chapter 19

The Future

In 1949, Charles O'Hara and James Osterburg, noted criminalistics authors, wrote: "The present position of criminalistics among the sciences may properly be compared with that of chemistry in the nineteenth century." Certainly, in this new millennium, the changes that have taken place since this observation was made have been nothing short of revolutionary. Forensic science may still have many shortcomings, but it has successfully shed the distinction of being a nineteenth-century science.

Crime laboratories have now become the major benefactors of enormous advancements in scientific technology. Chromatography and spectrophotometry have already had a tremendous impact on forensic methodology. In a very short span of time, DNA typing has developed into a routine forensic science technique. The future promises even more progress. Mass spectrometry, capillary electrophoresis, and high-performance liquid chromatography, among other developments, are rapidly gaining recognition as essential forensic tools. The scanning electron microscope is already enhancing the application of microscopy to the examination of trace physical evidence. An even more impressive tool is the scanning electron microscope linked to an X-ray microanalyzer. This combination gives forensic scientists the ability to examine very small samples nondestructively while plotting the elemental composition of the specimen in view.

Not only will practitioners of forensic science continue to see the development of new instruments and techniques suitable for solving their unique problems, but the old workhorses of the crime laboratory—that is, the gas chromatograph and the spectrophotometer—have under-

gone a major facelift thanks to a revolutionary development in electronics called the *microprocessor*. The microprocessor contains thousands of microscopic transistors, diodes, capacitors, and the like—all hooked together on a microchip. The electronic components of a computer that once filled a room are now reduced to the size of a few microprocessor chips. Instrument manufactures are taking advantage of this development to link personal computers to many types of analytical instrumentation. This will help further automate and speed the collection of data in the crime laboratory.

However, the unabated progress of analytical technology must not obscure the fact that the profession of forensic science has reached a critical junction in its history. The preoccupation with equipping a crime laboratory with elaborate and sophisticated hardware has left a wide gap between the skill of the scientist and the ability of the criminal investigator to recognize and preserve physical evidence at the crime scene. The crime scene is the critical first step in the process of using scientific services in a criminal investigation. All the expertise and instrumentation that any crime laboratory can muster will be rendered totally impotent if evidence has been left lying unrecognized or ignored on the ground, or if the evidence has been inadvertently destroyed by careless investigators or curiosity seekers.

The theme that there is a need for trained and knowledgeable evidence collectors at crime scenes has been a recurring one throughout this text. Once again, this requirement must be reiterated. How is the evidence collector or investigator to gain the skill and appreciation for recognizing the value of physical evidence? The trend of events seems to be one of conceding past failings and acknowledging the need for creating specialists to perform evidence-collection functions. In growing numbers, police agencies are training and equipping “evidence-collection technicians” to help criminal investigators retrieve evidence at the crime scene.

If this program is to have any significant impact on investigative procedures, immediate steps will have to be taken that go beyond mere designation of an evidence-collection unit on a police agency's organizational chart. The effectiveness of such a program should not be measured by the number of oversized and overequipped mobile vans at the unit's disposal; instead, a staff of dedicated operators and administrators trained and experienced in evidence collection has to be assembled. This unit must be recognized as the essential first step in forensic analysis and must become an integral part, both administratively and functionally, of the total forensic service offered by a law enforcement agency.

The education of evidence collectors and investigators is a critical factor in improving the quality of crime-scene investigation. Although continued in-depth training of investigators by forensic scientists is an essential ingredient for the success of such a program, many agencies, for lack of space, time, or desire, have not implemented this training. It is therefore gratifying that colleges and universities are emerging as centers of education for law enforcement personnel. Criminal justice or law enforcement programs provide viable forums for teaching the philosophy and theory of criminal investigation and forensic science. However, academia must strive to supplement, not supplant, police in-service training. Police administrators now have the responsibility for selecting the personnel to perform investigative functions. These administrators cannot abdicate their responsibility to create and foster training programs to ensure competent performance of the investigator's mission.

