

## What Educational Background Do Crime Laboratory Directors Require from Applicants?\*

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**ABSTRACT:** A summary of the results from a recent survey where crime lab directors listed their educational requirements from applicants for the positions of drug chemist, trace/impression evidence examiner, serologist/DNA analyst, and firearms/document examiner/fingerprint examiner is presented and discussed. Crime lab directors generally expect applicants to have "hard" science degrees with a preference for the B.S. in chemistry, followed by biology and forensic science degrees with significant chemistry components. Over 90% of the directors responding do not require an internship.

**KEYWORDS:** forensic science, crime lab directors, survey, educational requirements

There has been a renewed interest in the forensic science profession in recent years due, in part, to several recent high-profile trials in the U.S. One of the first questions students ask (or perhaps should ask) is, What educational and training background is needed to become a forensic scientist? These and other related questions were last critically evaluated about ten years ago at the symposium "Issues in Forensic Science Higher Education" presented before the Criminalistics Section at the 1987 Annual Meeting of the American Academy of Forensic Sciences (AAFS) in San Diego, California. A survey of 1985 AAFS laboratory managers indicated that chemical knowledge was the most important ability they considered when evaluating potential employees, followed by instrumental knowledge and laboratory procedures, with toxicology, crime scene, and law/court procedures not heavily weighted in their consideration of an applicant (1). Additionally, the majority felt that an atmosphere should exist where research is the result of a combined effort by academia, state, federal and local laboratories, and national laboratories (1).

Results of a 1986 survey to the membership of the American Society of Crime Laboratory Directors (ASCLD) showed the educational background most preferred for a career in forensic science would consist of a B.S. degree that has a major chemistry component and a M.S. in forensic science. Additional comments also

suggested the need for a strong background in chemistry and a general disdain for the B.S. in forensic science as the terminal degree unless it has a strong hard science component (2). Various innovative regional cooperative arrangements between the comparatively scarce resources of forensic science educational programs have been proposed (3), as has the importance of collaboration between academia and casework forensic science laboratories, including internships, joint research, forensic lab personnel teaching and faculty consultants (4). Better communications between educators, practitioners, and laboratory administrators, including ASCLD members, concerned with advancing the profession have been highlighted as essential in solving forensic research problems (5). A proposal based on a historical analysis of medical education developed over 100 years ago includes active entrepreneurial promotion of professional educational programs by academics and creation of a committee to critique and rate university programs (6).

Currently, many forensic science programs are revisiting how undergraduate and graduate education should be undertaken (7,8). In recent years, there has also been an increased demand for better quality control/assurance in forensic science laboratories, higher expectations being placed upon applicants seeking employment, and calls for expanded standardization of procedures in the forensic sciences (9). Educational standards of all areas of the forensic sciences, from technicians to lab supervisors and such diverse fields as accounting and nursing, are currently being re-evaluated. The diversity in education and practice in forensic nursing has been described and the need for excellence in observation, clinical and communication skills to aid in death investigation was highlighted (10). Forensic accounting education has also recently been reviewed, including perspectives from academicians and practitioners (11). Potential future implications of discrepancies found in the training of students in forensic anthropology have been appraised (12). It has been proposed that the educational standards for police scientific support personnel in the UK be raised to the level of a bachelor of science degree, designed to encompass the unique requirements of the field (13). Graduate education in "conventional" criminalistics (defined as the study of firearms, tool marks, fingerprints, questioned documents and the microscopic examination of glass, soil, hair and fibers) has recently been studied and a proposal made to include an apprenticeship under the supervision of court-qualified criminalists (14).

Presently, we present an evaluation of the detailed educational requirements for various crime laboratory positions, including individual course requirements. Results are presented from an educational survey mailed to the approximately 350 members of the American Society of Crime Lab Directors in their Winter 1996 newsletter. A representative portion of the survey form is

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TABLE 1—Survey used in this study.

**ASCLD Education Survey**

At the request of ASCLD, we are attempting to determine the desired requirements of the profession for new recruits at the undergraduate and graduate level. Please take a few minutes to complete the following questionnaire: (please circle one answer for each line)

