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ORGANIZATION OF FORENSIC CHEMICAL LABORATORIES IN NON-METROPOLITAN AREAS

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Two fundamental principles govern our American system of law enforcement: (1) Law enforcement and policing are considered sovereign local functions generally carried out at the community or county level, and (2) every citizen is entitled to the equal protection of the laws. It is implicit in these doctrines that persons in non-metropolitan areas are as much entitled to adequate forensic laboratory services as those living in the larger population centers, and that the responsibility for the provision of such adequate and appropriate forensic laboratory services rests with the local authorities. The nature and extent of these services is necessarily governed by certain practical considerations.

Certainly, the need for criminalistic investigations exists in every community; for example, it has been established that about 18 to 25 per cent of all deaths occurring within a given political jurisdiction, irrespective of population, require some degree of medicolegal investigation (1, 2). The experience of the New York State Police Scientific Laboratory is typical of utilization of state-level facilities: During 1958, 46.6 per cent of all 2,757 cases were handled for other agencies (3). The development of large and effective forensic laboratories by national and state law enforcement agencies with extension of their services cost-free to local law enforcement agencies has undoubtedly impeded development of adequate local forensic laboratories. The apparent convenience and economy of using these distant laboratories encourages a widening estrangement of the field and laboratory investigation phases of police work, to the detriment of both and of the needed teamwork. Many factors combine to restrict use of these distant laboratories to major crime investigations, with a concomitant tendency to ignore collection and examination of physical evidence in minor cases and in non-criminal investigations.

Local forensic laboratory services of proper

scope and type can contribute much to effective, economical and consistent local law enforcement. The problems of establishing such forensic laboratory facilities in non-metropolitan areas fall into several main categories, among which are those of organization, personnel, facilities, methodology, and coordination with already existing agencies and established procedures. Aside from the determination of ethyl alcohol in human biological materials, which remains the most common forensic chemical examination (4) and the need for which in itself forms an indication for establishment of local forensic chemistry laboratories, the majority of physical evidence examinations consist of various identifications, characterizations, and comparisons (5-9). Consequently, chemical techniques of examination, supplemented by certain related physical and biological methods, suffice for the examination and evaluation of the physical evidence accompanying much of the local police investigation caseload, including most offenses against the person. The local forensic chemistry laboratory, unlike the national agency laboratories, need not restrict its services to police, enforcement or prosecuting agencies, but can also serve the local medicolegal investigative offices which are an important and often neglected outlet for forensic chemical services, including most of the toxicology. Much or most of the forensic laboratory work performed will not ultimately be presented in court or before grand juries. Forensic chemistry is and should be regarded by all levels of law enforcement as one of the techniques of investigation employed to develop facts.

ORGANIZATION

Non-metropolitan forensic chemistry laboratories can be effectively organized in various settings, although college or university affiliations afford many special advantages, some of which are also shared by major hospital environments.

The practical and economic advantages of having available the basic physical facilities, libraries, and consultants in various related areas such as biological, physical and mathematical sciences, law, etc., are manifest. Further, the local forensic chemistry laboratory can advantageously extend its value through conduct of various training and in-service educational programs for the law enforcement agencies it serves, again most effectively carried out in academic surroundings and facilities.

While the local forensic chemistry laboratory need not necessarily be organized as an integral part of a law enforcement agency, there are special reasons for maintaining a close relation with some one such enforcement agency. Facilities for and certainty of communication ranks high among these reasons. Much of the superiority in certain situations of local over remote forensic chemistry laboratories is based on the opportunity for frequent, informal, and timely contacts between the field investigator and the laboratory scientist regarding a specific case at a time when additional evidence materials and supplemental field information may still be available. To realize these advantages fully requires a simple and certain method of contacting the laboratory when its services are most needed, which is often at night, over week-ends and on holidays. Early visits by the forensic chemist to the scenes of crimes and investigations are often productive of great dividends and can frequently simplify the problems of recognizing, collecting, identifying, and processing evidence materials; and require close cooperation with the enforcement agencies concerned. Irrespective of the operation of a local forensic laboratory autonomously or as an organically integral part of an enforcement or prosecuting agency, an appropriate clear and enforceable policy delineating the chain of command or line of authority including both the laboratory personnel and the enforcement and prosecuting officials should be established, widely disseminated, and rigorously adhered to.