Whether a college degree will someday be required by all police departments is still a subject of debate, but the trend is certainly in that direction. More than a thousand higher-education institutions in the United States offer some kind of law enforcement program. Future generations of criminal investigators and police administrators will be recruited from the ranks of these stu-

dents. For the forensic scientist, participation in these programs offers a unique opportunity to teach, develop, and put into practice the philosophy that science is an integral part of criminal investigation.

Of course, education alone will not guarantee the success of the criminal investigator or evidence collector. Experience, perceptive skill, persistence, and precise judgment are all essential ingredients to the makeup of the successful investigator and evidence collector. Combine all of these characteristics with a careful selection process designed to choose only those who qualify for this role, and the result will be substantial enhancement of the quality of criminal investigative services.

I don't want to leave the reader with the impression that crime laboratories are not being used or that forensic scientists have difficulty justifying a full day's work. On the contrary, these facilities are overworked and understaffed. The demand imposed on them just to complete the examination of drug and blood-alcohol evidence is enough to inundate and preoccupy all but the larger crime laboratories. Most facilities can barely keep their heads above water and are drowning in a "sea" of drugs. Furthermore, the disproportionate burden placed on the skills, time, and equipment of the laboratory by drug and blood-alcohol evidence has had a detrimental effect on the capacity of the law enforcement system to process physical evidence generated by more serious or violent crimes.

The solution to the problem may seem obvious: more people, larger facilities, and, of course, more money. But crime laboratories must stand in line with other components of the criminal justice system, because skyrocketing crime rates have overburdened our police, courts, and correctional institutions. In light of public and political outcries, criminal justice administrators have sought programs geared to producing quick and dramatic reductions in crime rates. In this kind

of atmosphere, hiring more scientists or buying a mass spectrometer or a gas chromatograph may hardly seem the best way to reduce crime.

I am not advocating a crash program for building crime laboratories or, for that matter, a crash program aimed at improving one segment of the criminal justice community at the expense of the others. Reduction of crime will come about only with a balanced approach to criminal justice, as well as alleviation of social injustices. We must keep the future role of the crime laboratory in its proper perspective while examining the goals and performance that we expect from all components of our criminal justice system.

The size and effectiveness of a crime laboratory directly mirror the capability of the investigative agencies that it services. If all or even most of the burglaries, homicides, assaults, rapes, and other types of major offenses were investigated with the thoroughness expected of a proper criminal investigation, the quantity of physical evidence collected would require the existence of better staffed and better equipped crime laboratories.

An important impetus behind the expansion of crime laboratory services in the United States has been the large influx of drug specimens. A required chemical analysis of these confiscated materials has made the laboratory's participation in prosecution proceedings mandatory. The criminal justice system, faced with the prospect of unreasonable delays due to understaffed laboratories, quickly moved to expand these facilities in order to keep pace with the ever-increasing number of drug seizures. Currently, the advent of DNA profiling has placed tremendous pressures on crime laboratory services. Laws passed to mandate entry into a DNA database for many convicted offenders has imposed tremendous workloads on crime laboratories that must also cope with an overwhelming variety of evidence retrieved from crime scenes collected for DNA analysis.

Although the commitment of police to improve the quality of crime-scene investigation is essential, it must be accompanied by a simultaneous effort to improve the caliber of crime laboratory services. Certainly, thorough collection of crime-scene evidence will require more forensic scientists to handle the increasing caseloads. However, forensic scientists should not be lulled into a false sense of security by believing that the tremendous strides made in the development of analytical instruments and techniques are sufficient to meet the needs and goals of their profession. Progress can be expected only if crime laboratories are staffed with trained and knowledgeable scientists.

