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A Basic Training Program for Forensic Drug Chemists

Probably every forensic drug laboratory has at one time or other, faced the problem of training a new chemist. His prior experience varies from a recent college graduate to a transferee from another laboratory. The latter person would only require instruction on the use of instruments he did not have in his former laboratory, a briefing on such matters as degree of analytical effort applied, laboratory personnel policies, and an introduction to the laboratory staff. However, it is the training of the new graduate of an accredited college with a baccalaureate degree in chemistry, and no professional work experience which will be discussed here.

Background

The laboratory system of the Bureau of Narcotics and Dangerous Drugs, which now consists of six regional laboratories and a Special Testing and Research facility, was conceived after the merger of the Federal Bureau of Narcotics (FBN) and the Bureau of Drug Abuse Control (BDAC) in April 1968. Prior to the existence of this system, FBN evidence was examined by laboratories of other Treasury agencies, such as Alcohol, Tobacco and Firearms and Customs. BDAC evidence was examined in district and headquarter laboratories of the Food and Drug Administration (FDA). In the summer of 1968, the Special Testing and Research Laboratory was opened in Washington, D.C., and by April 1969, regional laboratories were operational in New York City; Washington, D.C.; Chicago, Illinois; Dallas, Texas; and San Francisco, California. Initial staffing of the laboratories was accomplished through transfer of experienced personnel from FDA and the Treasury Department laboratories. Little or no training was required.

During the summer of 1970, however, the laboratory system was expanded, and the first inexperienced trainees arrived. The laboratories, still in the process of organizing to meet the demands being placed upon them, were faced with the prospect of training the new arrivals.

There are several choices of alternatives to be made in training totally inexperienced people. Should the program be a formal one, or primarily one of on-the-job training? Should each laboratory design its own program, based upon its particular needs, or should the program be designed at Headquarters for use in the field?

The Bureau laboratory system decided on a full-time, formal training program, written,

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and coordinated by Headquarters. A formal, written program centrally administered has the following advantages.

1. The training received is relatively uniform throughout the country. A chemist trained in this fashion could function effectively in any of the laboratories, and would not be limited to samples peculiar to a given laboratory, to the exclusion of other common drug substances.
2. The trainee is exposed to scientific and legal literature which will assist him in carrying out his function as an expert witness.
3. A large variety of techniques and methods can be taught, enabling the trainee to make intelligent choices in methodology. A person receiving training by assignment to an experienced chemist, will tend to follow the procedures used by his mentor, to the exclusion of other techniques.
4. The trainee is forced to perform work himself. He is not permitted merely to observe, but must instead think and make his own decisions.
5. Control over the program and evaluation of a trainee's progress can be monitored more effectively when a formal program is used.
6. The chief chemist, who is charged with the overall responsibility for the training of his employees, is relieved of the necessity of designing a training program.
7. The trainee's status as a witness is enhanced if he is able to state that he underwent a formal training program in forensic drug analysis, under the direct supervision of experienced senior forensic chemists.

A centrally administered, formal program has its disadvantages. The Chief Chemist is limited in his prerogatives; the trainee does not necessarily concentrate on developing proficiency in the sample types most often encountered in the laboratory; a formal program removes the trainee (and trainer, or training coordinator) from useful production for the duration of the program. It is extremely questionable, however, what value to the laboratory results from a traineee chemist appearing in court as an "expert" after only a few weeks or months on the job. Many laboratory managers prefer not to have a person testify until he has had one year's experience in the field. Irreparable harm can be done to a trainee (and to the laboratory) by rushing him into court prematurely.

A training period should also be one of testing and evaluating practices and procedures. By a guided selected course of study, the trainee can be exposed to all basic approaches to drug identification. He should witness first hand the specificity of each procedure used. For example, verify that thin layer chromatography does, in fact, distinguish LSD from such legitimate, closely related drugs, as ergonovine maleate and ergotamine tartrate. Most experienced chemists know that IR can easily distinguish between heroin and morphine. The trainee should see this for himself. Many future courtroom difficulties can be prevented if the trainee develops, early in his career, confidence in this testing procedures. He should also be made aware of the limitations of certain techniques. Fluorescence spectrophotometry, for example, will not distinguish LSD from other ergot alkaloids. These sorts of observations rarely will be made once the trainee is confronted with a sample load.

Most government agencies hire trainee chemists subject to successful completion of a probationary period. A formal training program will ensure that a trainee is thoroughly tested before a decision on whether or not to retain him is made.

Designing the Program

The training program presented here consists of nine parts to be accomplished in the laboratory, plus a tenth which consists of a one-week orientation session at Bureau

TABLE 1—*Contents of the training program.*

Lesson Plan	Topics Covered
1	Drug Analysis in General
2	Opium Alkaloids, Opiates and Cocaine
3	LSD and the Tryptamines
4	Amphetamines
5	Barbiturates
6	Other Controlled Substances and Frequently Encountered Non-Controlled Substances
7	Marihuana and THC
8	Clandestine Laboratories and Procedures for Synthesis
9	Legal Aspects and Court Testimony

Headquarters. Table 1 gives a listing of each lesson and the general topic covered. With the exception of Lesson Plan 1, which deals with the fundamental principles of general pharmaceutical analytical chemistry and should be given first, the order in which the lessons are presented is left to the discretion of the chief chemist. Each lesson plan consists of background readings into social and physiological effects of the drugs covered, qualitative and quantitative analysis procedures, laboratory exercises and analyses, legal status of the drugs, and questions and problems to be answered. Table 2 gives the format and contents of a typical lesson plan.

