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The Capabilities, Uses, and Effects of the Nation's Criminalistics Laboratories

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ABSTRACT: All criminalistics laboratories in the United States were surveyed and asked to provide information about their service characteristics, personnel, evidence caseloads, involvement in research, and opinions concerning the usefulness of forensic science evidence in administration of justice. The data indicate that the rapid expansion of crime laboratory facilities in the 1970s has subsided, but the number of scientific personnel continues to rise. Laboratories appear to be relatively successful in updating and acquiring new scientific instrumentation. Drug and alcohol cases constitute practically two thirds of laboratory caseloads. Laboratories engage in a minimal level of research and writing. Respondents believe forensic science evidence to have the greatest impact in homicide and rape cases at trial and prosecutors and police investigators to have the best understanding of it.

KEYWORDS: criminalistics, surveys, laboratories

With the assistance of a grant from the National Institute of Justice, we surveyed all operating criminalistics laboratories in the United States in January 1983. The questionnaire sought to gather information from these laboratories regarding their service characteristics, personnel, scientific and research activities, and relationships with various user agencies. We also asked the directors of laboratories to express their opinions about the value of scientific evidence in various case situations. The results of this survey help to form an up-to-date profile of crime laboratory operations, the types of services they provide to the criminal justice system, the scientific instrumentation in use in these laboratories, and areas meriting research attention in future years.

Method

Our goal was to survey all bona fide crime laboratories within the United States. The first task was to compile a listing of all crime laboratories (public and private) that regularly examine physical evidence in criminal cases and offer reports and expert testimony to courts of law. A listing of laboratories was initially developed by using a roster of members of the American Society of Crime Laboratory Directors and a list of laboratories that participated

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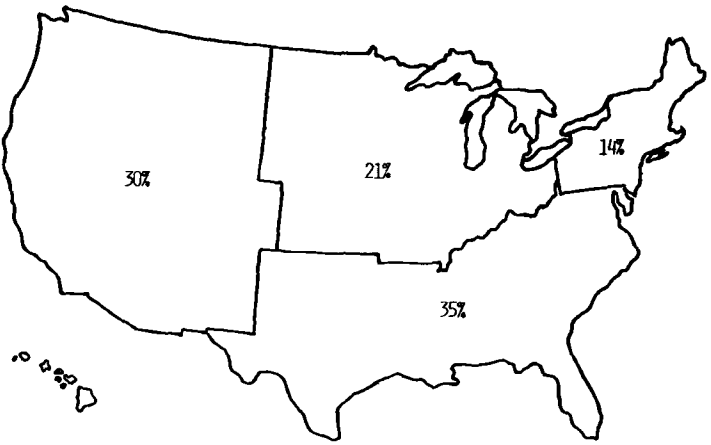
in the Forensic Sciences Foundation's proficiency testing program. The names of laboratories and their respective directors were then categorized by state and mailed to selected facilities within each state so that additions, deletions, and other corrections could be made. What resulted was a compilation of 319 federal, state, and local crime laboratories, each of which was mailed a copy of an eight-page questionnaire. The first mailing resulted in a return of 190 questionnaires; second and third mailings yielded 70 additional questionnaires. Three of these questionnaires were returned blank. The response rate was 82% (260/319) with a total of 257 usable questionnaires (see Fig. 1).

Origin and Placement of Laboratories

The oldest crime laboratory in the United States was established in 1923 and the most recent one in 1982 (see Fig. 2). Fifty-five percent (n = 240) of all laboratories were established in the ten-year period from 1968 to 1978. During this period, Supreme Court decisions restricting police interrogation practices, the President's Crime Commission Report and advice to police to place greater reliance on physical evidence, the creation of the Law Enforcement Assistance Administration (LEAA) and the availability of federal monies, the drug abuse explosion, and the upsurge in violent crime were all factors that stimulated the growth of laboratories [*1-6*].

Seventy-nine percent of all laboratories responding to our survey are located within law enforcement/public safety agencies. The remaining laboratories were distributed throughout such other agencies as medical examiner's offices, prosecutor's offices, scientific/public health agencies, and other public or private institutions.



