Forensic Science

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Key Terms

Crime reconstruction; Criminalistics; Forensic generalist; Forensic science; Forensic scientist; Forensic services; Forensic specialist; Forensic technician; Role strain; Science; Scientific knowledge; Scientific method; Scientist; Technician

The interconnected criminal and civil justice systems in the United States exist at the municipal, county, state, and federal levels. Each consists of the following major branches: law enforcement, forensic services, judiciary, and corrections. Law enforcement agencies at the local, state, and federal levels investigate reported crime, establish the facts, and determine whether a law has been violated. They also seek to identify and arrest criminal suspects. The judiciary is composed of attorneys, judges, magistrates, courts, and other professionals who provide related services (e.g., court reporters, bailiffs, and administrators). It deals with the adjudication and exoneration or punishment of criminal defendants. Corrections is composed of those agencies charged with handling the probation, incarceration, management, rehabilitation, treatment, parole, and execution of convicted criminals. This can include prisons, mental health hospitals, and a wide variety of other state-funded facilities.

Forensic services refers to the branch of the criminal justice system that deals with the examination and interpretation of evidence—physical, behavioral, and testimonial. Government-employed technicians, analysts, forensic scientists, and mental health experts perform a wide variety of forensic services on behalf of the state, most often employed directly by the police or the prosecution. However, the forensic community in the United States is also populated by a large number of privately employed, independent forensic examiners and laboratories. They are regularly engaged to perform examinations for the police, the prosecution, and the courts.

When state or private funds are available, as happens in major cases or those involving financially capable defendants, private forensic professionals may be hired to provide a necessary

1 Some sections of this chapter have been adapted from Turvey (2010) and Turvey and Petherick (2010).
counterbalance within the adversarial system. However, access to qualified private forensic examiners is by no means equal, varying widely from state to state. It is therefore reasonable to say that not every available forensic service is an adjunct of the government, although it is more often the case than not. And not every defendant has access to qualified forensic experts.

The purpose of this first chapter is to explain the relationship between forensic science and crime reconstruction as they relate to the justice system. Although this may seem too fundamental for inclusion in an advanced forensic science text, the authors disagree. For reasons that will become clear, is not uncommon to find even senior forensic practitioners who are ignorant of what forensic science and crime reconstruction are, let alone their scope and role in the process. Developing this understanding will provide the philosophical cohesion and integrity necessary for an informed reading of all subsequent chapters within. It will also resonate beyond those pages into research, casework, and testimony.

**FORENSIC SCIENCE**

Forensic science is the application of scientific knowledge and principles to the resolution of legal disputes, whether criminal or civil. This definition, generally consistent across forensic textbooks and professional organizations, is intentionally broad. There are, in fact, many different kinds of forensic scientists, as shown in this outline of specialties:

A. Criminalistics
   1. Event/incident analysis
      a. Accident reconstruction/forensic engineering
      b. Bloodshed pattern analysis
      c. Criminal activity reconstruction
      d. Digital evidence reconstruction
      e. Fire scene reconstruction
      f. Shooting incident reconstruction
      g. Transfer evidence reconstruction
      h. Wound pattern analysis and reconstruction
   2. Drug chemistry analysis and identification
   3. Forensic biology
      a. DNA analysis and comparison
      b. Serological analysis and comparison
   4. Fire debris analysis and comparison
   5. Pattern comparison
      a. Firearm and tool mark analysis and comparison
      b. Footwear pattern analysis and comparison
   6. Trace evidence analysis

2 This outline does not include all forensic specialties, only those found most commonly in service of the court. Additionally, it is limited to those forensic sciences associated with the examination of physical evidence.
a. Commercial materials analysis and comparison
b. Fiber analysis and comparison
c. Glass analysis and comparison
d. Gunshot residue analysis
e. Hair analysis and comparison
f. Natural materials analysis
g. Soil analysis and comparison

B. Digital evidence analysis
C. Fingerprint development and comparison
D. Forensic dentistry/odontology
E. Forensic nursing
F. Forensic pathology
G. Forensic toxicology
H. Questioned documents

The most common type of forensic scientist is the criminalist. As suggested in the aforementioned outline, criminalistics is a division of forensic science dedicated to the recognition, examination, and interpretation of physical evidence using the natural sciences, logic, and critical thinking.