Non-metropolitan forensic chemical laboratories have been successfully organized in this country as an integral unit of or under the auspices of each of the following types of agencies:

1. Joint city-county government
2. Coroner's or Medical Examiner's office
3. District Attorney's office or other Prosecuting Agency
4. Police Department
5. Sheriff's office

6. Joint Sheriff's-Coroner's establishment
7. State-level public safety or enforcement agency
8. University, including medical school.

Less commonly local forensic chemistry services of limited scope have been offered by private or commercial laboratories and by non-teaching hospitals.

PERSONNEL

It is fundamental to successful operation that in every case all work undertaken be performed by qualified scientists having the required technical and forensic background of education, training, and prior forensic experience in the specific field concerned. Generally, such forensic experience of suitable type and extent can only be acquired in the laboratories of national, state, and large municipal enforcement agencies. It is essential that the work performed be limited to areas within the prior experience of the forensic chemist which, in most instances, entirely eliminates special evidence examination fields, such as document examination.

It is desirable, if not indeed requisite, that the forensic chemist be given appropriate official status and consequently both the opportunities and responsibilities of a peace officer with respect to procurement, possession and transportation of evidence, firearms, narcotics, as well as full access to sources of information such as reports, files, records, and official publications such as the *FBI Law Enforcement Bulletin*, which are generally restricted. Minor, though important, advantages of such official status are the opportunity to join local peace officer organizations which often afford the best means for repeated effective contact between scientist and police officers, and the sanction of official status in the performance of duties, minimizing questions of propriety of and responsibility for these actions and professional liability problems. For similar reasons, the forensic chemist should receive a fixed salary for his services, rather than provide these services on a fee basis or gratuitously. While various designations for forensic chemists have been used in official appointments, the term "criminalist" has gained favor nationally in recent years and has much to recommend it, including universal recognition and appropriateness to all local situations. Although in some large forensic laboratories properly supervised laboratory technicians are effectively used, all work done in non-metropolitan forensic chemical laboratories should be performed in its entirety by a responsible

forensic chemist, and the volume of cases accepted should be limited to that which can be so handled.

FACILITIES AND SERVICES

In its broadest sense, forensic chemistry encompasses the application of chemical principles, concepts, methods, and techniques to legal problems and proceedings. Generally, however, the more restricted view of confining the immediate scope of forensic chemistry to its applications as a scientific method of judicial proof is held. Practical considerations usually limit local forensic chemistry laboratories to the application of chemistry and certain physical procedures to problems in the administration of justice and law enforcement. The nature and scope of the services to be offered and the required facilities must be considered together. Generally, non-metropolitan forensic chemistry laboratories should undertake those examinations in which proximity to the source of the evidence material affords substantial advantages (e.g., scene-collections), which are characterized by urgency of results (e.g., alcohol determination in traffic offenses), or which would otherwise remain unperformed. These services usually include:

1. Determination of alcoholic intoxication
2. Examination of stains, fibers, and other trace evidence
3. Identification of drugs, medicaments, and suspected narcotics
4. Examination of firearms discharge residues, bullet holes, etc.
5. Examination of blood and blood stains
6. Examination of seminal stains and other biological trace evidence
7. Toxicological examinations
8. Monitoring of chemical breath alcohol testing systems
9. Examination and identification of miscellaneous physical evidence
10. Examination of alcoholic beverages.