What is your educational background?: B.A. B.S. M.S. Ph.D. M.D. Other \_\_\_\_\_

How long have you been a director?: \_\_\_\_\_

What is your specialty?: \_\_\_\_\_

**What educational background do you require from an applicant for the position of Drug Chemist:**

Degree	none	BA	BS	MS	PhD	MD
Specialty		Biology	Chemistry	Forensic Sci.	Med. Lab Sci.	Other _____
General chemistry	none		1 semester	2 semesters	more than 2 semesters	
Organic chemistry	none		1 semester	2 semesters	more than 2 semesters	
Analytical chemistry	none		1 semester	2 semesters	more than 2 semesters	
Physical chemistry	none		1 semester	2 semesters	more than 2 semesters	
Inorganic chemistry	none		1 semester	2 semesters	more than 2 semesters	
General biology	none		1 semester	2 semesters	more than 2 semesters	
Genetics	none		1 semester	2 semesters	more than 2 semesters	
Serology	none		1 semester	2 semesters	more than 2 semesters	
Molecular biology	none		1 semester	2 semesters	more than 2 semesters	
Immunology	none		1 semester	2 semesters	more than 2 semesters	
Maths/statistics	none		1 semester	2 semesters	more than 2 semesters	
Computer science	none		1 semester	2 semesters	more than 2 semesters	
Criminal justice	none		1 semester	2 semesters	more than 2 semesters	
Communications skills	none		1 semester	2 semesters	more than 2 semesters	
Criminalistics (drugs, trace . . .)	none		1 semester	2 semesters	more than 2 semesters	
Internship	none		150 h	300 h	500 h	more than 500 h
Other (please specify)	_____					

NOTE.—The same format was used for the position of Trace/Impression Evidence Examiner, Serologist/DNA Analyst, and Firearms/Document Examiner/Fingerprint Examiner.

TABLE 2—Background summary of crime laboratory directors responding to survey.

Drug Chemist	Specialty of Director					
	Trace	Serology	Firearms	Management/ Administration	Questioned Documents	Toxicology
34%	21%	13%	10%	10%	6%	6%
Number of Years as Director						
0–5 years 37%	6–10 years 25%	11–15 years 14%	16–20 years 12%	>20 years 12%	average 9.9 years	s.d. 7.4 years
Education of Director						
B.S. 42%	M.S. 33%	Ph.D. 13%	B.A. 8%	other 4%		

given in Table 1. Crime lab directors were asked for their educational background, length of service and specialty, and what specific degree, specialty and course requirements they require from applicants applying for the positions of drug chemist, trace/impression evidence examiner, serologist/DNA analyst, and firearms/document examiner/fingerprint examiner. The survey was designed to be completed quickly, with single responses solicited for each question. A total of 52 completed surveys were received (15% response), which was less than hoped for, but was in keeping with 10 to 15% return rate typical for mailed surveys. The number is sufficient for general trend information, but additional course preference surveys or a larger survey audience is needed before this information is used for pedagogical purposes. The background of the crime lab directors responding to the survey is given in Table 2. The most common specialty was drug chemists, followed by trace, and the most common educational background was B.S. followed closely by M.S. The majority of the responders were lab directors for less than ten years with the most common time period less than five years and decreasing numbers with increasing five-year intervals.

The summary of degree required for all positions combined was 63% B.S., 27% B.A., 6% none, 3% M.S. and 1% Ph.D. Required degrees for specific positions are given in Tables 3–6. The degree specialty required was 41% chemistry (including biochemistry), 24% biology (including genetics and molecular biology), 22% forensic science, 7% medical laboratory science and 6% other (including 2% physics and 1% criminal justice). The degree specialty requirements for specific positions are given in Tables 3–6. More importantly, perhaps, are the specific courses suggested by respondents, as the department wherein forensic science programs are based may not adequately reflect the actual coursework students complete in that program. All recommended courses for each position are summarized in Tables 3–6. Regardless of the position, the majority of responders do not require courses in computer science, criminal justice, communication skills or criminalistics. They all, however, require one to two semesters of math/statistics, variable amounts of biological sciences courses and three to eight semesters of chemistry courses depending on the position. On average, the drug chemist position required 1.1 semesters of biological sciences and 7.8 semesters of chemistry, the trace position required

1.5 semesters of biology and 7.2 semesters of chemistry, the serology/DNA position required 5.4 semesters of biology and 5.5 semesters of chemistry and the firearms/document/fingerprint examiner position required 1.4 semesters of biology and 3.3 semesters of chemistry. It is hoped that these results and the results of other surveys can be used in the systematic evaluation/development of academic programs to better serve the forensic science profession.

Over 90% of responders do not require an internship from applicants, whereas a small number of directors require either a limited internship (2.8% 150 h) or an extensive internships (6.3% more than 500 h) as seen in Table 7. It is important to recall that this

survey asked directors their requirements of recruits, not their preferences. It is likely that, if asked for preferences, the percent preferring internships, and additional coursework as well, would likely increase. Also, while not required for employment, internships provide students valuable real-world experience as to what is involved in working in a crime laboratory and may yield references from the crime lab useful in future employment searches.