Thornton and Peterson (2002) explain that forensic scientists are defined by the possibility that they will be called upon to present scientific findings, under penalty of perjury, in a court of law. Subsequently, they will be asked to explain to the court what those findings mean and how they came to them. Those examiners whose work does not bring them into contact with the legal system are not “forensic” in nature. As provided in Thornton and Peterson (2002, p. 148):

What then, of the forensic scientist? The single feature that distinguishes forensic scientists from any other scientist is the expectation that they will appear in court and testify to their findings and offer an opinion as to the significance of those findings. The forensic scientist will, or should, testify not only to what things are, but to what things mean. Forensic science is science exercised on behalf of the law in the just resolution of conflict. It is therefore expected to be the handmaiden of the law, but at the same time this expectation may very well be the marina from which is launched the tension that exists between the two disciplines.

The unique role of the forensic scientist is ultimately that of an educator to attorneys, judges, and juries. Trust extended to them as an expert under these circumstances is not trivial. The results of their examinations and any related opinions can greatly influence the outcome of a legal proceeding. In civil matters, reputations and fortunes may be lost or won. In criminal matters, nothing less than the life and liberty of the accused is at stake. A convincing forensic scientist can be terribly compelling to a police officer, judge, or jury or provide an essential building block in the argument of an attorney, thus tipping the scales of justice for one side of a given dispute over the other.

Ultimately, then, the mission of forensic science is to develop and provide scientific knowledge and information for the decision makers of the justice system. These include:

- Police officers
- Attorneys
- Juries
- Judges/magistrates
• Probation/parole officers

The forensic scientist is not a decision maker in the justice system, and, as already discussed in the Prefaces, their goals must remain separate to maintain any semblance of impartiality.

GENERALISTS VS. SPECIALISTS

As in the field of medicine, or any other field for that matter, there are forensic generalists and there are forensic specialists. The distinction between generalist and specialist forensic practitioners is an important one that has been too often deemphasized. Forensic generalists and forensic specialists alike are required in order to effect informed forensic case examination, laboratory testing, and crime reconstruction.

Forensic generalists are a particular kind of forensic scientist, broadly educated and trained in a variety of forensic specialties. They understand the range of forensic testing available for particular kinds of evidence and the meaning of those findings to a reconstruction of events. They are “big picture” people who can help reconstruct a crime from work performed with the assistance of other forensic scientists and then direct investigators to forensic specialists as needed. They are not experts in all areas, but in the specific area of evidence interpretation. According to DeForest and colleagues (1983, p. 17):

Because of the depth and complexity of criminalistics, the need for specialists is inescapable. There can be serious problems, however, with overspecialization. Persons who have a working knowledge of a broad range of criminalistics problems and techniques are also necessary. These people are called generalists. The value of generalists lies in their ability to look at all of the aspects of a complex case and decide what needs to be done, which specialists should be involved, and in which order to carry out the required examinations.

Specialization occurs when a forensic scientist has been trained in a specific forensic subspecialty, such as an area of criminalistics, forensic toxicology, forensic pathology, or forensic anthropalogy. Specialists are an important part of forensic science casework, with an important role to fill. Traditionally, with respect to crime reconstruction, forensic specialists provide the bricks and forensic generalists provide the blueprints.

There are fewer and fewer generalists in the forensic science community, and it is not uncommon for forensic scientists to gain employment in government service without a generalist background at all. Rather it is more common for forensic scientists to be narrowly trained as specialists of some sort without the benefit of a general forensic education and then to learn other subspecialties once employed by a public crime lab. In fact, most crime lab employees are cross-trained in multiple areas of evidence to save having to hire additional personnel.

3 The reader is urged to read the Preface to the first edition (online) and the Preface to the second edition in the frontmatter, as they are integral to understanding the professional context and message of science that the authors intend to impart.
As explained in Inman and Rudin (1999), there is much confusion over who precisely the “real” forensic scientists are, and who they are not. An assessment of the discontinuity is offered in the NAS report by Edwards and Gotsonis (2009, p. S-5):

The term “forensic science” encompasses a broad range of forensic disciplines, each with its own set of technologies and practices. In other words, there is wide variability across forensic science disciplines with regard to techniques, methodologies, reliability, types and numbers of potential errors, research, general acceptability, and published material. Some of the forensic science disciplines are laboratory based (e.g., nuclear and mitochondrial DNA analysis, toxicology and drug analysis); others are based on expert interpretation of observed patterns (e.g., fingerprints, writing samples, toolmarks, bite marks, and specimens such as hair). The “forensic science community,” in turn, consists of a host of practitioners, including scientists (some with advanced degrees) in the fields of chemistry, biochemistry, biology, and medicine; laboratory technicians; crime scene investigators; and law enforcement officers. There are very important differences, however, between forensic laboratory work and crime scene investigations. There are also sharp distinctions between forensic practitioners who have been trained in chemistry, biochemistry, biology, and medicine (and who bring these disciplines to bear in their work) and technicians who lend support to forensic science enterprises.