Most non-metropolitan forensic chemistry laboratories should forego examinations requiring extensive and complex reference collections, e.g., automotive paint files, match collections, laundry and dry-cleaner's marks, etc., the assembly and maintenance of which is clearly beyond effective scope of such local units. This eliminates most document examinations, many types of firearms investigation and many examinations of common commercial materials such as wood, plastics, glass, etc., where absolute identifications rather than comparisons of specific known and questioned

TABLE 1
1958 CASE CLASSIFICATION*

Classification	Cases
Alcoholic Beverage Violations	2
Animal Poisoning	4
Arson	4
Assault	5
Automobile Theft	2
Breaking and Entering	5
Burglary	3
Death Investigations	53
Homicide	13
Suicide	12
Accidental	16
Natural Causes	3
Undetermined	9
Drug Identifications	6
Explosives and Bomb Investigations	3
Firearms Examinations	6
Food Examinations	4
Hit-and-Run Investigations	8
Kidnaping	1
Narcotic Violations	6
Sex Crimes	14
Crime Against Nature	2
Fornication	3
Molesting Minors	1
Rape	8
Special Hospital Toxicology	11
Suspected Poison Examinations	4
Vandalism and Malicious Mischief	17
Total Cases	158

* Exclusive of Alcohol Determinations.

specimens are involved. Tables 1 and 2 reflect the types of cases referred to our forensic chemistry laboratory during 1958, and the nature of the examinations performed, and are fairly typical of the work of such non-metropolitan laboratories.

Limited reference collections are definitely useful and practical in local laboratories. Included should be authentic exemplars of the more common alkaloids and narcotics, drug products, common natural and synthetic textile fibers, and ample authentic samples of blood and various other biological materials in the form of dried stains, for the validation of testing procedures. Photographic techniques form a valuable, if not indispensable, part of many forensic laboratory investigations, including many chemical investigations. Appropriate photographs should always be prepared of evidence materials which will probably be altered or destroyed by subsequent laboratory

TABLE 2
1958 TYPE OF CRIMINALISTIC EXAMINATION*

Examination	Number
Alcoholic Beverage Analysis	2
Analytical Microscopy and Physical Examinations	100
Biological Fluid Examinations	1
Blood and Blood Stain Examinations	47
Clothing Examinations	29
Drug and Medicament Identification	9
Explosive Examinations	2
Firearms Examinations	3
Food Examinations	8
Gunpowder Residue Examinations	11
Hair and Fiber Examinations	11
Laundry and Dry Cleaner Marks Examinations	1
Miscellaneous Chemical Examinations	34
Narcotics Analysis	4
Paint Examinations	20
Restoration of Obliterated Markings	2
Seminal Matter and Stain Examinations	25
Soil Examinations	2
Tool and Tool Mark Examinations	5
Toxicological Analyses	67
Trace Evidence Examinations	11
Total Examinations	394

* Exclusive of Alcohol Determinations.

examination; and photographic techniques including infrared, ultraviolet, and x-ray processes should be exploited to their fullest extent in directing or limiting chemical searches of gunpowder residues, stains and other trace evidence, eliminating the obscuring effects of blood stains, recording evanescent chemical restorations of serial numbers and other markings, etc. (10, 11). The required photographic facilities and techniques therefore usually require cooperation and assistance of special photography units, such as medical illustration departments, photography departments of universities or colleges, or the photographic laboratories of larger law enforcement agencies.

Since the range of potential evidence materials to be examined covers the entire field of commercial, industrial, and household articles, substances, and materials, such large categories as drugs and surface coatings, as well as biological materials and many unidentified items, a fully equipped general chemical laboratory is necessary as the basis for forensic chemical operations.

