

# Forensic

## A career in

By Hall Dillon

Blood spatters, spent shell casings, and forged signatures are the nuts and bolts of forensic science. Studying the messy details of crime, forensic scientists help identify criminals and analyze evidence against them.

**W**ho studies the evidence collected at a crime scene? Police detectives use the evidence in their investigation, and prosecuting attorneys need it to present the case in court. But other experts analyze and explain each piece of evidence. These specialists are forensic scientists.

The word “forensic” means “pertaining to the law”; forensic science resolves legal issues by applying scientific principles to them. Forensic scientists perform comprehensive chemical and physical analyses on evidence submitted by law enforcement agencies. Their work is often instrumental in apprehending and convicting criminals. Although most forensic scientists focus on criminal cases and are sometimes called criminalists, others work in the civil justice system—for example, performing handwriting comparisons to determine the validity of a signature on a will.

Forensic scientists perform two roles in their work. One is to analyze physical evidence found either on a victim, at the scene

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# scientists

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of a crime, or both and to compare it to evidence found on the suspect. The other is to provide expert testimony in a court of law. This article describes what forensic scientists do, where they work, what they earn, and how they train. It also provides sources of additional information.

### Nature of the work

Forensic scientists analyze the physical evidence they receive from police, then prepare reports describing the results of their analysis. Those documents, along with forensic scientists' expert testimony, can be important prosecutorial tools for convicting the accused.


**Analyzing evidence.** Whenever a crime is committed, police try to preserve the scene until an investigator collects every piece of evidence—like hair and fiber samples, pieces of clothing, or other personal belongings—that might provide clues to solving the case. The evidence is then turned over to forensic scientists for analysis. Their analyses involve a variety of sciences, mathematical principles, and problemsolving methods, including use of complex instruments; chemical, physical, and microscopic examining techniques; and reference literature.

Most physical evidence involves class and individual characteristics. Class characteristics are those common to a group of

similar objects—for example, a particular type of car tire. Individual characteristics are those unique to a given object, such as the wear and tear on your car tires. Analysis of detailed evidence can identify both class and individual characteristics. Forensic scientists can thus use physical evidence to determine the make, model, year, and, ultimately, identity of the car involved in a crime—and through further analysis can also tell which way the car was facing, how it pulled away from the crime scene, and in which direction.

Some forensic scientists are generalists; others specialize in a particular area of laboratory analyses. Persons employed in large laboratories tend to specialize. Most crime lab professionals work in one or more of the following areas.

- ◆ **Controlled substances and toxicology.** Crime lab professionals specializing in this area examine blood and other body fluids and tissues for the presence of alcohol, drugs, and poisons.
- ◆ **Biology.** Crime lab professionals compare body fluids and hair for typing factors, including DNA analysis. DNA analysis determines how frequently parts of a person's genetic code are found in the population; forensic scientists isolate DNA strands from an individual's body fluids to compare that person's unique DNA to the DNA of a sample of others



in a database. Because of its accuracy, DNA analysis has grown popular in recent years.

Analysis of a hair found at a crime scene can determine factors such as whether the hair belongs to a human or animal, the body area a hair came from, diseases the person or

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*Forensic scientists analyze evidence using science, math, and problem-solving methods involving complex instruments and techniques.*

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animal has, and, sometimes, race. And through simple side-by-side examination, hair comparisons can match a hair found at a crime scene to the person who left it there.

- ◆ **Chemistry.** Forensic scientists analyze trace physical evidence such as blood spatters, paint, soil, and glass. For example, blood spatters help reconstruct a crime scene: The patterns of spatters and the shapes of blood droplets tell how the crime was committed.
- ◆ **Document examination.** Document examination includes many areas of expertise, including forgery, document dating, and analysis of handwriting, typewriting, computer printing, and photocopying.
- ◆ **Firearms and toolmark identification.** Firearms examination involves matching identifying characteristics between a firearm and projectile and between a projectile and target. Typically, this includes matching bullets to the gun that fired them.  
Toolmark identification involves matching some identifying characteristics of a tool, such as a pry bar, to the object on which it was used, such as a door frame. It also includes explosives and imprint evidence.
- ◆ **Psychophysical detection of deception exam.** The psychophysical detection of deception exam (formerly known as the polygraph) is based on the scientific theory that when telling a lie, a person's body responds in a certain way despite any attempts to avoid detection. Forensic scientists use special equipment to measure changes to internal body functions—including breathing, blood pressure, and pulse rate—in response to their questions and then analyze the results. (For more information about this occupation, see Matthew Mariani's article, "You're a *What?* Forensic Psychophysicologist," in the spring 1996 *OOQ*.)