Moreover, Edwards and Gotsonis (2009) found the forensic science community poorly focused and badly fragmented, with no clear practice standards, consistent terminology, or standardized means of practitioner certification. Suffice it to say that forensic science is not always practiced in a crime lab, it is not always practiced by someone working for law enforcement (nor should it be), and, unfortunately, it is not always practiced by actual scientists. However, it must also be remembered that the vast majority of full-time forensic science practitioners in the United States work in police agencies or government-funded crime labs, providing their services almost exclusively to law enforcement and the prosecution. Edwards and Gotsonis explain that (2009, pp. 1–2)

according to a 2005 census by the Bureau of Justice Statistics (BJS), 389 publicly funded forensic crime laboratories were operating in the United States in 2005: These included 210 state or regional laboratories, 84 county laboratories, 62 municipal laboratories, and 33 federal laboratories, and they received evidence from nearly 2.7 million criminal cases. These laboratories are staffed by individuals with a wide range of training and expertise, from scientists with Ph.D.s to technicians who have been trained largely on the job. No data are available on the size and depth of the private forensic laboratories, except for private DNA laboratories.

These circumstances exist in no small part because forensic science in practice is an applied science (Inman and Rudin, 1999). This means that practitioners borrow from the research and principles of other established scientific disciplines and apply it to their own forensic casework.

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4 A full discussion of the NAS report, what it is, and its highly relevant findings is provided in the Preface to the second edition of this textbook: “The NAS Report: A Mandate for Science in Forensic Science.” Readers are encouraged to take the time to read this Preface, as well as the NAS report itself.

5 Edwards and Gotsonis (2009): “Not all forensic services are performed in traditional crime laboratories by trained forensic scientists. Some forensic tests might be conducted by a sworn law enforcement officer with no scientific training or credentials, other than experience. In smaller jurisdictions, members of the local police or sheriff’s department might conduct the analyses of evidence, such as latent print examinations and footwear comparisons.”
Because many forensic practitioners are not themselves scientists, especially those in direct police service, the results of their borrowed methods and analyses can range from the exceptionally informed to the patently absurd.

Another issue is the distinction that must be made between scientist and technician practitioners of forensic science. As with the first edition of this text, the NAS report goes out of its way to make a clear distinction between forensic scientists and forensic technicians. It provides, among other things, that (Edwards and Gotsonis, 2009, p. S-5)

there are also sharp distinctions between forensic practitioners who have been trained in chemistry, biochemistry, biology, and medicine (and who bring these disciplines to bear in their work) and technicians who lend support to forensic science enterprises. Many of these differences are discussed in the body of this report.

The greatest distinction identified in the NAS report is that of testing versus interpretation (p. 2–4):

Because of the distinctly different professional tracks within larger laboratories, for example, technicians perform tests with defined protocols, and credentialed scientists conduct specialized testing and interpretation.

As provided in the Preface of the first edition of this text, a technician is one trained in procedures learned by routine or repetition. A forensic technician is trained in the specific procedures related to collecting and even testing evidence found at or in association with crime scenes. This is without any need for employing or even understanding the underlying science involved, the scientific method, or the principles of forensic science. This describes police technicians documenting crime scenes and collecting evidence, and more than a few of the forensic personnel working in government crime labs who are trained to perform analytical testing without an interpretive role.

A scientist is someone who possesses an academic and clinical understanding of the scientific method and the analytical dexterity to construct experiments that will generate the empirical reality that science mandates. A forensic scientist is one who is educated and trained to examine and determine the meaning of physical evidence in accordance with the established principles of forensic science, with the expectation of presenting his or her findings in court. They also holds a degree in a natural science or in forensic science.

The position taken by the NAS is that science must be part of both methods and interpretations of forensic scientists. A technician can collect a sample, extract DNA, or test for the presence or absence of substances. But it takes a scientist to interpret the results of that test in the context in which it was run, with respect to the limits of good science. If others are interpreting evidentiary findings on their behalf or without a scientific background, then there is increased room for misrepresentation and error.

The contrast between technician and scientist is both subtle and tremendous. Currently, the trend is to populate government-funded crime labs with forensic technicians who do little more than inject a sample and push a button without knowing the science beneath their methods and

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7 The authors are never surprised to find crime lab employees who have learned their entire profession on the job, without a formal scientific education, holding only undergraduate degrees in unrelated areas such as criminal justice, business administration, public administration, or general studies.
instrumentation. This saves money in terms of having to hire fewer of those with advanced degrees. This also limits the testimony of forensic technicians to results only and prevents them from being able to explain the meaning of those results with competence.