Equipment for microchemistry, drop-scale analysis (12, 13) and other small sample operations is highly useful because of the limited quantities of much of the evidence material submitted. The forensic chemistry laboratory relies on physical examination methods, measurements, and comparisons to a much greater extent than most other chemical laboratories, and a few basic instruments are essential. These include an adequate stereoscopic microscope with vertical illuminator, a conventional binocular microscope of at least medical or pathologist's microscope grade, an adequate ultraviolet lamp of not less than 100 watts transmitting about 3660 Å, a small portable vacuum cleaner with filter attachment, and a complete set of basic hand tools. A complete evidence material collection kit is most useful and should include ample supplies of various plastic bags and containers, and a variety of labeling materials. A comparison microscope has numerous applications other than in firearms identifications and is nearly indispensable.

Special instrumentation and other specialized equipment, while often desirable, should not ordinarily be added to the laboratory facilities for the forensic chemical work only. Some specialized analytical instruments find other wide applications and are therefore normally available, such as a manual or recording ultraviolet spectrophotometer, suitable equipment for chromatography and paper electrophoresis, polarizing or phase microscopes, refractometers, radioactivity survey meters, etc. Most part-time forensic chemists will lack the opportunity to gain sufficient skill and experience in the use and application of emission spectrography, infrared spectroscopy, and x-ray diffraction, and evidence materials requiring examination by such means should be referred to national or regional laboratories which are also more likely to possess the reference collections necessary for adequate employment of such procedures and evaluation of the results.

Adequate and up-to-date books and technical information files are fundamental to success in forensic chemistry at all levels and should include not only major texts on criminalistics and forensic science practice but also a selection of basic books on examination and chemical analysis of commercial materials. Identification of commercial and household substances is a frequent forensic chemical problem and the information resources of the local laboratory can often be supplemented by the

files and contacts of the approximately 220 local poison information centers (14). Because of the obvious forensic and practical advantages of using standardized analysis procedures for certain evidence examinations, local laboratories should obtain and utilize the published procedures of the major forensic laboratories (15-19) whenever these are applicable to the local problems and facilities. The most versatile photocopying apparatus the local budget can afford will be found to be a worthwhile and nearly indispensable working tool.

In addition to the determination of ethyl alcohol in biological materials (20), a few other specialized categories of forensic laboratory examination will usually constitute the bulk of the workload of local laboratories. These include examination of suspected blood and seminal matter stains, surface coating examinations, drug and medicament identifications, certain toxicological analyses, and various trace evidence examinations. In several of these areas, sound evaluations of the forensic laboratory problems and reliable and practical suggestions for appropriate laboratory investigations of universal applicability are available (21-24), and constitute a worthwhile point of departure for newly organized laboratories.

PRINCIPLES OF OPERATION

As in their larger counterparts, administrative problems and details often create greater concern and more difficulties in non-metropolitan forensic chemical laboratories than do most of the technical and scientific investigations undertaken. Adequate prior planning, complete and clear-cut agreements, and full and effective statements of the principles which are to govern the local operations can minimize these problems. Decisions should be reached and implemented concerning the following matters, among others, prior to beginning any operations:

1. Agencies, organizations, and officials to whom services and facilities will be available.

2. Prescribed official procedure and channels for requesting services, including appropriate authorizations, endorsements (e.g., by State Attorneys, etc.), approvals when required, and forms to be used.

3. Nature and extent of available services, excluded services, and procedures for declining inappropriate requests.

4. Arrangements for compensation, reimbursements for operating expenditures, and

other financial matters in connection with forensic laboratory examinations, field investigations, and testimony.

5. Official procedure for reporting results of laboratory examinations, including the nature and format of reports to be rendered, and recipients of such information, and policies regarding contacts with news media, public information agencies, etc.

6. Standard operating procedures for submission, custody, and return or disposal of evidence materials and exhibits.

7. Policies relating to the sharing of samples and referral of examinations to other agencies or other forensic laboratories.