Region	Number	Percent
Northeast	36	14%
South	89	35%
North Central	53	21%
West	78	30%

FIG. 1—*Geographical distribution of criminalistics laboratories responding to survey.*

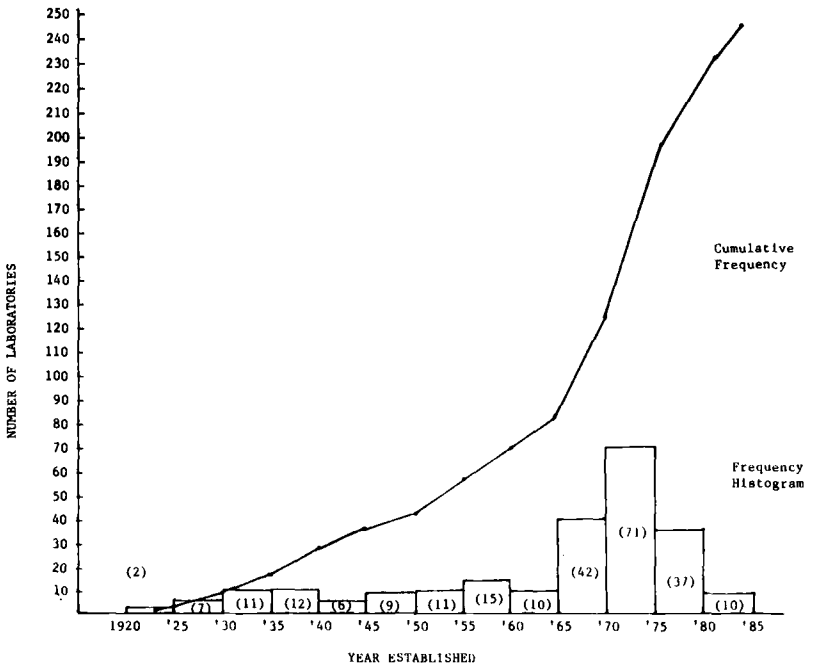


FIG. 2—*Cumulative frequency and frequency histogram for date crime laboratories were established.*

Laboratory Budgets

Laboratories were asked to report their total annual budgets for the years 1977 and 1982. For the purpose of this article, federal laboratories were excluded from the analysis. Of remaining laboratories answering this question, 68% were positioned within law enforcement agencies. The results of the 81 state and local laboratories responding to this question are presented in Table 1. The average annual budget for these laboratories rose from about $544 000 in 1977 to more than $900 000 in 1982, an increase of approximately 67%.

Service Policies and Practices

Laboratories were asked to report the type of jurisdiction they *primarily* served (see Table 2). Apart from the federal laboratories (9% of respondents) and the independent laborato-

TABLE 1—*Comparison of laboratory budgets in 1977 and 1982.*[a]

Budget	1977 (n = 81)	1982 (n = 81)
Total budgets, $	44 100 190	73 549 150
Mean budget, $	544 450	908 010
Increase, %		67

[a] This table includes only those (nonfederal) laboratories that were in operation during the five-year period from 1977 to 1982 and reported their budgets on the survey instrument.

TABLE 2—*Jurisdiction served (n = 255).*

Type of Jurisdiction	Percent
State/satellite	30
State/main facility	16
County	15
Municipal	14
Regional	13
Federal	9
Other	3

ries (3%), the remaining laboratories were almost evenly divided between state facilities (46%) and local operations (42%). Within the state category, we found twice as many satellite laboratories (30%) as main facilities (16%). At the local level the number of laboratories was almost equally divided among municipal (14%), county (15%), and regional (13%) operations.

Number of Personnel in Laboratories

Slightly more than 3000 scientific personnel were employed in the 257 laboratories responding to the questionnaire. Although the mean number of personnel per laboratory was 11.7, the median was 6. In other words 50% of the laboratories had six or fewer scientific personnel; 25% had three or fewer.