◆ **Fingerprinting.** Fingerprints provide a highly accurate means of identification because each person's fingerprints are unique. And because they are formed underneath the skin, fingerprints never change—even after scarring or burning. Forensic scientists match developed fingerprints from an individual against the fingerprints on file to make a positive identification. Digital technology allows crime lab professionals to compare prints at a rate of 400,000 per second.

**Describing results.** Crime lab professionals provide the judicial system with expert opinions and analyses of evidence. They prepare reports that explain the results of their analyses and describe the methods and techniques used to support their conclusions. Everything they do must be accurately documented, since the written report must be able to stand on its own in a court of law.

Forensic scientists examine evidence within the context of an entire case, and prosecuting attorneys rely on that expertise in preparing the case for court. Forensic scientists may also be called to testify in court as expert witnesses on evidence or crime lab techniques.

### Employment and working conditions

There are no reliable data on the number of forensic scientists employed in 1998. Most forensic scientists work in crime laboratories run by city, county, or State governments. The next largest group works for Federal agencies including the Departments of Justice (Federal Bureau of Investigation [FBI] and Secret Service), Treasury (Drug Enforcement Administration and the Bureau of Alcohol,

Tobacco, and Firearms), Postal Inspection Service, and Health and Human Services. Other Federal agencies send them work on a case-by-case basis. A smaller number work in private labs and colleges and universities.

Employment of most crime lab professionals is contingent upon satisfactory completion of a background investigation and random drug testing.

Forensic scientists usually work a regular 40-hour week. Sometimes they have to travel and work long, irregular hours. They spend much time in laboratories analyzing evidence but

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### *Forensic scientists testify in court as expert witnesses.*

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also work in offices to record and draft reports on the results of their analyses. Those who work in large labs may use technologically advanced equipment such as chromatographs, to analyze drugs, alcohol, arson evidence, and fibers; spectrographs, to identify chemicals; and computerized laboratory equipment. Crime lab professionals may be exposed to health or safety hazards when working in the lab or handling certain chemicals, but there is little risk if procedures are followed.

When testifying in court, they should be well prepared, poised, and confident in their testimony and have a neat personal appearance.

### Earnings and outlook

According to the limited information available, starting salaries for forensic scientists ranged from \$20,000 to \$40,000 in 1998. Experienced crime lab professionals earned about \$40,000 to \$85,000, and some lab directors earned as much as \$100,000.

Job opportunities for forensic scientists are expected to increase as a result of the judicial system's continuing need for corroborating evidence in prosecutions. However, forensic scientists can expect competition for jobs at the Departments of Justice, Treasury, and other Federal law enforcement agencies. Job opportunities will be best for crime lab professionals who have an advanced degree or certification

