

It is noteworthy that in no case has the pharmaceutical industry shown any interest in industry-wide centralized efforts such as those in the petroleum industry. This may be attributable to the high level of competition and proprietary secrecy. Note, for example, that in no existing service is there a centralized searching facility. On the contrary, there is a definite preference to have a set of searching tools "in house," to be manipulated by company information personnel.

The design characteristics of the alerting services bear marked resemblances. In most, the chemical structure dominates the display mode, with a variety of index entry points. Those services which do not supply such a display output have employed the storage and speed of manipulation characteristics of computers to provide, through scope and rapidity of action, bodies of information not available through more conventional techniques, counterbalancing the lack of topological entries.

The cost of these alerting services is highly variable with a general trend to higher-priced services. The individual chemist is in a difficult position if he is without recourse to

a collective information source able to afford these rates. One may hope that future technological developments will allow for individual services at individual prices, and that industrial cooperation will help to pave the way for these as it has for collectives in the past.

LITERATURE CITED

- (1) Bohr, P. G., Owen, K. C., *J. Chem. Doc.*, **3**, 201 (1963).
- (2) Savitz, G. S., *Proc. Am. Doc. Inst.*, **1**, 89 (1964).
- (3) Garfield, E., *J. Chem. Doc.*, **3**, 97 (1963).
- (4) Luhn, H. P., "Keyword-in-Context Index for Technical Literature (KWIC Index)," IBM Advanced Systems Development Division, Yorktown Heights, N. Y., 1959.
- (5) Wightman, J. P., *J. Chem. Doc.*, **1** (3), 16 (1961).
- (6) Freeman, R. R., Dyson, G. M., *ibid.*, **3**, 16 (1963).
- (7) Rice, C. N., *ibid.*, **5**, 163 (1965).
- (8) Frome, J., Leibowitz, J., "A Punched Card System for Searching Steroid Compounds," U. S. Patent Office, R & D Rept. No. 7, PB-140670, 1957.
- (9) Dyson, G. M., Lynch, M. F., *J. Chem. Doc.*, **3**, 81 (1963).

The World Literature on Psychopharmacology*

ISAAC D. WELT**

Institute for Advancement of Medical Communication, Washington, D. C.

Received January 6, 1965

INTRODUCTION

A comprehensive retrospective search of the available pertinent literature for the origin of the term "psychopharmacology" disclosed it was first used in 1935 by Thorner (1) who discussed the psychopharmacology of sodium amylal.

Since that time, and particularly during the last decade, this area of research has developed rapidly. This activity has resulted in a large rapidly expanding literature. It is difficult to estimate the size of the total number of papers in this new field, but a figure of 20,000 does not seem to be excessive.

Despite the difficulty in defining adequately the term "psychopharmacology," many definitions have been attempted. A short, useful definition is the "effect of chemical substances upon normal and abnormal behavior." A more detailed description is that applied to the activities of the Psychopharmacology Service Center which was set up by Congress in 1956 within the National Institute of

Mental Health. The mission of this group was "to establish a special research program on the clinical effectiveness, liabilities, and basic mechanisms of action of the tranquilizers and other drugs used in psychiatric treatment."

Since we are dealing with behavior and the behavioral sciences, it is obvious that this subject-matter area is extremely broad. In fact, it is an excellent example of the interdisciplinary approach to research. Psychopharmacological agents are synthesized by the organic and medicinal chemist, studied and tested by the neurophysiologist, neuropharmacologist, and experimental psychologist, and evaluated clinically by the clinical psychologist and by the psychiatrist. Students of cultural anthropology, social and educational psychology, and even comparative religion are also involved. As a result, the pertinent literature is scattered widely among a diverse group of scholarly journals and other publications.

These substances have been and continue to be popular prescription items. Many drug firms have had to include the dissemination of psychopharmacological information among the major services of their technical information centers.

For the past three years, our group has been developing a detailed informative indexing system in this field, that is,

* Presented before the Division of Chemical Literature, 148th National Meeting of the American Chemical Society, Chicago, Ill., Sept. 2, 1964. Supported by Research Grant MH-05255 from the National Institute of Mental Health, National Institutes of Health, U. S. Public Health Service.