Fortunately, more colleges and universities are offering courses and degree programs in forensic science or criminalistics. These institutions are beginning to serve as fertile training grounds for new forensic scientists. Although many of these individuals have textbook knowledge of the techniques used in forensic analysis, few arrive at the crime laboratory possessing an understanding of the practical aspects of criminal investigation. This deficiency necessitates a prolonged and time-consuming period of intensive training under the direction of trained criminalists. Not only must the new criminalist learn to apply specialized skills to the responsibilities and objectives of a working crime laboratory, he or she must also acquire a familiarity with all phases of crime laboratory operation.

The extent and depth of versatility expected of the forensic scientist are usually determined by the size of the crime laboratory's staff. Scientists in smaller laboratories are often expected to be generalists, performing a wide variety of tasks in order to fulfill the varied objectives of the laboratory. Their counterparts in larger facilities enjoy the luxury of working in specialized areas, relying on a teamwork approach to provide the spectrum of scientific skills needed for the comparison or identification of physical evidence.

In addition to his or her technical responsibilities, the newly trained criminalist must discover and master the role of the expert witness. A good courtroom demeanor and the ability to communicate thoughts and ideas in clear, concise terms are absolutely essential if the scientist's examination and conclusions are to be properly and effectively presented at a hearing or in court.

The present momentum of forensic research could very well falter unless individuals who possess relevant knowledge and skills are attracted to careers in forensic science. The recognition by a sufficient number of colleges and universities of the need to foster undergraduate and graduate programs in this field is essential for ensuring an ample supply of scientists to meet the anticipated personnel needs of the profession. Furthermore, the establishment of forensic education programs, especially at the graduate level, should be accompanied by the formulation of new academic research programs dedicated to investigating fertile areas of research that are pertinent to the expanding role of forensic science in criminal justice. In a university environment, these research programs can be pursued in an atmosphere unaffected by the pressures of everyday casework, a burden that presently weighs heavily on the shoulders of the working forensic scientist.

The prospects for significant technological advances in forensic science in the near future are great. In fact, the computer-aided search of single latent fingerprints is already a reality in most jurisdictions. The ability to search, in a matter of minutes, files composed of millions of prints in order to ascertain a probable match to a latent fingerprint represents the most significant contribution that forensic science has made to criminal investigation since the introduction of the fingerprint itself. Jurisdictions using this approach have reported startling increases in arrests.

Computerized technology is also helping investigators link multiple unrelated shooting cases to a single firearm. The automated search system NIBIN (see pp. 468–471) allows the surface

characteristics of a bullet or cartridge case to be scanned and stored in a computerized database. This database is networked throughout various regions of the United States. An investigator can search the database for entries bearing similar characteristics to the evidential bullet or cartridge case. If a match is made, multiple crimes may be linked and associated with a single firearm.

Practically every week we read in our newspapers that researchers are developing new products with their ability to manipulate genes. The ability of scientists to penetrate DNA, the basic building block of genes, provides investigators with a powerful forensic tool to individualize blood, semen, and hair. The FBI has initiated an aggressive forensic research program to develop this technology along with an ambitious technical training program to instruct personnel of state and local crime laboratories throughout the United States in the use of this technology. DNA typing has already progressed to the stage at which all states are routinely DNA typing offenders involved in sex-related and other crimes. The technology of DNA profiling has progressed so rapidly that today blood and semen stains recovered from crime scenes are as revealing of human identity as a fingerprint. CODIS is a computer software program developed and maintained by the FBI that links local, state, and national databases of DNA profiles from convicted offenders, unsolved crime-scene evidence, and missing people. CODIS software has enabled local, state, and national crime laboratories to compare DNA profiles electronically. Thousands of matches have linked criminal perpetrators to DNA profiles in CODIS databases.

One unexpected dividend from DNA testing has been the reinvigorating of the investigation of “minor crimes.” For decades, police have given the investigation of house burglary scenes and other property crimes low priority. Evidence now suggests that DNA evidence collected at property crime scenes may help law enforcement solve those crimes and identify perpetrators of more serious offenses. According to one state study, more than 50 percent of the DNA database hits

against murder and sexual assault cases matched individuals who had prior convictions for burglary.

