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# The Computer's Role in the Laboratories of the Drug Enforcement Administration

This year, the Drug Enforcement Administration (DEA) will analyze about 50,000 exhibits of drug evidence in its seven laboratories. This expensive process, using well-equipped laboratories and experts in drug analysis, necessitates maximum use of every dollar of tax monies spent.

To help make use of all of the data obtained, computer programs have been or are being planned. These programs range from simple compilations to the more complex and sophisticated System to Retrieve Information from Drug Evidence (STRIDE) and its teammate, the "Ballistics" program. Let us briefly describe DEA's use, or proposed use, of each of the programs.

## STRIDE

STRIDE's forerunner started on a yellow, but not yellowed, ledger sheet in 1967, when drug exhibits of one of the predecessor agencies, Bureau of Drug Abuse Control (BDAC), were analyzed by the U.S. Food and Drug Administration. BDAC and the Federal Bureau of Narcotics were reorganized in 1968 and the then new Bureau of Narcotics and Dangerous Drugs (BNDD) laboratories were opened in 1969. A manual weekly report of drugs analyzed and a monthly report of manpower expenditures were started. The latter was easy to use in the laboratories, but presented a horrendous task at headquarters, taking hours to figure ratios, percentages, and other limited statistics. As word got around about the weekly report, the small staff at headquarters received more and more requests for various compilations of the data. Complying with all requests became a physical impossibility.

By the time BNDD got its first computer in 1970, a roughly designed input document was ready. Several compromises had to be made, because (1) many of the chemists had had bad experiences in previous employment with the computer services and (2) the type of program we envisaged had not been previously used by any Federal law enforcement agency. With considerable effort and many ups and downs, the computer program began compilations, with limited special query

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capability batched by printouts, rather than by immediate retrieval. Despite the limitation that the only data were from exhibits submitted by our agents and by police officers, the output was found to be very useful to many officials.

Congress, for example, is always interested in data supporting statements about enforcement of drug laws. The laboratory data, in part, mirror the law enforcement effort against illicit drugs. These data can be shown for DEA by case, by geographical locale, and by drug, for example. Changes can thereby be shown from year to year, for example, for relative frequencies between drugs. From the data the total amount of any one drug that has been removed from the street can be shown and, for purchased drugs, their cost.

Given cost, quantity, and purity, a market index can be developed (which one of our econometricians did) as a sort of "Dow-Jones" of the illicit drug market—the cost per milligram of pure drug. (With LSD this is expressed in micrograms.) Now with this index and with city codes, changes in index for heroin can be noted for any given city for this week compared to last week, last month, or last year.

With this in mind, both domestic and foreign city codes are being included in our latest revision of STRIDE. Standard Metropolitan Statistical Areas (SMSA's) are being included to make our data usable with other statistical data (for example, demographic data).

As shown by Johnson and Gunn [*1*], and as Marshman and Gibbins [*2*] and Cheek et al [*3*] demonstrated previously, the drug user does not know what he has used. In 1971 16% of the drugs submitted to our laboratories by trained officers were not what they were suspected of being. Our unpublished study of computerized laboratory data for the fiscal year ending 30 June 1973 shows about the same percentage.

The DEA laboratories, as do others, analyze each exhibit to obtain optimal data for the time available. They not only determine the suspected drug but, when there are significant quantities of the substance, they determine its "purity." They also determine other substances that are present as additional active ingredients and the diluents, or "cutting" agents, in the descending order of predominance. Thus, there might be an exhibit of suspected methamphetamine found to be 8% heroin. It may also contain phenylpropanolamine, lactose, dextrose, and starch. All information of this kind is grist for the computer mill, and a potential gold mine for researchers and intelligence analysts.

For example, if one agrees that drugs must be described and measured before the drug abuse problem can be truly understood, consider the implications of this type of analysis on the problem of drug-related deaths. Over the years there have been numerous reports of overdoses but, as many authors have indicated [*4–16*], these may or may not be due to overdoses of heroin itself. To better determine what may have caused a drug-related death or injury, it is helpful to know what the drug packet contained both quantitatively and qualitatively, particularly if toxicology is negative. Only DEA laboratories use this depth of analysis on a national basis, with the results in computerized form.

Ours are law enforcement laboratories, teammates of the investigative officer and the intelligence analyst. By Federal regulations DEA has set up a National Narcotic Intelligence Office. The STRIDE data are very important data for the intelligence analyst. For example, what are the kinds and amounts of drugs in certain cities, and what are the trends and changes in time? What is going on elsewhere, at the same time, that might be related? When a half ton of heroin is seized in Marseille, what cities in the U.S.A. react, and how long does it take each to react? These are some of the

questions asked by the analyst, and these are some of the questions we hope to help answer with STRIDE. In many cases we already have.