The training program is administered by the Chief Chemist, who usually designates an individual to supervise the day-to-day training activities; he is usually a senior chemist or supervisory chemist. His duties are to review the trainee's submitted work; assign unknowns and training samples; conduct training critiques and seminars; answer routine questions from the trainees; arrange for instruction in instrumental techniques (or provide the instruction himself); keep the chief chemist informed of the trainee's progress; and ensure that required reports to Headquarters are prepared.

At some time during the training period, the trainees attend a one-week orientation seminar at BNDD Headquarters. The curriculum for this seminar consists of personnel matters; legal topics such as rules of evidence, court testimony, and the content of the law; enforcement procedures; and a general overview of the Bureau's mission and functions. By learning of the problems and procedures of enforcement personnel, the trainee develops an appreciation of the agent's needs, and can thus serve the enforcement program more effectively.

To write a training program of this type, it was necessary to review and collate published information on the subject of the analysis of narcotics and other controlled substances. Many of the controlled substances have only been known as drugs of abuse for the past 3 to 5 years, and not much information has been published on their methods of analysis, identification, and physiological effects. As a consequence, much of the background material had to be written into the text of the lesson plan, in lieu of providing the trainee with published references. Descriptions of analytical procedures become less detailed after the first two or three lessons; by this time the fledgling chemist should be familiar with basic methodology. A standardized approach to drug analysis is generally discouraged; the trainee must learn early in his training that submitted exhibits seldom follow the rules, and that he must exercise considerable ingenuity. The training program functions to provide him with the tools.

Although an attempt is made to describe and assess the relative specificity of testing techniques, the trainee is almost immediately prodded into developing his own philosophy

TABLE 2—*Format and contents of a typical lesson plan.*

EXAMPLE: Lesson Plan 3—*LSD and the Tryptamines*

Reading Assignments[a]

1. *LSD 25: A Factual Account* (Bureau of Narcotics and Dangerous Drugs, Washington, D.C. 20537).
2. Louria, *The Drug Scene*, Chapters 7, 8.
3. Connors, *A Textbook of Pharmaceutical Analysis*, Chapter 11, pp. 231–247.
4. *Microgram*, Vol. 1, No. 2, pp. 4–6, 8–15; Vol. 1, No. 4, pp. 2–5, 9–12, 18–22, 25–27, 33.

[a] The reading assignments for each lesson are designed to expose the trainee to the social, physiological, legal aspects, and chemistry of the drugs covered.

General

A short passage describing the drugs covered, with definitions of some terms supplied (in the case of LSD and the Tryptamines, for example, the term *hallucinogen* is defined and explained).

Qualitative Identification

Procedures by which the drugs are identified are given here, along with a discussion of problems inherent in analysis. In the case of LSD, for example, the problems associated with identifying the substance at the low levels usually encountered are discussed. Screening tests are given, followed by definitive procedures (TLC solvent systems, GLC conditions, IR characteristics) and the relative strengths and weaknesses of each. In the case of LSD, the relationship of structure to optical activity is also discussed.

Quantitative Analysis

Procedures for and discussion of difficulties in quantitative analysis are given.

Legal Aspects

A discussion of legal controls on the drugs, along with penalty structures. A short history of the evolution of control statutes is also given.

Safety Procedures

Safety procedures and hazards in handling of drugs are discussed.

Laboratory Exercises

Training samples are provided the trainees, who are required to perform all tests suggested in the Lesson Plan, plus quantitative analysis. The evidence is presented to the trainee in the same manner in which it would be received if it were a regular exhibit, and reporting of results is done in accordance with established laboratory procedure.

Questions and Problems

Questions and problems designed to test the trainee's comprehension of the material covered are given here. The answers to the problems are usually discussed in a symposium-type format by the trainees and the individual designated to coordinate the training.

on depth of analysis—how much must he do to be able to "call it" and defend his findings in a court of law. The lesson dealing with expert testimony stresses repeatedly that the forensic chemist is an impartial witness, and must maintain objectivity in his work, that he is the last line of defense against a false accusation.

As each lesson plan was issued, comments and criticisms were solicited from each chief chemist. These comments were recorded and then used to assist in revising the lesson plans. Of most crucial importance, perhaps, were the comments concerning methodology—"This is how *we* do it." Since the program is designed to expose the trainee to all aspects of the state-of-the-art, incorporating this additional methodology strengthened the program considerably.

To date, eighteen chemists have successfully completed the training program. Reports from the chief chemists of the laboratories concerned indicate that these "graduates" have

fitted in well and are fully productive members of the staff. At the present time, 13 chemists throughout the laboratory system are being trained using this program.

Responsibility for training employees, however, falls with the laboratory's supervisory staff, and this program is not intended to detract from this responsibility. Trainees receive additional training during the training period in the form of ACS short courses, law enforcement seminars, and on-the-job participation in clandestine laboratory seizures under the direction of an experienced chemist. We consider it advisable, however, that longer periods of formal training at facilities outside the laboratory be deferred until the chemist has completed his formal basic training program.

Conclusion

Through the design and implementation of this training program, the Laboratory Division of BNDD believes that progress has been made in solving a vexing problem in laboratory management—that of converting a college trained but professionally inexperienced individual into a functional forensic chemist.

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