** The American University, Washington, D. C.

one which would not only "pin-point" those papers containing pertinent information, but which would, in many cases, substitute for the original papers, as has been done by the "Index-Handbook of Cardiovascular Agents." Our first efforts involved the identification of its major literature resources. With the cooperation of the Psychopharmacology Service Center, we were able to do so.

The present study may be of some benefit to designers of information systems in psychopharmacology since it provides some measure of the nature, size, language, and journal distribution, etc., of the available literature.

BOOKS

In addition to its multidisciplinary scope, there are other characteristics of the literature which make its acquisition rather difficult. One of these involves the use of monographs, symposia, and proceedings as one of the major vehicles for the dissemination of experimental and clinico-therapeutic information. These appear either sporadically or irregularly in a variety of formats. It is therefore frequently necessary to look through numerous announcements by book publishers in order to achieve a complete collection instead of relying upon subscriptions to journals which appear on a relatively regular basis.

A number of advanced textbooks have appeared which cover the field from a variety of different viewpoints. Among such publications, we have found the following most useful.

1. "Drugs and Behavior" edited by Uhr and Miller and published in 1960 (2). This volume by 63 contributors discusses such important areas as methodology and experimental design. Much of its value stems from the fact that it is the product of truly interdisciplinary research. Its authors represent every discipline pertinent to psychopharmacology.

2. "Einführung in die Pharmakopsychologie" by Lippert, published in 1959 (3), is an excellent introduction and contains a valuable bibliography of 1965 items from the pertinent world literature.

3. "Psychotropic Drugs" edited by Garattini and Ghetti and published in 1957 (4) is a good representative of the many symposium proceedings which are of great importance in the literature of this area. Most of the contributions are in English, and all the papers have English summaries.

4. "The Effect of Pharmacologic Agents on the Nervous System," edited by Braceland, published in 1959 (5), covers the proceedings of a meeting of the Association for Research in Nervous and Mental Disease held more than a year earlier. There are a number of good introductory chapters in this volume on the development of psychopharmacology in addition to those dealing with related areas such as neuropharmacology and neurochemistry.

5. "Psychopharmacology Frontiers," edited by Kline and published in 1959 (6) is based upon the Proceedings of the Psychopharmacology Symposium held during the Second International Congress of Psychiatry in Zurich, Switzerland in 1957. Nearly 100 participants report on recent progress in this field.

6. "Neuro-Psychopharmacology" containing the Proceedings of the First and Second International Congresses

of Neuro-Pharmacology, held in 1958 and 1960 and published in 1959 and 1961 (7, 8), presents the point of view of the neuropharmacologist. These volumes provide an excellent collection of basic work and emphasize the international scope of research upon drugs and behavior.

7. "Psychopharmacology. Problems in Evaluation," edited by Cole and Gerard (9), published in 1959, is the product of a conference on The Evaluation of Pharmacotherapy in Mental Illness held in 1956.

8. Conferences sponsored by the New York Academy of Sciences in 1956 resulted in publication of "Meprobamate and Other Agents Used in Mental Disturbances" (10) and "The Pharmacology of Psychotomimetic and Psychotherapeutic Drugs" (11), in 1957.

9. A more recent publication under the same auspices is entitled "Some Biological Aspects of Schizophrenic Behavior" (12) and appeared in 1962.

10. A 1962 monograph by Benson and Schiele, "Tranquillizing and Antidepressive Drugs," is a good introduction to psychotherapeutic drugs (13).

11. Another publication of interest resulted from a 1961 German symposium. Although originally published in a medical journal (14), it is available in a separate volume, "Neuropsychopharmakologie."

12. "Child Research in Psychopharmacology," (15) edited by Fisher and published in 1959, is another proceedings volume and is concerned with a more specialized aspect of the subject.

13. Valuable information appears in primarily psychiatric publications such as "Chemical Concepts of Psychosis" (16) and Volumes III and IV of "Recent Advances in Biological Psychiatry" (17). The transactions of the fourth research conference on "Chemotherapy in Psychiatry" (18) held under the auspices of the Veterans Administration between 1956 and 1960 and that of the fifth conference entitled "Cooperative Chemotherapy Studies in Psychiatry and Research Approaches to Mental Illness" (19) are good sources which may not be widely available.