Using data from the laboratory tapes (supported by other data), an extensive study of the heroin market in the United States has just been completed. The laboratory material was supported by independent data in showing the heroin profile for the country and the changes in it, by geographical region, over the past year. For example, using the computerized laboratory data, the drop in potency and the concurrent rise in price of "white" heroin on the Atlantic seaboard was documented. At the same time, the data showed a rapid geographic spread of "brown" heroin, with increasing numbers encountered in Eastern cities.

If this can be documented, then it follows that the same data can be used to predict. If a particular product appears in New York today, when can it be expected in Washington, D.C.? Or, if I put $x$ number of agents into this kind of operation, what effect will it have on the drug market in A, B, and C cities? These and many other questions should be answerable.

In addition, a DEA statistician has developed a model which will be tested shortly. Using the STRIDE data we hope to be able to determine a drug profile for all of the major cities in the United States. Also, if we can obtain the data base we want to be able to determine possible market distribution systems, using the analytical data resulting from each exhibit as a "fingerprint" of that exhibit. For instance, purity, other drugs present, and the order of predominance of the diluents would be examples of the loops and whorls of the drug fingerprint. Success of this venture is clouded, however, because there is no quality control in a clandestine laboratory making LSD tablets, nor is there in a heroin cutting operation. The results, therefore, may be too inconsistent to allow for the fine-tuned analysis needed.

Although DEA laboratories analyze many drug submissions each year, more data would make conclusions and predictions more accurate. To enlarge the data base, DEA expects to use state and local laboratories to supplement the DEA data. This possibility has been explored in recent years and, in January 1974, a meeting was held in Columbia, Md. to determine the possibilities. At the time of this writing (January 1974), recommendations of the participating laboratory directors are being compiled into a final report which will be presented to federal authorities for consideration. In a short time we hope to be using data from a few laboratories, and later will expand to additional laboratories.

STRIDE's greatest value, however, will be as an intelligence tool. Its companion, the ballistics program (based on tool-mark comparison), will also be an important tool to the intelligence officer.

## Ballistics Program

In general the ballistics[2] examination is a tool-mark comparison examination, plus a microchemical and macrochemical analysis. In other words, drug tablets have measurable size and shape. The tablets are scored, double-scored, or are not scored; the scores have depth, width, and angle; there are colors, often not the same color inside as outside; and there is a finite amount of certain drug or drugs present, as well as diluents and other excipients in a certain order of predominance. Finally, when the granulation is compressed under tremendous pressure between two punches in a die,

[2] The word "ballistics" is obviously a misnomer, as is "pillistics," another appellation of the program. For want of another name, "ballistics" seems to be the term adopted by popular usage.

every little scratch, every little minute defect in the faces of the punches will be shown in reverse on the surface of the tablet. Therefore, if all of these characteristics of an unknown tablet match those of one of the more than 7000 samples in the DEA Special Testing and Research Laboratory drug tablet reference library, our experts can attest to the fact.

This analysis obviously generates a considerable quantity of data. Over past years this, too, has run the evolution from yellow ledger sheets to a hand-compiled tabulation of paper. The clerical task alone forced us a few years ago to cease routine compilations on all sources of illicit tablets.

We have now computerized the program, in a first step toward a computer-assisted examination. Conceivably, years hence, some chemist in a crime laboratory or physician in a poison control center may be able to sit down at a split-screen cathode ray terminal (CRT). Using both the keyboard and a light pen, or similar device, he will be able to compare his unknown tablet on half of the screen with possible "hits" on the other half. If he gets a match the analysis would be expedited, and DEA would know of one more instance of a tablet from a particular source in a particular city.

At present there are almost 200 sets of tablet punches that have been actively producing illicit tablets in the past two years. There are about 70 that can be considered to be currently active, and most of those are producing LSD. The smuggled "mini-bennies," and their look-alike caffeine or ephedrine tablets, continue to cross the border by the millions, of course, and information on them is being computerized.

**Manpower Utilization Program**

If Congress adds 25, 50, or 1000 more criminal investigative agents to DEA, we can fairly accurately determine how many DEA forensic chemists and laboratory support people will be needed. If the geographical location or distribution of the agents is known, we can tell quite accurately whether or not a laboratory is needed and the size of its staff. From that, based on other modules [*17*], it is a simple matter to tell the size of the laboratory space needed, the amount of bench space, or the number and kinds of instruments.

These data are derived from information obtained from the forensic chemists on the time they spend daily on various tasks. This is input for the Manpower Utilization Program. The output is used for budget and planning decisions. This program, supplemented with data from STRIDE, provides a wealth of management information.