We have found it helpful to prepare a few special forms for the submission of specimen materials, to acknowledge the receipt of evidence materials, to list specimen requirements, and to outline in a series of one-page resumés the nature of some of the more frequent criminalistic examinations, their specimen requirements, obtainable information and probative value.¹ Interpretation tabulations (25) have proved effective in reducing the need for repetitive explanations of the interpretation of findings and the conclusions based thereon.

For effective operation, it is imperative that the laboratory require and receive for each case undertaken a full and clear statement of the nature of the case (offense or investigative classification, etc.), a complete listing of the evidence materials being submitted with identifying data, sources, etc., and a clear and concise statement of the examinations requested and the information sought, all in writing. Failure to obtain this basic information is unfortunately nearly universal and seriously impedes this work. In order to simplify the proper collection, preservation, and submission of specimen materials while maintaining the necessary legal evidentiary safeguards we have prepared a series of appropriate collection units consisting of sample container, outer (mailing) container, directions, laboratory request form, return label and numbered sealing device. An illustrated field manual, evidence guide or suggestions for handling of physical evidence, similar to those prepared by the larger agencies (26-28) and appropriately modified for the specific local situation can be

¹ Readers desiring to obtain samples of this material are asked to write the author at the University of Florida Teaching Hospital and Clinics, Gainesville, Florida.

most valuable and will save much time and wasted effort.

Two general rules should govern acceptance of evidence materials for processing by local laboratories:

1. To avoid duplication and examination of possibly altered evidence materials, no examinations should be undertaken which are also to be performed or have been performed on the same specimens by any other laboratory.

2. To avoid loss of time and evidence material and interference with subsequent processing, no examinations should be undertaken on evidence materials which will obviously require additional different examinations by another laboratory. In such instances, the materials are best referred immediately to an agency capable of performing all of the initially indicated procedures.

The local laboratory must also consistently resist the temptation to yield to the flattering and often urgent requests to extend its operations into areas outside of its competency, proper scope, experience or facilities, which will almost invariably follow successful rendering of the basic services. The limitations as well as the unique advantages of non-metropolitan forensic chemical practice (29) must continue to guide a successful program.