14. This list cannot be complete without mentioning several short monographs dealing with specific agents such as LSD-25 or *d*-lysergic acid diethylamide (20, 21) and trifluoperazine (22, 23) or with Woolley's theory concerning the "Biochemical Bases of Psychoses" (24).

15. The practicing physician is represented by "Chemotherapy in Emotional Disorders" by Flach and Regan (25), published in 1960.

The preceding list is by no means complete or up-to-date. It does, however, illustrate the broad scope of the literature and the use of hard-bound volumes for the publication of research papers instead of the conventional journal. The medicinal chemist and chemical librarian must be made aware of the existence of these important literature resources. During the past five years, the situation has been greatly improved by a number of publications of the Psychopharmacology Service Center, such as its Bulletin (26), which have called attention to both regular and irregular publications of conferences, symposia, proceedings, and transactions.

As in other areas of pharmacology and the biomedical sciences in general, textbooks supplemented by the plethora of review publications such as the Annual Reviews, Advances, Recent Progress, etc., are necessary to an under-

standing of the literature, particularly for the chemist who must familiarize himself with the difficult and confusing terminology of psychiatry. Our work in standardizing the terminology was greatly facilitated by two specialized dictionaries, "A Comprehensive Dictionary of Psychological and Psychoanalytical Terms" (27) and "Psychiatric Dictionary" (28).

The nomenclature of psychopharmacological agents does not represent too much of a problem. Drug dictionaries and compendia are adequate to the task.

SECONDARY PUBLICATIONS

As in other areas of scientific research, particularly in active fields, there is no substitute for abstract and index publications. However, as psychopharmacology covers such a broad spectrum of subject matter, no one publication is adequate. Thus, *Chemical Abstracts* does not cover the clinical papers, while *Biological Abstracts* and the *Index Medicus* do not cover psychology comprehensively. The development of specialized abstracting and indexing services for psychopharmacology was therefore indicated.

The first large scale effort was that of the National Library of Medicine, resulting in the publication of "Psychopharmaca. A Bibliography of Psychopharmacology. 1952-1957," compiled by Caldwell, and published in 1958 (29). It covered some 2,500 papers published during the five-year period. It actually is an index with generic drug names as the main headings. Under each drug name, references are grouped under such subheadings as "Pharmacodynamics," "Therapeutic Use," and so on. This feature greatly enhances the value of the index and facilitates its use. There is also a drug index with adequate cross-references, which lists most of the earlier compounds, and an author index. Unfortunately, it was never updated. It is, nevertheless, a valuable key to earlier literature. Most retrospective searches in the field of behavioral drugs can be profitably begun with the use of this volume, for very little was published before 1952.

In 1961, Orr (30) published a study concerning the status of psychopharmacological literature. Among his conclusions is the following: "Scatter of papers of related subject matter among different journals is especially marked in psychopharmacology, and it is probable that many workers will not learn of papers pertinent to their work until some time after the papers appear in print—when they have been abstracted or indexed, when they have been cited in another paper, or when colleagues have called attention to them. The field of psychopharmacology appears to be less well served by the standard abstracting services than comparable areas of research."

That same year, *Psychopharmacology Abstracts*, a monthly abstract publication was inaugurated, with the financial support of the Psychopharmacology Service Center and distributed free of charge to interested and qualified investigators. Its coverage began with the literature published in 1961. During its first year, 2,835 abstracts were published, together with a monthly and annually cumulated index. In 1962, 3,230 abstracts appeared. At the present time, abstracts are being published under the auspices of the Mental Health Clearinghouse of the National Institute of Mental Health.

As mentioned earlier, the *Psychopharmacology Service Center Bulletin*, published at quarterly intervals between April 1959 and July 1963, is a good source of general information concerning the literature, various conferences and their proceedings, and miscellaneous articles on various aspects of the subjects, including results of screening programs (31) and special annotated bibliographies (32).