As with all such tools, it must be interpreted with caution. For example, the laboratory director in one laboratory can compare the average time of analysis of LSD tablets for a given period of time. Maybe the time for his laboratory, on the average, is far more than any of the other laboratories. This is a red flag alerting the director to search for the problem. He may find that his laboratory has been receiving LSD exhibits with an unusual formulation, making analysis difficult and resulting in the longer time period per exhibit. On the other hand, he may find that a new chemist needs additional instruction, or there may be another explanation.

Although of no secret to the laboratory director, it usually comes as a surprise to the non-law-enforcement budget officer when he or she learns that chemists do not spend all of their time making fuming test tubes of colored solutions turn from one color to another. In fact, according to our Manpower Utilization Program output, DEA chemists only spend about half of their time at the bench. They spend a lot of their time training other chemists or police officials; they go to court; they go to most of the

seizures of clandestine laboratories; and, of course, they take vacations and get sick. The program tells the Administration what a DEA forensic chemist is.

## Simple Compilations

### *Glossary*

"The Glossary of Terms in the Drug Culture" idea was first presented by an Illinois law enforcement official at an informal meeting of forensic scientists in 1969. The editor of *Microgram* was asked to publish the glossary, if the law enforcement agencies supplied the information. We agreed and the result was a small booklet, which rapidly went through an initial printing of 10,000 copies. Even though it was then out of date, a second printing was rapidly depleted. Requests still are received for copies, and the manual file of terms is frequently queried because of need to interpret street terms.

We have long needed to computerize the glossary. Lacking resources, at present, we are having an update typed on a magnetic tape Selectric® typewriter (MTST), which should allow for easier and faster revision for our own needs. Then, when resources are available, we will computerize the list, making for easier and more accurate alpha sorting, with cross-indexing.

### *Mailing Lists*

The *Microgram* mailing list contains, without doubt, the most complete list in existence of laboratories performing drug analyses for law enforcement agencies. Because of the sensitivity of some material, there are times when we need to mail only to state laboratories, or only to toxicologists, or to some other particular category. With the present resources and mailing system, such a task is impossible. To solve this, we plan to shift from the present system to a computerized system. That system, when properly coded, will permit us to mail to any of several selections.

### *Reference Standards*

Although DEA has a laboratory system coordinated at headquarters, each of our laboratories is administered by a laboratory director, and each laboratory has developed its own character based on the local drug problem. Consequently, each laboratory has developed its own library of drug reference standards reflecting its own past and present needs. It has frequently happened that one laboratory will be trying to obtain a drug compound from a commercial source, very likely with difficulty, only to find later that a sister laboratory had an ample supply.

To help each director know what is on hand in each of the laboratories, a simple computer listing of all drug reference standards, by laboratory, is now periodically updated, printed, and distributed to each of the DEA laboratories.

### *Libraries of Spectral Data*

Spectral data and libraries of other physical constants have long been a need in our laboratories and in the laboratories of state and local law enforcement agencies. Although we made our first attempt to start developing the libraries in 1967, we have not been able to proceed with this program as rapidly as we would like, although we

have been exploring and evaluating the problem. For now, we are using a small computer in the Special Testing and Research Laboratory where it is interfaced with the nuclear magnetic resonance (NMR) spectrometer, the mass spectrometer, and the gas chromatograph for data acquisition and interpretation. Also, one regional laboratory is evaluating the use of a dedicated computer with a gas chromatograph-mass spectrometer.

One of us (JWG) is a member of the Criminalistics Laboratory Information System (CLIS) committee of Project SEARCH. This committee, consisting of several of the leading forensic scientists in the United States, is exploring the needs of law enforcement laboratories in this area.

DEA will continue to explore this problem, but it is felt that Project SEARCH's CLIS committee is supplying manpower resources that DEA does not have. We will therefore await the SEARCH report with interest.

## Conclusion

We have tried to hint at where we were, and we have tried to describe where we are now in DEA. But what of tomorrow? Some important evidence is now ignored, but could be extremely important to a trained investigator. Fibers, packaging, material, handwriting, color comparisons, sealing materials, and methods—all, when coupled with the analysis of the accompanying drug, could be of vital importance. Research is ongoing, and two of our laboratories are using electrophoresis for color comparisons of drug dyes in illicit dosage forms (for example, white heroin dyed to make it appear brown). One chemist is studying packaging, which, even with the past crude examination methods, has shown a positive link between certain packaging methods and certain drug sources.

These examinations will provide more data to feed the computer, permitting it to use matrix analysis, set theory, and other mathematical and statistical methods to provide output for the administrator, the manager, the intelligence analyst, the pathologist, the sociologist, the physician, the investigator ad infinitum.

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