As the authors have experienced on countless cases, it is technicians, investigators, and ultimately attorneys who are providing a majority of crime reconstructions in court, often with little understanding of forensic science or the scientific method, to say nothing of the natural limits of physical evidence. Crime lab personnel are performing the necessary laboratory analysis, but police and prosecutors are taking the final step to explain events and their relationships in court. This has the net effect of elevating the lay testimony of investigators and forensic technicians to that of the forensic scientist, while at the same time reducing the expert findings of the forensic scientist to the level of the technician. It should not need to be said that this is highly inappropriate, if not also misleading, to the trier of fact.

CRIME RECONSTRUCTION

Crime reconstruction is the determination of the actions and events surrounding the commission of a crime. A reconstruction may be accomplished by using the statements of witnesses, the confession of a suspect, or the statement of a living victim or by examining and interpreting physical evidence. Some refer to this process as crime scene reconstruction; however, the scene is not actually being put back together as it was—only some of the actions and sequences of events are being established.

Crime reconstruction is best conceived as the work of forensic generalists putting together theories of the crime based on the consideration of aggregated results from a variety of forensic disciplines. As explained in the Preface to the first edition of this text, the generalist—reconstructionist need not know how to perform all of the forensic examinations that were conducted. They need not have the ability to operate a camera to view a photograph; they need not have the ability to extract DNA and amplify it to comprehend a DNA analyst’s report; and they need not have the ability to perform an autopsy to understand the cause and manner of death or to appreciate the trajectory of the projectiles that passed through the body. Rather, they must be able to understand what the results of forensic examinations are, how they were reached, what they mean, and how they may be integrated to render a picture of knowable events.

Integration of findings is key because crime is best reconstructed when forged by a collaboration of the forensic evidence, not by a reliance on one single examination or discipline. Even DNA findings cannot be given meaning in a particular case absent a reconstruction of the conditions of transfer. Relying on one piece of evidence, or one theory, without placing it in context with other physical evidence and thus reconciling it, is not only potentially misleading but also a disservice to the justice system.

CRIME RECONSTRUCTION AS A SCIENTIFIC PRACTICE

Crime reconstruction is a forensic discipline based on the forensic sciences, the scientific method, analytical logic, and critical thinking. But is the discipline of reconstruction a science in its own right? This requires some discussion. The first problem is consistency with terms and usage between forensic professionals, as described in Moenssens (1997):
One of the recurring problems we must face in the law of opinion evidence is that the words “scientific evidence,” as they have come to be used by courts, lawyers, and legal commentators, do not necessarily connote that the evidence is arrived at purely by mathematically verifiable scientific principles. Indeed, courts are not always in agreement on whether a particular forensic practice is to be called “scientific” or not. Much opinion testimony that has been by common usage labeled as “scientific evidence,” involves aspects wherein standard and measurable rules govern certain determinations. It also involves evaluations that are much more a matter of art and interpretation, yielding an opinion that is rarely quantifiable, despite the fact that defined methodologies for conducting examinations exist. Forensic disciplines may prescribe the use of certain protocols and measurements for some phases of the analytical process, but when it comes to interpreting the meaning of the evidence in court it often becomes a matter of judgment based on the expert’s considerable experience.

Education in the sciences and specialized training help define a scientist, not just experience, and even this is not enough. Although it often escapes notice, scientists are actually defined by their adherence to the scientific method when solving problems, such as how something works, why something does not work, or how something happened. Anyone who fully comprehends and diligently employs the scientific method is a scientist, lab coat or not. Although these seemingly limited criteria may appear to the uninitiated as a lowering of the bar, they actually raise it. A degree requirement, for example, even in the hard sciences, in no way ensures student exposure to, or comprehension of, the scientific method. The emphasis, again, is on full comprehension and diligent employment of the scientific method; all the college degrees in the world combined with a lifetime of experience do not matter unless it shows in one’s work. This is discussed later in this chapter and is a theme that runs through every page of this text.

A forensic scientist, as discussed previously, is one who examines and determines the meaning of physical evidence in accordance with the established theories and principles of forensic science, with the expectation of presenting his or her findings in court. This presumes use of the scientific method, analytical logic, and critical thinking.

The scientific method is a way to investigate how or why something works, or how something happened, through the development of hypotheses and subsequent attempts at falsification through testing and other accepted means.\(^8\) It is a structured process designed to build scientific knowledge by way of answering specific questions about observed events through analysis and critical thinking. Observations are used to form testable hypotheses, and with sufficient testing hypotheses can become scientific theories. Eventually, over much time, with precise testing marked by a failure to falsify, scientific theories can become scientific principles. The scientific method is the particular approach to knowledge building and problem solving employed by scientists.