The main state and federal laboratories are typically the largest facilities, with an average of 18 and 19 examiners, respectively, per laboratory. State satellite, county, and municipal laboratories averaged between 10 and 14 examiners, while regional laboratories averaged the fewest scientific personnel, with 7.

Availability of Services to Various Users

This section summarizes the results of a series of questions designed to determine the extent to which the services of these laboratories are available to various parties. The responses indicated that:

- Fifty-seven percent of the responding laboratories would *only* examine evidence submitted by law enforcement officials.

Table 3 shows that state and federal laboratories examined evidence for users who are not law enforcement officials at a significantly lower rate than other types of laboratories.

TABLE 3—*Percent of laboratories that examine evidence for clients who are not law enforcement officials by type of jurisdiction served (n = 255).*

Jurisdiction Served	Percent
Municipal	51
County	54
Regional	52
State/main facility	40
State/satellite	30
Federal	36
Other	88

• Seventy-eight percent of laboratories would not allow their facilities/equipment to be used by private examiners in analyzing physical evidence.

No significant organizational differences were found among laboratories that permitted their facilities to be used by private examiners and those that did not.

• Twenty-two percent of the laboratories allowed their examiners to engage in private criminal casework or consultations.

When the data were controlled for type of jurisdiction served, significant differences emerged. State-satellite and federal laboratories permitted their examiners to do private criminal casework at a significantly lower level (13 and 5%, respectively) than other laboratory types, where about 25% allowed examiners to take on private criminal cases.

• Sixty-two percent of the laboratories permitted their examiners to be involved in private civil casework or consultations.

Further breakdowns show that there were significant differences when the data were controlled for jurisdiction. Federal laboratories allowed their examiners to be involved in civil casework only 18% of the time (well below the average), while municipal laboratories allowed private civil casework close to 75% of the time.

• Thirty percent of the laboratories would analyze noncriminal evidence samples (pollutants, pesticides, and the like) upon request.

A breakdown by organization revealed that county and regional laboratories were significantly more likely to analyze noncriminal evidence samples than other types of laboratories.

Case Examination Practices

Responses indicating what types of evidence are examined are summarized in Table 4. Almost all of the laboratories surveyed examined drug evidence (93%). More than three fourths of the laboratories examined semen, bloodstains, fibers, hairs, accelerants, paint, and toolmarks. More than half the laboratories examined firearms, glass, alcohol, explosives, and fingerprints. Less than half the laboratories examined documents, gunshot

TABLE 4—*Percent of laboratories that examine various categories of physical evidence* (n = 257).

Type of Evidence	Percent
Drugs	93
Semen	81
Bloodstains	81
Fibers	79
Hairs	79
Accelerants	76
Paint	79
Toolmarks	75
Firearms	73
Glass	70
Alcohol	67
Explosives	61
Fingerprints	62
Documents	45
Gunshot residue/powder patterns	43
Toxicology	42
Polygraph	30
Voiceprints	5

residues, voiceprints, or toxicological samples or have responsibility for polygraph examinations.

Laboratory Caseloads

Laboratories were asked to estimate their caseloads for 1982. Five major categories were specified in the questionnaire: evidence derived from (1) violent crimes, (2) property crimes, (3) drugs, (4) driving while intoxicated, and (5) other. Table 5 shows these caseload data broken out by type of crime category and jurisdiction served. It can be seen that, overall, drugs, and driving while intoxicated (DWI) cases accounted for close to two thirds (64%) of total caseloads. Violent and property crimes constituted 12% and 15% of the caseloads, respectively. Breaking caseloads out by specific jurisdiction showed some interesting patterns. While the violent crime caseload for regional, state-main and state-satellite laboratories was very close to the overall average (12%), the violent crime caseload for municipal and other (primarily private) laboratories was significantly higher. At the other extreme, the violent crime caseloads for county and federal laboratories were substantially lower than the mean. For federal laboratories, this low percent of violent crimes is principally a function of Drug Enforcement Administration (DEA) laboratories, which examine drug evidence exclusively. The property crime caseloads for municipal, federal, and other (private) laboratories made up about one fourth of their total caseloads, which was higher than for other laboratories.