JOURNAL LITERATURE

The only extensive collection of reprints of papers in psychopharmacology available to us in 1961 was that of the Psychopharmacology Service Center. A careful examination of this collection demonstrated, at least to our group, the difficulties of establishing pertinence. Although we disagreed from time to time with the criteria used for deciding whether a particular item should or should not be included, this collection probably represents a good cross-section of what was being published during the years from 1955 to 1961. There is no way of knowing whether these figures can be extrapolated to the more recent literature, particularly since abstracts are included. In the collection 10,810 papers were published during the years 1955 to 1960 inclusive; 868 being published in 1955, 1,617 in 1956, 1,981 in 1957, 2,343 in 1958, 2,574 in 1959, and 1,427 in 1960. The figures for 1960 are incomplete.

An analysis of the language distribution of some 9,263 papers showed that a preponderance of them were in English. The results are expressed in both the numbers of papers as well as a percentage of the total.

	No. of papers	%		No. of papers	%
English	5,819	62.8	Italian	753	8.1
French	1,026	11.1	Russian	217	3.6
German	873	9.4	Spanish	153	1.6

The remaining 3.4% are distributed among such languages as Swedish, Czech, Polish, Danish, Portuguese, Dutch, Norwegian, Hungarian, Bulgarian, Serbo-croatian, Finnish, Hebrew, Rumanian, Chinese, Indonesian, and Slovenian, in that order. Although the Japanese literature is of significance, our figures (based on the collection of the Psychopharmacology Service Center) do not, unfortunately, reflect this fact.

582 journals were listed in descending order of the number of pertinent papers which they contained. Abstracts were included. This list shows that, despite the large scatter, a relatively small number of journals account for most of the pertinent papers in this field. Approximately 25% of the articles originated in the first ten journals, which were, in order, *American Journal of Psychiatry*, *Federation Proceedings*, *Diseases of the Nervous System*, *Annales Medico-Psychologiques*, *Journal of Pharmacology and Experimental Therapeutics*, *Journal of Mental Sciences*, *Archives internationales de pharmacodynamie*, *Journal of the American Medical Association*, *Journal of Nervous and Mental Diseases*, and *Encephale*.

The 2,835 abstracts published in the 1961 volume of *Psychopharmacological Abstracts* were similarly analyzed. Here, once more, the first ten journals accounted for 30% of the papers. Six of them were identical with those of the former list, that is, that compiled from papers published during 1956 to 1960.