Scientific knowledge is any knowledge, enlightenment, or awareness that comes from examining events or problems through the lens of the scientific method. The accumulation of scientific knowledge in a particular subject or discipline leads to its development as a science. The classic definition of a science, as provided by Thornton (1997, p. 12), is “an orderly body of knowledge with principles that are clearly enunciated,” as well as being reality oriented and having conclusions susceptible to testing.

A strong cautionary is needed here. The use of statistics does not make something scientific. The use of a computer does not make something scientific. The use of chemicals does not make

\(^8\) A more complete discussion of the scientific method is provided in Chapter 5: Practice Standards for the Reconstruction of Crime.
something scientific. The use of technology does not make something scientific. Science is found in the interpretations; in whether the scientific method has been used to synthesize the knowledge at hand and whether that knowledge has been applied correctly to render interpretations, with the necessary humility.

The relationship of scientists, the scientific method, and science is thus: Scientists employing the scientific method can work within a particular discipline to help create and build a body of scientific knowledge to the point where its theories become principles, and the discipline as a whole eventually becomes a science. And the discipline remains a science through the continued building of scientific knowledge.

Crime reconstruction as a discipline is ripe for development as a science; however, its scientific theories have, arguably, yet to achieve the necessary level of empirical maturity. Crime reconstruction is reality based, there is an orderly body of knowledge that exists in the literature, there are generally accepted theories and practice standards, and reconstruction conclusions reached through the scientific method are susceptible to verification through independent peer review and testing. Where the discipline falls short is in the realm of empirically established scientific principles that are clearly enunciated, but this hardly distinguishes it from the majority of the forensic sciences [for discussions, see Inman and Rudin, 1999; Jonakait, 1991, 1994; Thornton, 1994; see also Edwards and Gotsonis (2009), which proclaims the utter absence of science in almost every aspect of forensic science]. The vast majority of forensic sciences do not have principles or even practice standards for interpretation that are clearly enunciated, and those claiming otherwise should be asked precisely what these are while under oath.

In any event, there is much good forensic science theory in crime reconstruction, and as described in this text it is often based on sound scientific methodology. There is simply not enough published research to establish a clear body of scientific principles. This will take more time, more data, and more research. Consequently, courts rightly perceive the discipline of crime reconstruction as an area of specialized knowledge built on scientific knowledge.

ROLE STRAIN: ASSERTING SCIENTIFIC IMPARTIALITY

In mystery novels, television, and films, the homicide detective reconstructs crime and deduces the identity of the criminal—then gets an ironclad confession. In reality, the homicide detective seldom has the scientific background necessary to build a reconstruction on his or her own. For the majority of detectives, the use of physical evidence is secondary to the interview and interrogation of the witnesses and suspects. Theirs is commonly a mind-set of chasing suspects like a dog on a scent, and once focused they are regularly undeterred until a capture has been made. They build cases and box suspects in with deliberation through the lenses of authority and suspicion. It is an approach that, if unchecked by an impartial filter, can result in a wrongful arrest and even a miscarriage of justice.

Forensic science is meant to assist the justice system as an impartial and even skeptical filter for unsupportable case theory and biased agendas. As a result, the objective mandates of good science are frequently in direct conflict with the needs of investigators, the desires of attorneys, and even the rule of law as decided by various courts. This conflict creates often unbearable strain in the role that forensic scientists intend to serve.
Role Strain

The constant shifting of roles and the collision of multiple role expectations can cause what sociologists refer to as role strain. As explained in Kennedy and Kennedy (1972, p. 16), role strain is a reference to the “difficulties and contradictions inherent in one’s role.” In private practice, forensic criminologists must abide by the often incompatible principles of both science and law.

This is compounded by the expectations of police agencies, attorneys, and judges. If directly employed by the government, agency policy and politics will ensure further tension for the forensic scientist. As discussed in Thornton (1983, pp. 86–88):

Basic conflicts that influence the practice of forensic science become apparent at the interface of law and science. Law and science on occasion have conflicting goals, each having developed in response to different social attitudes and intellectual needs. The goal of law is the just resolution of human conflict, while the goal of science traditionally has been cast, although perhaps too smugly, as the search for “truth.” Certainly there is nothing intrinsically dichotomous in the pursuit of these goals; the court or jury strive in good faith to determine the truth in a given situation as a way to resolve conflicts. But proof is viewed somewhat differently by law and science, as is the application of logic and the perception of societal values.