Drug cases accounted for the largest percentage (41%) of all laboratories' caseloads. The federal laboratories and state-satellite laboratories had the highest percentage of drug cases—in excess of 50%. The DEA laboratories again bias these caseload data. The DWI cases also constituted a major portion of crime laboratory caseloads, with county and state-main facilities having the highest percentage (36 and 34%, respectively). When drug and DWI cases are combined, we see that practically three fourths of state-main and county caseloads fell into this category.

Scientific Examiners and Their Involvement in Court

It was reported that on the average, crime laboratory examiners testified in 8% of drug cases (the percentage ranged from 0 to 86%) and 10% of criminalistics cases (the percentage ranged from 0 to 87%) where evidence was examined. Laboratory directors were asked to estimate the fraction of time their examiners spent conferring beforehand with prosecutors and defense attorneys before testifying in court. On the average, examiners conferred with

TABLE 5—*Breakout of caseload by jurisdiction served (*n = *1 123 149).*

Evidence Examined from Different Crime Categories	Percent Caseload by Jurisdiction[a]						
	Muni	Co	Reg	St-M	St-Sat	Fed	Overall
Violent crime	18	6	13	11	11	7	12
Property crime	25	6	10	11	13	24	15
Drugs	32	40	41	40	51	55	41
DWI	20	36	15	34	18	0	23
Other[b]	5	12	21	4	8	14	9
Total	100	100	100	100	100	100	100

[a] Muni = municipal, Co = county, Reg = regional, St-M = state-main, St-Sat = state-satellite, and Fed = federal.

[b] Includes hit-and-run accidents, documents, carrying a concealed weapon, toxicology samples, and civil cases.

prosecutors in 57% of cases, but with defense attorneys only 13% of the time. Directors were also asked in what percentage of cases in which examiners testified did they learn of the final outcome of the case; the estimate provided was about 20% of the time. Respondents also replied to a question asking how satisfied they were with judicial feedback about the evidence and the testimony of their examiners after a case was decided. Responses ranged from very satisfied (1) to very dissatisfied (7). The mean response was 4.3, suggesting that on the average laboratories were neither satisfied nor dissatisfied.

When the responses to the previous question (percent of cases where laboratories learned of the judicial outcome) were cross-tabulated by the satisfaction responses, an interesting trend emerged. Only 23% of laboratories that learned of the final outcome of cases 20% or less of the time were satisfied with judicial feedback, while 48% of the laboratories that learned of the final outcome of cases more than 20% of the time were satisfied with the feedback they received. This significant relationship ($p < 0.001$) indicates that laboratories that learned of the final outcome of more cases were more satisfied with the feedback they received.

Perceived Importance and Understanding of Forensic Science Evidence

A series of questions were asked about the perceived importance of forensic science evidence in deciding the outcome of criminal cases and at various stages of the criminal justice process; possible responses to these questions ranged from 1 (minimal) to 4 (essential).

Table 6 shows the mean value for the importance of forensic evidence at nine stages of the criminal justice process. Generally, laboratory directors rated highly the importance of forensic science evidence at the trial stage and in corroborating the involvement of suspects in crimes. Moderate importance was placed on the value of forensic science evidence in determining if a crime has been committed, providing investigative leads, verifying statements of victims, suspects, and witnesses, deciding to charge a suspect, and plea bargaining. Minimal importance was given to physical evidence in deciding whether to grant bail and sentencing the defendant.

Table 7 shows that the laboratories surveyed rated forensic science evidence very important to essential in deciding the outcome of the following types of cases: drug-related offenses, homicides, rapes, and hit-and-run accidents. Moderate to high importance was given to the other types of crimes: arson, burglary, aggravated assault, robbery, and larceny, with larceny-related evidence receiving the lowest importance.

