonist with gasoline.

As in this case, the use of physical evidence for a reconstruction may determine if the death is an accident, suicide, homicide, or natural. The determination of a natural death is left to the pathologist and the toxicologist. In the following case, the bloodstain patterns, the direction of the shot, and the way

clothing was arranged were the clues that yielded information to prove a homicide.

A second-grade student came home from school to find the doors locked. Because her mother was 9 mo and 1 d pregnant, she was sure her mother went to the hospital. She went into the garage to get the house key and saw a shape that looked like a person. She ran two blocks to her grandparents and told them that her mother had gone to the hospital and someone was in the garage. Because they were supposed to take their daughter to the hospital they were very concerned. The grandfather went to the garage and found his daughter in a lawn chair with her head split down the middle and a shotgun at her feet. He called the police.

Examination of the crime scene led the reconstructionist to the conclusion that this was a staged crime scene. The following clues were the basis for this conclusion:

The bloodstains on the arms and hands were not consistent with the blood that would result from a shotgun blast to the head. The shot was directed parallel to the floor as evidenced by the blood spatter on the wall behind her. Finally, her belt was above her breasts.

These clues show that the victim was beaten elsewhere then placed in the chair and then shot with the shotgun. Later, a search warrant was obtained allowing entry to the house. Inside the house there were blood cast-off and spatter patterns on the walls and ceilings of the dining room and kitchen. There were two heavily bloodstained cast iron skillets with the bottoms broken out. A similar cast iron saucepan had the handle broken off, and a second saucepan was also spattered.

The husband had a perfect alibi; he was seen at work 1 h before his daughter left for school and was not missing at any time during the day. The investigation led to an old Army buddy of the husband's, who had been staying at the home for a couple of weeks. He had been paid $10,000 worth of cocaine by the husband to kill his wife. He stated, "She didn't want to die." Her husband and his buddy were convicted of two counts each of murder for hire. The actual killer was sentenced to two life sentences; the husband to two death penalties.

This was another staged crime scene. If the "plan" had succeed and she had been knocked unconscious with the first blow and no blood shed in the house or on her clothing, would the responding officer have been able to recognize the clues that showed this was a homicide? Probably not. This would have been a "perfect crime." Fortunately, if anything can be fortunate in a homicide, the victim did not respond as planned.

7. Reconstruction in Behavioral Analysis

Criminal profiling, or analysis of the behavior of the criminal at the scene, is a relatively new approach in criminal investigations. Crime reconstruction is an important component of these profiles. The Academy of Behavioral Profiling has stated that a reconstruction must be made before a behavior analysis is rendered *(8)*.

Cooley wrote an on-line article titled *Crime Scene Reconstruction: The Foundation of Behavioral Evidence Analysis (4)*. He stated in the introduction, "The chief goal of this report is to argue that the foundation of any competent criminal profile is that of a complete crime scene reconstruction, brought about by the physical evidence documented and collected at the crime scene(s)." In other words, the profile is based on the evidence and what it can "tell" the reconstructionist about the actions at the crime scene. Cooley also compared the processes of reconstruction and profiling: "Crime scene reconstruction like behavioral evidence analysis is both a science and an art. The process is founded on the scientific method, while the practice and degree of success is dependent upon the skill and experience of the reconstructionist. The important aspect being that its foundation is that of the scientific method. With reconstruction and behavioral evidence analysis both relying upon the scientific method the end result of one's analysis will be shielded from attacks on its reliability and validity" *(4)*. Both processes use the scientific method; however, one process is dependent on the other. If the reconstruction is flawed, it follows that the profile will also be flawed.

8. Ethics

Reconstruction experts must be aware that the analysis rendered is, in many cases, going to be the deciding factor in how justice is dispensed. They cannot afford to allow speculation into their findings. They must pursue as much information as they can about a case. A reconstruction cannot be made without all the evidence.

It is also necessary to know the limitations of one's abilities. A disagreement between experts can usually be traced to one of them lacking knowledge about a type of evidence or the cause and effect. For example, arterial spurting is a known phenomenon, but when the torso is upright or is clothed, this is not a factor because the chest cavity fills or the clothing absorbs the energy of the blood stream. Therefore, the expert who "sees arterial spurting" from a chest wound on an upright person is misinterpreting blood that has been cast off from the hands or weapon.