Numerous writers have commented on these differences, including Glanville Williams in his Proof of Guilt (1958):

The principles of [the legal system] are not the product of scientific observation, but embody a system of values. These values do not necessarily have to be changed with the march of knowledge of the material world. . . . The rule conferring upon an accused the right not to be questioned . . . may be a good or a bad rule, [but it] has certainly not been made better or worse by the invention of printing or the aeroplane.

How, then, do these differences between law and science lead to abuse of forensic science? They do simply because all the players want to win and are likely to use any ethical means at their disposal to do so. The attorneys in a case are aligned with only one side, and it is entirely appropriate under the adversary system for them to advocate a particular point of view, even without full and fair disclosure of all relevant facts. Subject only to the rules of evidence, the rules of procedure, and the Code of Professional Responsibility, attorneys are free to manipulate scientific evidence to maximize the opportunity for their side to prevail. Not only is behavior of this sort countenanced by the law, it is the ethical responsibility of counsel to attempt to do so.

In some government agencies, “the culture of group loyalty and protection is powerful” and attitudes develop where “loyalty to [coworkers]—even corrupt ones—exceeds loyalty to the [agency] and to the law” (Mollen, 1994, p. 5). As these conflicting rules, values, and circumstances compound, strain draws and weakens even the most honorable practitioners.

When roles and expectations are in direct and irrefutable conflict, forensic scientists must decide which duty is primary and which set of rules they are going to follow. Theoretically, science should win out: objectivity and skepticism are what give them value to the criminal justice system. In reality, however, acting objectively and skeptically comes at a cost. It can end friendships, it can earn one the derision of colleagues or supervisors, it can hamper promotions and pay raises, it can bring unwanted attention to individual errors and failings, and it can even get one fired. Role strain blurs matters further and weakens the resolve to conduct oneself impartially.

Concern for this kind of agenda-oriented bias is echoed by retired Army CID Investigator Ross M. Gardner (2005), who admits that impartiality within this community remains a problem:
We (police supervisors of which I used to count myself as) have done a poor job of teaching impartiality across the board. There are still many police officers and criminal investigators who think they work for the DA or who think their job is to put people in jail. Our job has been and always will be investigating and reporting crime and then bringing the people we think are involved to justice. Juries and judges (our communities) decide if they really are “bad guys” and what to do with them, a.k.a. justice.

District attorneys (DAs), Mr. Gardner reminds us, have their own agenda. They want to convince the jury of the guilt of the defendant, a belief that may be based on evidence, emotion, politics, or any combination thereof. However, the interpretation of the evidence does not always favor the prosecution. District attorneys, in preparation for prosecuting a case, put together a theory of the crime. The less reconstruction done by forensic scientists, the more this role falls to the DA. Without the proper tools, this can have disastrous results, especially when the defense lacks the ability and/or resources to independently investigate and understand the evidence.

Zealous Advocates

Attorneys are zealous advocates—that is their nature and function. The prosecutor zealously seeks to convict the defendant by making the crime more heinous in nature. The defense zealously seeks to exonerate the defendant by minimizing the prosecution’s arguments and evidence. Both will theorize about how the crime occurred with different objectives. Both cannot be correct and, lacking a scientific reconstruction, both will probably be wrong. The case theories of attorneys are alternatives and should be examined against the evidence.

No court or attorney should direct or dictate the forensic scientists’ methods. They may have particular questions about the evidence, or particular issues that they believe require attention, and that is typically the nature of their need for assistance. However, the application of scientific methodology and the interpretation of any conclusions must remain the strict domain of the forensic scientist.

Misunderstandings and miscommunications often occur when attorneys seek the services of forensic scientists because attorneys work in a professional domain that is essentially binary in nature. Evidence either supports or fails to support a legal finding of guilt or innocence, and through their efforts attorneys either win or lose the case. The findings of the forensic scientist are not binary—they are multivalued and independent of legal determinations. Very seldom is anything in science black or white. Rather, it is often some shade of gray along an almost infinite continuum. Those practicing in the legal professions need to recognize that forensic scientists are professionals in their own fields, as attorneys are in theirs. Respect must be had for the differences in their desired ends.

There is another component adding tension to the strained relationship between forensic science and the law. In any criminal legal proceeding, the prosecution often has its own stable of police officers and police scientists working directly or indirectly under its administration. This circumstance can create the false impression that only forensic scientists working for the prosecution are on the right or just side of the conflict, protecting society and speaking for the victim. This is an impression that many prosecutors are happy to encourage and that many forensic scientists are infrequently quick to correct. The defense expert is often regarded
as the one “wearing the black hat” or on “the Dark Side” in the words of prosecutors, police officers, and public-employed forensic scientists. This can help create the false impression that the forensic scientists working for the defense are on the wrong or unjust side of a conflict, out to protect the defendant. This is also a false impression that many prosecutors are pleased to encourage.