Shifting from crime-specific to evidence-specific analysis, Table 8 shows that the following

TABLE 6—*Importance of forensic science evidence in the criminal justice process (n = 256).*

Stage in Criminal Justice Process	Importance of Forensic Science Evidence (Mean Value)[a]
Determining if crime has been committed	2.3
Providing investigative leads	2.6
Corroborating involvement of suspects	3.0
Verifying statements of victims, suspects, and witnesses	2.8
Deciding to charge a suspect	2.7
Deciding to grant bail, pretrial release	1.5
Plea bargaining	2.4
Trial	3.2
Sentencing	1.7

[a] Rankings of importance ranged from (1) minimal to (4) essential.

TABLE 7—*Importance of forensic science evidence in deciding the outcomes of crimes (n = 245).*

Crime Type	Importance of Forensic Science Evidence (Mean Value)[a]
Drug-related	3.8
Homicide	3.4
Rape	3.3
Hit-and-run accidents	3.0
Arson	2.8
Burglary	2.6
Aggravated assault	2.4
Robbery	2.3
Larceny	2.0

[a] Rankings of importance ranged from (1) minimal to (4) essential.

TABLE 8—*Importance of physical evidence in deciding the outcome of criminal cases (n = 241).*

Evidence Category	Importance of Specific Evidence Categories (Mean Value)[a]
Drugs	3.8
Fingerprints	3.6
Firearms	3.5
Toolmarks	3.0
Bloodstains (grouping)	3.0
Accelerants	2.6
Explosives	2.5
Fibers	2.4
Paint	2.5
Hair	2.2
Glass	2.1
Bloodstains (patterns)	2.1
Soil	1.7

[a] Rankings of importance ranged from (1) minimal to (4) essential.

categories of physical evidence were rated as highly important or essential in determining case outcome: drugs, fingerprints, firearms, toolmarks, and bloodstains (grouping). Moderate importance was given to accelerants, explosives, fibers, paint, hair, glass, and bloodstains (patterns). Soil was rated least important.

Laboratory directors were also asked to rank how well various users of scientific evidence understand the significance of laboratory results. A five-point scale was used, ranging from 1 (very good understanding) to 5 (very poor understanding). Table 9 shows how users' understanding was rated by laboratory directors. In general, police investigators, prosecutors, defense attorneys, and judges were ranked as having a good understanding of the significance of laboratory results. Jurors and police administrators were rated as having only a fair understanding of the significance of laboratory results.

TABLE 9—*User understanding of significance of laboratory results (n = 253).*

User	Understanding the Significance of Laboratory Results (Mean Value)[a]
Police investigators	2.2
Prosecutors	2.2
Defense attorneys	2.5
Judges	2.5
Police officers	3.0
Police administrators	3.1
Jurors	3.1

[a] Rankings ranged from (1) very good understanding to (5) very poor understanding.

Classification and Educational Level of Personnel

Laboratories were asked to provide data on the number of examiners employed as well as breakdowns of the highest level of education attained by these examiners for the years 1977 and 1982. Table 10 shows the total number of personnel for the two years, broken out by sworn status. For the laboratories responding to this question, the number of laboratory personnel increased from 2033 to 3010 (an increase of 50%) in the five-year period from 1977 to 1982. The percentage of sworn to nonsworn personnel, however, remained relatively constant: about 70% of the personnel were nonsworn and 30% sworn.

For 1982, the percentage of sworn and nonsworn personnel employed was broken out by type of jurisdiction served. Table 11 shows that nonsworn personnel accounted for 60 to 80% of total examiners, except for the federal system, where only 39% of employees were nonsworn.

Table 12 shows the educational level for all personnel, broken out by sworn status. Overall, from 1977 to 1982, personnel were becoming slightly better educated. In 1982, more personnel were working toward a graduate degree or had received a graduate degree than in 1977 (35 compared with 29%). Controlling for sworn status of examiners, we found that in 1977, 35% of nonsworn personnel had graduate education compared with only 15% of the sworn personnel. However, by 1982, sworn personnel closed this gap considerably; 38% of nonsworn staff had graduate education, compared to 30% of sworn personnel. Having staff with graduate degrees appeared to be largely a function of laboratory size, with larger laboratories having more personnel with graduate degrees than smaller ones. The number of sworn staff who had no college education was also reduced by more than half, from 16 to 7%. In sum, then, we found that it was the sworn laboratory examiners who made the greatest educational strides over the five years studied.