The understanding of critical thinking and logic is absolutely necessary for the reconstructionist. Even with a clear understanding of these processes,

not knowing how to interpret a piece of evidence will result in a faulty analysis because a wrong premise is the starting point in the process. It is also important to remember the difference between inductive and deductive logic because starting with a faulty premise will lead to wrong conclusions. As John Thornton states, "Induction is a type of inference that proceeds from a set of specific observations to a generalization, called a premise. This premise is a working assumption, but it many not always be valid. A deduction, on the other hand, proceeds from a generalization to a specific case, and that is generally what happens in forensic practice. Providing that the premise is valid, the deduction will be valid. But knowing whether the premise is valid is the name of the game here; it is not difficult to be fooled into thinking that one's premises are valid when they are not.

"Forensic scientists have, for the most part, treated induction and deduction rather casually. They have failed to recognize that induction, not deduction, is the counterpart of hypothesis testing and theory revision... too often a hypothesis is declared as a deductive conclusion, when in fact it is a statement awaiting verification through testing" *(9)*.

The reconstruction can also be faulty because evidence was not available for analysis. This can be because law enforcement did not think the evidence would be of value and, therefore, did not submit it for laboratory analysis. But more frequently, it is because the analyst did not ask for photos and reports to help interpret the evidence.

9. Conclusion

For reconstruction purposes, the value of physical evidence and documentation of the crime scene by competent personnel cannot be overemphasized. The reconstruction analyst relies on correct, complete information to render a reconstruction of the events of a crime. Not all cases can or need to be reconstructed and the evidence in some of the cases does not need to be collected. In others, competent personnel are not available to respond to the crime scenes. Therefore, a reconstruction will not be possible. "The value of physical evidence varies from type to type and case to case. In some investigations, its potential may never be fully appreciated. In some jurisdictions it is a matter of the availability of trained personnel who can respond to crime scenes and collect the appropriate evidence" *(10)*.

The workload at the crime laboratories has become so great that many laboratory workers no longer respond to crime scenes. They do not develop the expertise necessary for crime reconstruction. The forensic scientist should understand the uses of the physical evidence and the importance of reconstructing the crime.

GLOSSARY

BAC: Blood alcohol concentration. Usually reported in gram percent (g%). The legal limit for driving in most states is 0.080 g%.

DUI: Driving under the influence, usually restricted to situations involving driving under the influence of alcohol.

DUID: Driving under the influence of drugs. Usually used for situations involving driving under the influence of any drug other than alcohol.

FID: Flame ionization detector. A device used to detect compounds that have been isolated by a gas chromatograph. An FID essentially detects anything that burns.

GC: Gas chromatography. A separation technique that is used to separate mixtures of chemical compounds. A GC is usually run at relatively high temperatures (100–300ºC) and uses helium to help move the unknown compounds through the system. A GC is coupled to any one of a number of different detectors, including NPD, FID, and MS detectors.

GC/MS: A GC coupled to an MS detector.

HPLC: High-performance liquid chromatography. A separation technique that is used to separate mixtures of chemical compounds. An HPLC is usually run at relatively low temperatures and frequently uses aqueous solutions so that the analysis of temperature sensitive and water-soluble substances may be detected. An HPLC is coupled to any one of a number of different detectors, including UV and MS detectors.

IA: Immunoassay. A detection technique relying on the interaction of an antibody with a drug or poison.

LC/MS: Also called HPLC/MS. An HPLC coupled to an MS detector.

ME: Medical examiner.

MS: Mass spectrometer. A device used to detect compounds which have been isolated by a gas chromatograph, a liquid chromatograph (HPLC), or can be used alone to identify pure substances. A mass spectrometer provides a great deal of information to help identify unknown substances, information which may include the molecular weight, a unique mass spectral fingerprint, presence of nitrogen or other halogens, and some information on how the molecule is structured.

NPD: Nitrogen-phosphorus detector. A device used to detect compounds that have been isolated by a gas chromatograph. An NPD essentially detects anything that contains nitrogen or phosphorus and is useful for detecting drugs, poisons, and explosives.

OTC: Over the counter. Drugs that are available without a prescription.

Toxicology: The science of poisons.

UV: Ultraviolet detector. A device used to detect compounds that have been isolated by a liquid chromatograph. A UV detector detects anything that absorbs ultraviolet light.

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