Apprehending perpetrators of property crimes can certainly discourage criminals from moving on to the commission of more serious violent crimes, and thus can have a dramatic long-term impact on decreasing the overall crime rate. In this respect, it is apparent that DNA collected at burglary scenes is a powerful investigative tool. In one major jurisdiction, DNA evidence from 201 burglaries yielded 86 DNA profiles for entry in CODIS. Most of the profiles resulted in links to multiple unsolved cases. One profile uncovered a five-burglary serial offender. A few were linked to more serious violent crimes such as sexual assault and robbery. Significantly, more than 30 of the burglaries were matched though CODIS to convicted offenders. In Florida jurisdictions, individuals associated with two hundred DNA samples collected from various burglary investigations were identified by CODIS.

Unfortunately, in spite of the fact that crime laboratories are equipped with expensive and sophisticated instruments, often a forensic scientist cannot report to a police officer or a jury that a scientific examination of the evidence has in itself solved a case. More often than not, a conclusive comparison of evidential and control material cannot exclude other possible sources. To further complicate matters, the statistical data available to support such conclusions are usually sketchy or nonexistent. In such situations, heavy reliance must necessarily be placed on the experience and opinion of the expert in interpreting the significance of the forensic examination.

Even though class physical evidence for corroborating investigative findings is an important contribution to any criminal case, its nonexclusive character does not always motivate investigators to go all out in their search for class physical evidence. The items most sought at the crime site are those that possess potential individual characteristics—that is, DNA, fingerprints, fire-

arms, bullets, tool marks, and track impressions—because these are more likely to have the greatest impact on an investigation. Once these avenues have been exhausted, there seems to be little desire to progress any further. Clearly, future research will have to concentrate on defining the value of class evidence so that these items can become statistically more meaningful and attractive to scientists and investigators alike. However, a salient point of this book is that all physical evidence, whether class or individualistic in nature, is critical to a properly conducted criminal investigation. Criminalists have become extremely proficient in conducting tests that will narrow the origin of class evidence to a small number of possibilities. Yet some insist that if a scientist cannot define the significance of a comparison in statistical terms, the evidence should be excluded from consideration. To succumb to this reasoning is tantamount to eviscerating a core principle of criminalistics—the collection and presentation of impartial and objective information for evaluation by a trier of fact. The criminalistic community must aggressively communicate its capabilities and objectives to both the police and legal communities.

A major thrust of forensic research must concentrate on defining the most distinctive properties of evidence and relating these properties to statistics that measure their frequency of occurrence. The creation of data banks to collect, store, and disseminate this kind of information will facilitate the task. Because the responsibility for providing forensic services is spread among more than 350 independent government laboratories in the United States, the task of accumulating meaningful statistical data applicable to the entire country or to large regions is exceedingly difficult. Future progress will depend on the willingness of all crime laboratories to enter into cooperative programs that will ensure uniform standards of analysis as well as provide for the collection and dissemination of analytical and statistical data.

The FBI's Forensic Science Research and Training Center is a key ingredient in the devel-

opment of criminalistics in the United States. The FBI has made a substantial commitment to the center in terms of personnel and equipment. This facility has established a research program concentrated in the areas of biochemistry, immunology, chemistry, and physics. This program is directed toward the development of new methods for forensic science. The research staff interacts with researchers from academia, industry, and other government and forensic science laboratories. Furthermore, the staff also participates in specialized scientific courses offered by the FBI to state and local crime laboratory personnel. These courses not only have improved the quality of forensic science practices in the United States but have encouraged standardization of many of the scientific procedures used by forensic laboratories throughout the United States.

A foundation of cooperation has been laid; much now remains to be accomplished. How successful our profession will be in fulfilling its present and future obligations to justice depends on the skill, dedication, and ingenuity of its practitioners.

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