TABLE 10—*Laboratory personnel by sworn status, %.*

Type of Personnel	1977 (n = 2033)	1982 (n = 3010)
Nonsworn	71	69
Sworn	29	31

TABLE 11—*Status of examiners by type of jurisdiction served.*

Type of Jurisdiction	Total Number of Examiners	Percent Sworn	Percent Nonsworn
Municipal	472	39	61
County	413	20	80
Regional	213	24	76
State-main	760	29	71
State-satellite	677	24	76
Federal	340	61	39
Other	98	0	100

Technological Innovations and Research

Laboratories were asked to specify the most significant scientific and technological advances in criminalistics in the five years studied. The top three responses were: (1) serology, which was mentioned by 60% of the respondents, (2) computers and related innovations (14%), and (3) laser applications to fingerprints (7%). Clearly, laboratories believed the serological advances to have been most important. The greatest need for future research was perceived by 28% of the laboratories in serology (bloodstains and other body fluids); 15% mentioned trace analysis (paint, glass, fibers, and the like); 13% specifically mentioned individualization of hair; and the remaining responses varied widely.

Looking further at the research issue, laboratories were asked what average percentage of staff time was devoted to research on new laboratory techniques. The mean response was 4.4%. Nineteen percent of responding laboratories reported they did not devote any staff time to research. Interesting enough, it was the medium-sized laboratories (between 4 and 15 examiners) that devoted the greatest time on average to research. Of research performed in the five-year period under study, only 9% was funded through outside grants. For the 23 laboratories awarded research grants in the 5-year period, 13 (56%) were either main or satellite-state laboratory facilities.

Presentations and Publications

Laboratories were questioned as to the number of presentations made by staff at scientific meetings in 1982 and the number of papers published in scientific journals in that year. Staff from 53% of the laboratories responding to this question ($n = 252$) made at least one pre-

TABLE 12—*Highest educational level reached by laboratory personnel.*[a]

Highest Educational Level	Nonsworn Personnel		Sworn Personnel		Combined Sworn and Nonsworn Personnel	
	1977 ($n = 1442$)	1982 ($n = 2066$)	1977 ($n = 591$)	1982 ($n = 944$)	1977 ($n = 2033$)	1982 ($n = 3010$)
No college	4	3	16	7	8	5
Some college	9	9	20	19	12	12
B.A. degree	52	50	45	43	50	48
Graduate credit	12	14	6	11	10	13
Graduate degree	23	24	9	19	19	22
Unknown	0	1	3	1	1	1
Total	100	100	100	100	100	100

[a] All values are percentages.

sentation at a scientific meeting in 1982. Twenty-five percent made one or two presentations, 20% made three to five presentations, and 8% made six or more presentations.

If we review this activity by type of jurisdiction served, it is seen that a greater percentage of federal and state-main laboratories, 77 and 72%, respectively, made scientific presentations than county (56%), regional (48%), municipal (43%), or state-satellite (42%) laboratories.

In terms of published journal articles, 36% of the laboratories surveyed reported they had at least one article published in a scientific journal in 1982. Seventeen percent of the laboratories had one article published, 17% had two to five articles published, and 2% had six or more articles published.

Whether a laboratory reported making scientific presentations or publishing journal articles was largely a function of its size. The personnel from small laboratories (three or less staff) rarely made presentations or published articles, while those from the large laboratories did so at a much greater rate. We were interested in seeing whether having personnel with graduate degrees led to more presentations and publications. Initially it appeared that there was a positive correlation, but when we controlled for laboratory size, the association ceased to be significant.