REFERENCES

1. GONZALES, T. A., VANCE, M., HELPERN, M., AND UMBERGER, C. J., *LEGAL MEDICINE, PATHOLOGY AND TOXICOLOGY*, 2nd ed., New York, Appleton-Century-Crofts, Inc., 1954, pp. xi, 100.
2. FISHER, R. S., *TWENTIETH ANNUAL REPORT OF THE DEPARTMENT OF POST MORTEM EXAMINERS. STATE OF MARYLAND, 1958*, Baltimore, Office of the Chief Medical Examiner, 1959, p. 7.
3. *FORTY-FIRST ANNUAL REPORT OF THE NEW YORK STATE TROOPERS FOR THE YEAR 1958*, Albany, New York State Police, 1959, pp. 33-34.
4. DUBOWSKI, K. M., Some practical laboratory aspects of forensic alcohol determinations. *PROC. IOWA ACAD. SCIENCE* 63, 364-390 (1956).
5. JONES, L. V., *SCIENTIFIC INVESTIGATION AND PHYSICAL EVIDENCE*, Springfield, Charles C Thomas, 1959.
6. KIRK, P. L., *CRIME INVESTIGATION*, New York, Interscience Publishers, Inc., 1953.
7. NICKOLLS, L. C., *THE SCIENTIFIC INVESTIGATION OF CRIME*, London, Butterworth, 1956.
8. O'HARA, C. E., AND OSTERBURG, J. W., *AN INTRODUCTION TO CRIMINALISTICS*, New York, The MacMillan Company, 1949.
9. SVENSSON, A., AND WENDEL, O., *CRIME DETECTION—MODERN METHODS OF CRIMINAL INVESTIGATION*, New York, Elsevier Publishing Company, 1955.
10. *PHOTOGRAPHY IN LAW ENFORCEMENT*, Rochester, Eastman Kodak Co., 1959.
11. *KODAK DATA BOOK ON INFRARED AND ULTRAVIOLET PHOTOGRAPHY*, 6th ed., Rochester, Eastman Kodak Co., 1959.
12. FEIGL, F., *SPOT TESTS IN ORGANIC ANALYSIS*, 5th ed., Amsterdam, Elsevier Publishing Company, 1956.
13. FEIGL, F., *SPOT TESTS IN INORGANIC ANALYSIS*, 5th ed., Amsterdam, Elsevier Publishing Company, 1958.
14. National Clearinghouse for Poison Control Centers, U.S.P.H.S., *DIRECTORY OF POISON CONTROL CENTERS*, Washington, Dept. of Health, Education and Welfare, March 1960.
15. YOUNG, J. L., *METHODS OF ANALYSIS FOR ALKALOIDS, OPIATES AND SYNTHETIC DRUGS*, Publication No. 341, Washington, U. S. Treasury Dept. Internal Revenue Service, November 1956.
16. U.S. Treasury Dept., Bureau of Narcotics, *MARIHUANA—ITS IDENTIFICATION*, Washington, Government Printing Office, 1948.
17. Crime Detection Laboratories, Royal Canadian Mounted Police, SEMINAR No. 1: *DETERMINATION OF DRUGS BY X-RAY DIFFRACTION, ULTRAVIOLET AND INFRARED SPECTROPHOTOMETRY AND BY MICROCHEMICAL COLOR AND CRYSTAL REACTIONS*, Ottawa, Royal Canadian Mounted Police, 1954.
18. Crime Detection Laboratories, Royal Canadian Mounted Police, SEMINAR No. 2: *THE ISOLATION AND PURIFICATION OF TOXICOLOGICALLY IMPORTANT DRUGS WITH SPECIAL EMPHASIS ON ALKALOIDS*, Ottawa, Royal Canadian Mounted Police, 1955.
19. Crime Detection Laboratories, Royal Canadian Mounted Police, SEMINAR No. 3 (Immunological and Serological Techniques), Ottawa, Royal Canadian Mounted Police, 1956.
20. Friedemann, T. E., and Dubowski, K. M., Chemical testing procedures for the determination of ethyl alcohol, Chapter V in *CHEMICAL TESTS FOR INTOXICATION MANUAL*, Chicago, Committee on Medicolegal Problems, American Medical Association, 1959.
21. WIENER, A. S., Examination of blood stains in forensic medicine, *J. FORENSIC SCI.* 1, 89-102 (1956).
22. MCBAY, A. J., Toxicologic studies in suicide investigation, *J. FORENSIC SCI.* 5, 72-83 (1960).
23. OSTERBURG, J. W., The investigation of suspicious, violent, or unexplained sudden death, from the crime laboratory viewpoint, *J. FORENSIC SCI.* 4, 463-472 (1959).
24. DUBOWSKI, K. M., The current status of some chemical methods for the investigation of sudden, unexplained or obscure deaths, *J. FORENSIC SCI.*, in press.
25. DUBOWSKI, K. M., Stages of acute alcoholic influence/intoxication, *POLICE* 1 (3), 32 (Jan.-Feb. 1957).
26. *SCIENTIFIC AIDS IN CRIMINAL INVESTIGATIONS: SUGGESTIONS FOR HANDLING OF PHYSICAL EVIDENCE*, Washington, Federal Bureau of Investigation, n.d.
27. *NEW YORK STATE TROOPERS EVIDENCE GUIDE*, 3rd ed., Albany, Division of State Police, 1956.
28. Bureau of Government, University of Wisconsin, *INSTITUTE ON SCIENTIFIC AND LABORATORY METHODS OF JUDICIAL PROOF*, Madison, University of Wisconsin Extension Division, 1954.
29. DUBOWSKI, K. M., Forensic science practice in smaller communities, *ANNALS OF WESTERN MED. & SURGERY* 5, 876-881 (1951).