LITERATURE CITED

- (1) Thorner, M. W., "The Psychopharmacology of Sodium Amytal," *J. Nervous Mental Disease*, **81**, 167 (1935).
- (2) Uhr, L., Miller, J. G., "Drugs and Behavior," John Wiley Sons, Inc., New York, N. Y., 1960, 676 pp.
- (3) Lippert, H., "Einführung in die Pharmakopsychologie," Verlag Hans Huber, Bern und Stuttgart, 1959, 254 pp.
- (4) Garratini, S., Ghetti, V., "Psychotropic Drugs," Elsevier Publishing Co., New York, N. Y., 1957, 606 pp.
- (5) Braceland, F., "The Effect of Pharmacologic Agents on the Nervous System," Williams and Wilkins Co., Baltimore, Md., 1959, 488 pp.; *J. Res. Publ. Assoc. Nervous Mental Disease*, **37** (1959).
- (6) Kline, N. S., "Psychopharmacology Frontiers," Little, Brown and Co., Boston, Mass., 1959, 523 pp.
- (7) Bradley, P. B., Deniker, P., Radouco-Thomas, C., "Neuro-Psychopharmacology," Vol. I, Elsevier Publishing Co., New York, N. Y., 1959, 727 pp.
- (8) Rothlin, E., "Neuro-Psychopharmacology," Vol. 2, Elsevier Publishing Co., New York, N. Y., 1961, 521 pp.
- (9) Cole, J. O., Gerard, R. W., "Psychopharmacology. Problems in Evaluation," Publication 583, National Academy of Sciences-National Research Council, Washington, D. C., 1959, 662 pp.
- (10) Berger, F. M., "Meprobamate and Other Agents Used in Mental Disturbances," *Ann. N. Y. Acad. Sci.*, **67** (10), 671-894 (1957).
- (11) Kety, S., "The Pharmacology of Psychotomimetic and Psychotherapeutic Drugs," *ibid.*, **66**(3), 417-480 (1957).
- (12) Sankar, D. V. S., "Some Biological Aspects of Schizophrenic Behavior," *ibid.*, **96** (1), 1-490 (1962).
- (13) Benson, W. M., Schiele, B. C., "Tranquilizing and Anti-depressive Drugs," Charles C. Thomas, Springfield, Ill., 1962, 89 pp.
- (14) "Neuropsychopharmakologie" *Med. Exp.*, **5** (3-5), 137-421 (1961); published separately by S. Karger, New York, N. Y., 1962.
- (15) Fisher, S., "Child Research in Psychopharmacology," Charles C. Thomas, Springfield, Ill., 1959, 216 pp.
- (16) Rinkel, M., Denber, H. C. B., "Chemical Concepts of Psychosis," McDowell, New York, N. Y., 1958, 485 pp.
- (17) Wortis, J., "Recent Advances in Biological Psychiatry," Vol. III and IV, Grune and Stratton, New York, N. Y., 1961, 1962.
- (18) "Chemotherapy in Psychiatry," Transactions of the First, Second, Third, Fourth, and Fifth Research Conferences, Veterans Administration, Dept. of Medicine and Surgery, Washington, D. C., 1956-1960.
- (19) "Cooperative Chemotherapy Studies in Psychiatry and Research Approaches to Mental Illness," Transactions of the Fifth Research Conference, Veterans Administration, Dept. of Medicine and Surgery, Washington, D. C., 1960.
- (20) Cholden, L., "Lysergic Acid Diethylamide and Mescaline in Experimental Psychiatry," Grune and Stratton, New York, N. Y., 1956, 85 pp.
- (21) Abramson, H. S., "The Use of LSD in Psychotherapy," Josiah Macy, Jr., Foundation, New York, N. Y., 1960, 304 pp.
- (22) "Trifluoperazine, Clinical and Pharmacological Aspects," Lea and Febiger, Philadelphia, Pa., 1958, 219 pp.
- (23) "Trifluoperazine. Further Clinical and Laboratory Studies," Lea and Febiger, Philadelphia, Pa., 1959, 191 pp.
- (24) Woolley, D. W., "The Biochemical Bases of Psychoses on the Serotonin Hypothesis about Mental Disease," John Wiley and Sons, Inc., New York, N. Y., 1962, 331 pp.
- (25) Flach, F. F., Regan, P. F., III, "Chemotherapy in Emotional Disorders," Blakiston Division, McGraw-Hill Book Co., Inc., New York, N. Y., 1960, 314 pp.
- (26) Psychopharmacology Service Center Bulletin, U. S. Dept. of Health, Education and Welfare, Public Health Service.
- (27) English, H. B., English, A. C., "A Comprehensive Dictionary of Psychological and Psychoanalytical Terms," Longmans, Green and Co., New York, N. Y., 1958, 594 pp.
- (28) Hinsie, L. E., Campbell, R. J., "Psychiatric Dictionary," 3rd Ed., Oxford University Press, New York, N. Y., 1960, 788 pp.
- (29) Caldwell, A. E., "Psychopharmaca. A Bibliography of Psychopharmacology. 1952-1957," Public Health Service Publication No. 581, Public Health Bibliography Series No. 19, U. S. Government Printing Office, Washington, D. C., 1958, 258 pp.
- (30) Orr, R. H., "The Metabolism of Information in Psychopharmacology," *Psychopharmacol. Serv. Center Bull.*, **1**, 4-6 (1961).
- (31) Usdin, E., Amai, R. L. S., "Psychotropic and Related Compounds," *ibid.*, **2**, 17-93 (1963).
- (32) Carr, C. J., Karel, C., "Metabolic Studies and Analytical Methods for Phenothiazine Derivatives of Psychopharmacologic Interest," *ibid.*, **2**, 71-106 (1963).