Instrumentation

Tables 13 and 14 display the responses received from laboratories concerning the types of instrumentation they employ. Table 13 gives the percent of laboratories that were currently using particular instrumentation and which laboratories employed computers to store or interpret data from these instruments. The gas chromatograph and ultraviolet (UV) and

TABLE 13—*Instrumentation (n = 252).*

Instrument	Percent of Laboratories with Instrument in Use	Percent of Laboratories in Which Data from Instruments Are Computerized
Gas chromatograph	92	42
Liquid chromatograph	31	30
Emission spectrograph	25	3
Mass spectrometer	10	53
GC-MS	40	70
UV-visible spectrophotometer	91	8
IR spectrophotometer	90	19
IR-Fourier transform	6	59
Atomic absorption spectrophotometer	29	18
Raman spectrophotometer	0.4	0
Ultramicrospectrophotometer	2	50
X-ray diffraction	18	7
Energy dispersive X-ray	19	69
Scanning electron microscope	16	44
Polarimeter	16	2
Neutron Activation Analysis (NAA)	1	50
Electrophoresis	68	2
Isoelectric focusing	20	4
Radioimmunoassay	10	28
Hot stage	58	3
Laser	4	0
Electrostatic detection apparatus	11	3
Voice spectrograph	5	0
Computerized management information system	29	

TABLE 14—*Year in which first and newest instruments were acquired.*

	Year First Unit Acquired				Year Newest Unit Acquired			
	$\bar{X}$	*SD*	Median	Mode	$\bar{X}$	*SD*	Median	Mode
Gas chromatograph	1972	6	1972	1970	1980	3	1981	1982
Liquid chromatograph	1978	4	1978	1980	1979	3	1979	1982
Emission spectrograph	1967	10	1971	1972	1971	7	1972	1972
Mass spectrometer	1976	4	1976	1976	1977	4	1977	1976
GC-MS	1976	4	1976	1975	1979	3	1980	1982
UV-visible spectrophotometer	1970	8	1972	1973	1977	5	1977	1980
IR spectrophotometer	1972	6	1973	1972	1977	4	1978	1982
IR-Fourier transform	1982	2	1982	1982	1982	2	1982	1982
Atomic absorption spectrophotometer	1976	4	1976	1975	1977	3	1978	1975
Raman spectrophotometer	1978	4	1978	1975	1978	4	1978	1975
Ultramicrospectrophotometer	1981	1	1981	1980	1981	1	1981	1980
X-ray diffraction	1967	8	1972	1972	1970	8	1972	1972
Energy dispersive X-ray	1976	4	1976	1975	1978	4	1978	1975
Scanning electron microscope	1978	3	1978	1978	1978	3	1978	1978
Polarimeter	1975	8	1978	1981	1976	8	1979	1981
NAA	1969	6	1966	1965	1973	7	1972	1980
Electrophoresis	1977	3	1977	1978	1980	2	1981	1982
Isoelectric focusing	1980	2	1980	1982	1980	2	1981	1982
Radioimmunoassay	1978	3	1979	1980	1979	3	1979	1980
Hot stage	1974	7	1975	1972	1976	5	1976	1972
Laser	1975	16	1980	1980	1975	18	1980	1980
ESDA	1980	1	1980	1980	1981	2	1980	1980
Voice spectrograph	1972	4	1974	1974	1974	5	1974	1974
Management information system	1980	4	1981	1982	1980	3	1982	1982

infrared (IR) spectrophotometers were the workhorse instruments, used at more than 90% of crime laboratories. About two thirds of laboratories reported employing electrophoresis equipment, 58% used a hot stage, and 40% had gas chromatography-mass spectrometry (GC-MS) systems. About 30% of laboratories were using liquid chromatographs and atomic absorption spectrophotometers.

The energy dispersive X-ray and GC-MS units were the primary instruments relying on computers to store or interpret data, with about 70% of the laboratories doing so. More than 50% of laboratories having mass spectrometers, IR-Fourier transform instruments, and ultramicrospectrophotometers reported using computer support units as well. Slightly more than 40% of laboratories with GCs and scanning electron microscopes made use of computers to store or interpret data.