As already explained, for the forensic scientist there are no sides to a case. There is only what the evidence supports or fails to support. The problem is that the nature of the adversarial process can pressure even well-intentioned forensic scientists to forget this, enabling them to become advocates bent on getting the bad guy. The phrase that has been used to describe this occurrence is “cops in lab coats”—those in police laboratories who try to make their results match their agency’s case against the accused. According to Dr. Elizabeth Johnson, a private forensic DNA analyst, formerly DNA section chief for the Harris County, Texas, medical examiner’s office (“DNA Testing,” 2003),

> [It is] a problem that’s found in many cities when crime labs are located in police departments and analysts can feel pressured to be “cops in lab coats”—trying to make the science match the police department’s case.

> “Too much of the time the police or the detectives come in and they submit evidence and they stand around and visit for a while and start telling chemists their version of what happened in the crime,” says Johnson. “That’s a dangerous situation.”

David McBride, the former chief of police in Oklahoma City, Oklahoma, who oversaw the recently embattled police crime lab there before scandal broke out, has admitted publicly that this kind of bias is far too common, and (“Under the Microscope,” 2002)

> could happen anywhere that a forensics lab is attached to a police agency, and that is the case in most large American cities.

He says it creates scientists who consider themselves cops in lab coats. “I think there’s an inherent potential conflict there,” he says. “And I don’t know that that’s always healthy for the criminal justice system.”

This problem is also described in James and Nordby (2003, p. 4):

> This is also described in James and Nordby (2003, p. 4):

> While crime laboratory scientists may pride themselves as being “independent finders of fact,” most operate under police jurisdiction or administration, and many scientists, perhaps unconsciously, develop the attitude that they work exclusively for the police or prosecutor.

> This particular form of bias creates a confirmatory environment in which forensic scientists are rewarded, often directly, through promotions, bonuses, or letters of appreciation, for their certainty and for their assistance with successful prosecutions (Saks, 1998):

> No other fields are as closely affiliated with a single side of litigation as forensic science is to criminal prosecution. … The institutional setting of forensic science promotes habits of thought that more closely resemble the thinking of litigators than of scientists. While science pursues knowledge through disconfirmation, prosecutions are won by confirmatory proofs. This confirmatory bias dominates the thinking of most forensic scientists. Where science advances by open discussion and debate, forensic science has been infected by the litigator’s preference for secrecy. Tests of the proficiency of crime laboratories are conducted anonymously, kept secret, and are
not routinely published. It is ironic that while studies of the effectiveness and accuracy of so many professional enterprises are available in published literature, the same is not true of a field whose sole purpose is to do some of the public’s most public business.

Some regard confirmatory, pro-prosecution bias a problem that begins with inexperience and continues for lack of exposure to actual science, as in Moenssens (1993):

This special issue [pro-prosecution bias] demonstrates that even where crime laboratories do employ qualified scientists, these individuals may be so imbued with a pro-police bias that they are willing to circumvent true scientific investigation methods for the sake of “making their point.”

Unfortunately, this attitude is even more prevalent among some “technicians” (nonscientists) in the crime laboratories, for whom the presumption of innocence disappears as soon as police investigative methods focus on a likely suspect. These individuals, who are frequently trained to do forensic work on the job after obtaining an undergraduate degree in chemistry or biology, are bestowed with the job title of “forensic scientist” after only a short time in their crime laboratory function. Their pro-police bias is inconsistent with being a scientist. In fact, the less of a scientific background a lab person has, the less critical that person is likely to be in terms of investigating the validity of claims made by other laboratory personnel. These are the “experts” who typically jump on the bandwagon of anything new that comes down the pike, and will staunchly advocate its reliability, even in the absence of any objective investigation and validated experimentation.

Again, many of these individuals do good work in the field in which they have been trained, but their bias is often so strongly pro-prosecution that they may lack the kind of objectivity and dispassionate judgment that one expects of a true scientist, be it forensic or otherwise.

Such attitudes, and a bias, are perpetuated by a slew of popular television shows and docudramas in which forensic scientists are portrayed as part of the law enforcement team, and sometimes the whole affair, wielding science like a badge to push suspects into confessions and even make arrests. This powerful imagery, given an air of authenticity by consulting law enforcement officers and police scientists whose names roll in the credits, contradicts everything that good forensic science is about.