In summary, the results of this recent survey indicate that the majority of crime lab directors responding require applicants to have B.S. degrees with a preference for chemistry/biochemistry, followed by biology and forensic science with a requirement for a substantial number of chemistry and other natural science courses.

TABLE 3—Summary of crime lab director requirements for the position of drug chemist.

Required degree(s)	{	None 2% (1)	B.A. 31% (18)	B.S. 65% (39)	M.S. 2% (1)	Ph.D. 0% (0)
Required specialty(s)	{	Biology 15% (9)	Chemistry 63% (39)	Forensic Science 13% (8)	Medical Laboratory Science 6% (4)	Other (incl. Criminal Justice) 3% (2)
Required Courses		None	1 Semester	2 Semesters	3 Semesters	Average No. Semesters
General chemistry		0	5.1% (2)	87.2% (34)	7.7% (3)	2.02
Organic chemistry		0	2.6% (1)	89.5% (34)	7.9% (3)	2.05
Analytical chemistry		2.7% (1)	47.2% (17)	41.7% (15)	8.3% (3)	1.55
Physical chemistry		32.1% (9)	7.1% (2)	60.7% (17)	0	1.28
Inorganic chemistry		24.3% (9)	54.1% (20)	21.6% (8)	0	0.972
General biology		54.5% (18)	33.3% (11)	42.1% (4)	0	0.576
Genetics		87.8% (29)	9.1% (3)	3.0% (1)	0	0.152
Serology		96.8% (31)	0	3.1% (1)	0	0.063
Molecular biology		91.1% (31)	2.9% (1)	5.8% (2)	0	0.117
Immunology		91.2% (31)	2.9% (1)	2.9% (1)	2.9% (1)	0.176
Math/statistics		30.3% (10)	12.1% (4)	18.2% (6)	39.4% (13)	1.67
Computer science		75.0% (24)	15.6% (5)	6.3% (2)	3.1% (1)	0.375
Criminal justice		87.1% (27)	9.6% (3)	3.2% (1)	0	0.161
Communications skills		66.7% (22)	21.2% (7)	6.1% (2)	6.1% (2)	0.405
Criminalistics (drugs, trace . . .)		82.9% (29)	6.1% (2)	6.1% (2)	0	0.182

TABLE 4—Summary of crime lab director requirements for the position of trace/impression evidence examiner.

Required degree(s)	{	None 5% (3)	B.A. 25% (15)	B.S. 68% (40)	M.S. 2% (1)	Ph.D. 0% (0)
Required specialty(s)	{	Biology 18% (16)	Chemistry 41% (36)	Forensic Science 32% (28)	Medical Laboratory Science 6% (5)	Other (incl. Criminal Justice) 3% (3)
Courses		None	1 Semester	2 Semesters	3 Semesters	Average No. Semesters
General chemistry		0	5.3% (2)	92.1% (35)	2.6% (1)	1.95
Organic chemistry		0	7.6% (3)	89.7% (35)	2.5% (1)	1.92
Analytical chemistry		13.5% (5)	54.1% (20)	24.3% (9)	8.1% (3)	1.31
Physical chemistry		32.4% (12)	29.7% (11)	37.8% (14)	0	1.05
Inorganic chemistry		29.7% (11)	41.0% (15)	29.7% (11)	0	1.00
General biology		48.4% (16)	39.3% (13)	12.1% (4)	0	0.636
Genetics		82.3% (28)	11.7% (4)	5.8% (2)	0	0.235
Serology		91.1% (31)	5.8% (2)	2.9% (1)	0	0.117
Molecular biology		88.2% (30)	5.8% (2)	5.8% (2)	0	0.176
Immunology		79.4% (27)	8.8% (3)	5.8% (2)	5.8% (2)	0.382
Math/statistics		31.4% (11)	20.0% (7)	31.4% (11)	17.1% (6)	1.34
Computer science		73.5% (25)	14.7% (5)	11.7% (4)	0	0.382
Criminal justice		81.8% (27)	12.1% (4)	6.1% (2)	0	0.364
Communications skills		68.7% (22)	28.1% (9)	0	3.1% (1)	0.344
Criminalistics (drugs, trace . . .)		82.4% (28)	11.7% (4)	5.8% (2)	0	0.235

TABLE 5—Summary of crime lab director requirements for the position of serologist/DNA analyst.