Table 14 summarizes the year in which the first of the above-mentioned units was acquired and the year in which the newest of these units was obtained. The table lists the mean ($\bar{X}$), the standard deviation (*SD*), the median, and the mode for each of these categories. For the gas chromatograph, therefore, 1972 is the mean year in which the first of these units was acquired by responding laboratories. The standard deviation (6) indicates that about 68% of responding laboratories acquired their first GC in the time period 1972 $\pm$ 6 years, or 1966-1978. If one carries this to two standard deviations, $\pm$12 years, we would find that 95% of all GCs were first acquired between 1960 and the present day. The median year (1972 for the GC) tells us that this year represents the midpoint, with half of all GCs first acquired before this date and half after it. The mode tells us that 1970 is the year when most GCs were first acquired.

The mode columns provide a quick way to review the status of various instruments and to determine trends in usage. For example, while the mode year for first acquiring IR equip-

ment was 1972, we see that the mode for acquiring the newest units was 1982: it is apparent that laboratories were continuing to purchase and update such instrumentation. On the other hand, for X-ray diffraction units, most of the oldest units were first purchased in 1972; we find that most of the newest units were purchased in the same year. Evidently, laboratories were not continuing to acquire and update their X-ray diffraction units. The emission spectrographs and hot stage units fell into this same category; similarly, atomic absorption and Raman spectrophotometers had most oldest and newest units acquired in 1975. At the other extreme we found the modal year of acquisition for isoelectric focusing and IR-Fourier transform units to be 1982; consequently these are two of the newest techniques in use.

Conclusion

While it is clear that the rapid expansion of criminalistics laboratory facilities of the 1970s has subsided, the increase in the number of scientific personnel in these laboratories (50% over the five years studied) and their budgets (an increase of 67% in the same period) continued. The two-to-one ratio of nonsworn to sworn staff remained relatively constant, as did the educational levels of these personnel.

Laboratories appeared to be relatively successful in updating and acquiring new scientific instrumentation. The workhorse instruments in the laboratories were the gas chromatographs and UV and IR spectrophotometers; many more laboratories were currently using electrophoresis techniques, liquid chromatographs, and GC-MS equipment. Isoelectric focusing and IR-Fourier transform units were two of the newest techniques in use in the laboratories. Practically 30% of responding laboratories also made use of management information systems, which were principally acquired between 1979 and 1982.

Crime laboratories were customarily positioned within police agencies and usually restrict their services to law enforcement clients. They did little casework for private individuals, and only about one third would analyze noncriminal evidence samples. Overall, approximately two thirds of the caseloads of laboratories were in the offense areas of drugs and driving while intoxicated; accordingly, only about one third were in the personal and property crime area.

Putting drug and narcotic cases aside for the moment, laboratories believed the traditional evidence categories of fingerprints, firearms, and bloodstain/biological fluid analysis to be the most important forms of physical evidence in deciding cases. The types of crimes where the laboratories believed forensic science evidence was most important were the personal offenses of homicides, rapes, and hit-and-run accidents. The respondents believed laboratory results to have the greatest impact at trial, in corroborating suspect guilt, and in verifying the statements of suspects, victims, and witnesses. The perception that physical evidence has the greatest impact at trial is interesting when contrasted with the finding that laboratories estimated their examiners only testified in approximately 10% of cases where they actually examined evidence.

Continuing this theme of use of forensic science evidence, laboratory directors believed that jurors and police administrators had the poorest understanding of such evidence, while prosecutors and police investigators had the best understanding. Judges and defense attorneys were ranked in between these groups.

Laboratories were also asked about their involvement in research and areas meriting study. Respondents believed that the most significant advances in criminalistics research over the five years studied were in serology. When laboratories were asked where research was needed most urgently in the future, the reply was once again serology. The laboratories also indicated that research was needed in trace evidence, in particular, hair. The laboratories themselves engaged in little research, with less than 5% of staff time devoted to this activity. This level of effort is evident when we look at the level of publications and presentations at scientific meetings. About half the laboratories reported that they made no presenta-

tions at professional meetings in 1982, and about two thirds reported they did not publish any articles in scientific journals.

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