Even when the forensic scientist does maintain an aura of impartiality, the system may cause them to contribute a biased result. Unless the forensic scientist has gone to the crime scene and knows what evidence has been collected, or may have been present but uncollected, he or she will be limited to receive and analyze only that which is given to him or her. The evidence they are provided is selected by the investigator in support of a particular theory or by the prosecutor in support of a conviction. The forensic scientist is given the evidence with a specific request for analysis.

They should ask, “What is the purpose of this analysis?” or “What is the question you are trying to answer with this test?” Only then can they, and not the nonscientist, ascribe meaning to the evidence. As long as the forensic scientist receives only selected evidence and selected information about a case, the analyses and conclusions of that scientist are biased to that extent.

On the other side of the spectrum, there are private forensic experts who will testify to any position for the right amount of money or prestige, rightly labeled by some as “hired guns” or “whores of the court.” Such individuals will offer whatever conclusion or interpretation helps their employer, regardless of whether it contradicts something they have testified to before. This practice also contradicts good science because a true forensic scientist will prefer to give his or her client “bad” news before anyone else does—to realistically educate the client regarding the nature and the strengths of the opposition’s evidence.
Taking the Side of the Evidence

The paradigm of sides within the forensic science community has and continues to strain and rend its members because of their need to secure or maintain employment, relationships, friendships, and fidelities with those outside, but in control of, the forensic realm. In other words, bias toward one side of the courtroom or the other is often about politics—the politics of a too often subordinated group, forensic scientists, in relation to their vested interest colleagues and employers to whom they are commonly beholden.

While the justice system necessarily sets two legal sides against each other, objective scientists do not take up the banner of either. In fact, their only value to the legal process is with respect to their objectivity. These scientists are there to advocate for evidence and its dispassionate interpretation—nothing more.

Forensic scientists can have no emotional, professional, or financial stake in the outcome. In other words, they cannot be paid to guarantee findings or testimony favorable to their employer, nor can their advancement be connected to the success of one party over another. This is, of course, separate from being compensated for time spent performing analysis and giving testimony.

The division of investigative, legal, and scientific spheres exists to allow forensic practitioners to act as an objective foil to those who hire them—whether they are attorneys or law enforcement investigators. As discussed previously, investigators and lawyers have different goals and ethical considerations than do scientists. Each is admonished to (1) act within the scope afforded his or her role and (2) not intrude upon that of the others.

When scientists step outside their objective role to withhold or distort relevant findings and, in essence, take sides, justice is perverted. Science exercised on behalf of the law is forensic science; science exercised on behalf of politics, personal or professional, is not science at all—it is a form of propaganda. Rising above this through soundness of reason and methodology is a tremendous challenge and an awesome responsibility.

SUMMARY

Forensic science is the application of scientific knowledge and principles to the resolution of legal disputes, whether criminal or civil. A forensic scientist is one who examines and determines the meaning of physical evidence in accordance with the established theories and principles of forensic science, with the expectation of presenting his or her findings in court. The unique role of the forensic scientist is ultimately that of an educator to attorneys, judges, and juries.

A scientist is someone who possesses an academic and clinical understanding of the scientific method. The scientific method is a way to investigate how or why something works, or how something happened, through the development of hypotheses and subsequent attempts at falsification through testing and other accepted means. Crime reconstruction is a forensic discipline based on the forensic sciences, the scientific method, analytical logic, and critical thinking. But this chapter discusses whether reconstruction is a science in its own right.

Crime reconstruction is the determination of the actions and events surrounding the commission of a crime. Crime reconstruction is reality based, there is an orderly body of knowledge that exists in the literature, there are generally accepted theories and practice standards, and
reconstruction conclusions reached through the scientific method are susceptible to verification through independent peer review and testing. Where the discipline falls short is in the realm of empirically established scientific principles that are clearly enunciated, but this hardly distinguishes it from the majority of the forensic sciences.

There is much good forensic science theory in crime reconstruction and, as described in this text, it is often based on sound scientific methodology. There is simply not enough published research to establish a clear body of scientific principles. This will take more time, more data, and more research. Consequently, courts rightly perceive the discipline of crime reconstruction as an area of specialized knowledge built on scientific knowledge.

QUESTIONS

1. List the four major branches of the criminal and civil justice systems in the United States.
2. List three different kinds of forensic scientists.
3. Explain the difference between a forensic generalist and a forensic specialist.
4. The vast majority of forensic sciences have principles and practice standards for interpretation that are clearly enunciated. True or false?
5. Explain the difference between a forensic scientist and a forensic technician.

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