Required degree(s)	None 2% (1)	B.A. 20% (12)	B.S. 71% (42)	M.S. 5% (3)	Ph.D. 2% (1)
Required specialty(s)	Biology 41% (36)	Chemistry 28% (24)	Forensic Science 21% (18)	Medical Laboratory Science 8% (7)	Other (incl. Criminal Justice) 2% (2)
Courses	None	1 Semester	2 Semesters	3 Semesters	Average No. Semesters
General chemistry	40.0% (22)	1.8% (1)	56.3% (31)	1.8% (1)	1.20
Organic chemistry	5.7% (2)	2.8% (1)	88.5% (31)	2.8% (1)	1.88
Analytical chemistry	29.4% (10)	35.3% (12)	35.3% (12)	0	0.782
Physical chemistry	54.5% (18)	21.2% (7)	24.2% (8)	0	0.697
Inorganic chemistry	45.4% (15)	21.2% (7)	30.3% (10)	3.3% (1)	0.909
General biology	15.6% (5)	18.7% (6)	59.4% (19)	6.3% (2)	1.56
Genetics	14.3% (5)	62.8% (22)	17.1% (6)	5.7% (2)	1.14
Serology	37.5% (12)	50.0% (16)	12.5% (4)	0	0.750
Molecular biology	16.6% (6)	50.0% (18)	25.0% (9)	8.3% (3)	1.25
Immunology	41.9% (13)	41.9% (13)	16.1% (5)	0	0.742
Math/statistics	11.7% (4)	38.2% (13)	38.2% (13)	11.7% (4)	1.50
Computer science	64.5% (20)	19.3% (6)	16.1% (5)	0	0.516
Criminal justice	87.1% (27)	12.9% (4)	0	0	0.129
Communications skills	61.2% (19)	32.2% (10)	0	6.4% (2)	0.838
Criminalistics (drugs, trace . . .)	87.8% (29)	9.1% (3)	3.0% (1)	0	0.152

TABLE 6—Summary of crime lab director requirements for the position of firearms/document/fingerprint examiner.

Required degree(s)	None 17% (10)	B.A. 32% (19)	B.S. 46% (27)	M.S. 3% (2)	Ph.D. 2% (1)
Required specialty(s)	Biology 20% (14)	Chemistry 33% (23)	Forensic Science 21% (15)	Medical Laboratory Science 8% (6)	Other (incl. Criminal Justice) 18% (13)
Courses	None	1 Semester	2 Semesters	3 Semesters	Average No. Semesters
General chemistry	30.4% (7)	0	69.5% (16)	0	0.821
Organic chemistry	34.7% (8)	13.0% (3)	52.2% (12)	0	1.17
Analytical chemistry	47.8% (11)	39.1% (9)	13.0% (3)	0	0.652
Physical chemistry	86.9% (20)	8.7% (2)	4.3% (1)	0	0.091
Inorganic chemistry	60.8% (14)	21.7% (5)	17.4% (4)	0	0.565
General biology	60.8% (14)	13.0% (3)	26.1% (6)	0	0.652
Genetics	91.3% (21)	4.3% (1)	4.3% (1)	0	0.130
Serology	91.6% (22)	4.1% (1)	4.1% (1)	0	0.125
Molecular biology	91.6% (22)	4.1% (1)	4.1% (1)	0	0.125
Immunology	77.2% (17)	9.1% (2)	9.1% (2)	4.5% (1)	0.409
Math/statistics	48.0% (12)	16.0% (4)	28.0% (7)	8.0% (2)	0.960
Computer science	63.6% (15)	27.3% (6)	9.1% (2)	0	0.434
Criminal justice	78.2% (18)	17.4% (4)	4.3% (1)	0	0.261
Communications skills	67.5% (15)	25.0% (6)	4.1% (1)	8.3% (2)	0.541
Criminalistics (drugs, trace . . .)	77.3% (17)	18.1% (4)	4.5% (1)	0	0.318

TABLE 7—Results of the internship survey.

	Amount of Internship Required				
	None	150 Hours	300 Hours	500 Hours	More than 500 Hours
Drug chemist	93.2% (41)	4.5% (2)	0	0	2.3% (1)
Serologist/DNA examiner	90.9% (40)	2.3% (1)	0	0	6.8% (3)
Firearm/document/fingerprint examiner	88.3% (38)	0	0	0	11.6% (5)
Trace/impression evidence examiner	90.9% (40)	4.5% (2)	0	0	4.5% (2)
Average	90.8%	2.8%	0	0	6.3%

These results reinforce the conclusions from previous surveys (1,2) stressing lab directors' preference for applicants who have a strong chemistry background. Based on this survey and others, students interested in careers in crime laboratories are advised to complete bachelor of science degrees with a substantial number of chemistry courses. It is important to complete educational surveys such as the one summarized here on a regular basis in order to ascertain current trends in desired educational requirements by potential employers. Such information is invaluable in the future development of forensic science education programs.

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