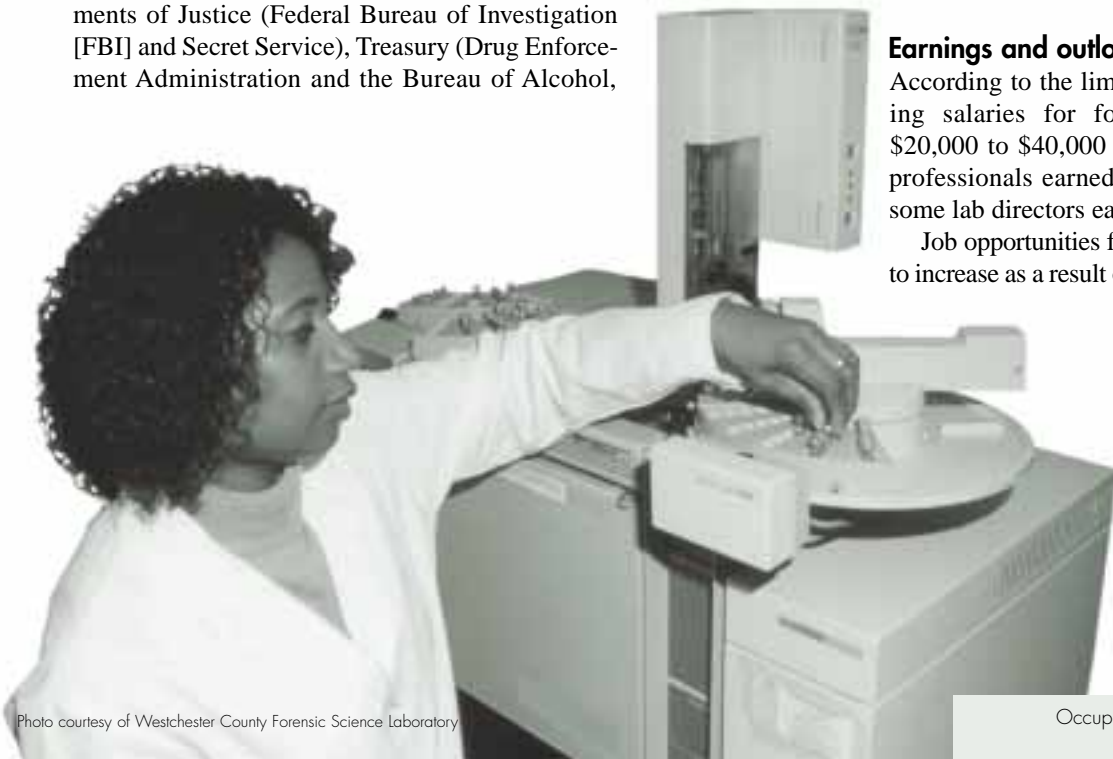



Photo courtesy of Westchester County Forensic Science Laboratory



in a forensic specialty—especially one that is growing rapidly, such as DNA analysis.

### **Qualifications and training**

Students planning careers as a forensic scientist must have perseverance, curiosity, and the ability to concentrate on detail and work independently. They should enjoy science and mathematics, which forensic scientists rely on heavily in their work. In a

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murder investigation, for example, detectives and forensic scientists use chemistry, physics, and biology in combination to conduct special tests such as determining blood alcohol levels, making barely visible bloodstains more visible, and typing blood to identify possible suspects. Geometry and trigonometry help investigators evaluate critical evidence like the angles of lethal blows and the trajectory of bullets.

Because forensic scientists prepare reports and may be called as expert witnesses, they must have good oral and written communication skills. Lab experience, either in an academic laboratory or through an internship or co-op program, also is useful.

Beginning forensic scientists usually must have at least a bachelor's degree in forensic science, chemistry, biology, physics, or physical anthropology. Thirty-one colleges and universities offer a bachelor's degree in forensic science; most also offer advanced degrees in specialized areas of forensic science. Whatever the major, required college courses include sciences such as biology, physics, chemistry, and pharmacology; also frequently required is a course in quantitative analysis and statistics. Laboratory experience involving analytical instruments or blood sample analysis is helpful. Computer courses are also recommended, as employers prefer job applicants with computer skills for modeling and simulation tasks and to operate computerized laboratory equipment.

Students do not need to specialize at the undergraduate level. In fact, broad training allows bachelor's degree holders more flexibility for job hunting or changing jobs. Students who pursue study beyond a bachelor's degree often specialize in a subfield of forensic science, such as firearms

examination, depending on their interests. A Ph.D. is usually preferred for advancement to many administrative positions such as lab director. Those with a Ph.D. also may teach forensic science at the college or university level.

Forensic scientists must be acquainted with the methods that are usually accepted in their specialty. For example, controlled substances examiners and toxicologists should be able to select appropriate procedures and equipment for reliable analyses of controlled substances; develop a valid procedure, if necessary; and evaluate the significance of test results.

Most employers provide additional education or training for new employees with bachelor's degrees. Many crime lab professionals attend postgraduate training on subjects such as biochemistry, population genetics, and molecular biology. In addition, they may attend conferences or workshops on topics such as specific analytical techniques, exhibit handling, and court testimony. Forensic scientists often receive training prior to their appearance as an expert witness. This training may include moot court practice, actual court observation, and appropriate reading material.

The FBI Forensic Science Research and Training Center offers forensic science courses for FBI special agents and laboratory examiners and technicians. The forensic science training program also is open to forensic scientists of other Federal agencies and State and local agencies. The program includes hands-on training and introduces new or advanced techniques for examining physical evidence.

Voluntary certification, available through nongovernmental organizations such as professional societies or certifying agencies, demonstrates professional competence in one or more specialties. Certifying organizations include the American Board of Criminalists, the American College of Forensic Examiners, and the International Association for Identification.

### Continuing your investigation

Using a variety of tests, forensic scientists analyze body fluids, tissue, and other substances. Similar or related procedures are performed by chemists, science and laboratory technicians, food testers, and veterinary laboratory technicians. To learn more about these related careers, check your local library or school counselor's office for a

copy of the *Occupational Outlook Handbook, 1998-99 Edition*. Or, view it online at <http://stats.bls.gov/ocohome.htm>.

The American Academy of Forensic Sciences has general information on job qualifications, training, and career opportunities for crime lab professionals. Contact the Academy for details. Or, visit its website, which includes links to other forensic science-related sites.

American Academy of Forensic Sciences  
P.O. Box 669  
Colorado Springs, CO 80901-0669  
(719) 636-1100

<http://www.aafs.org>

Information on Federal job opportunities is available from local offices of State employment services and through a telephone based system of the U.S. Office of Personnel Management. Consult your local directory under U.S. Government for a local number or call (912) 757-3000 (TDD: (912) 744-2299). Information also is available on the Internet: <http://www.usajobs.opm.gov>.

