CHEMICAL PUBLICATIONS

THEIR NATURE AND USE

BY

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The late Dr. H. P. Talbot was Consulting Editor of the International Chemical Series from its inception in 1911 until his death in 1927.

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PREFACE

The records of known chemical facts, and the theoretical discussions involving them, even when limited to those recorded in the century and a half since the fundamental discoveries of Lavoisier, present an impressive collection as viewed in a fairly complete library of chemistry. To this existing collection there is added annually a constantly increasing volume of material. This chemical literature is the storehouse of the available published information of chemical science and chemical industry. Such a storehouse—the permanent memory of the chemist—can be opened only by those who have become acquainted with its contents. The successful searcher must have acquired the necessary technique—the knowledge of how and where to find desired information in the library.

The object of this book is threefold: first, to sketch briefly the general trend of events giving rise to and accompanying the development of chemical publications; second, to present an outline of the present sources of published chemical information, with a consideration of the general nature of each class and of typical examples in the various classes; and third, to suggest certain exercises indicating possible laboratory work for class use.

The material included constitutes the basis of an undergraduate course in chemical literature, the general aim of which is to present to the student some conception of the types of chemical information which are available, where they may be found, and how to locate and use them. It has seemed desirable to take up the types of publications, and the method of using them, as lectures and discussions in the class hour. This is done preferably in the library itself. It is obvious, of course, that lectures alone are insufficient to acquaint one with the content and arrangement of the material of chemical publications. The novice in such work must learn by contact with the publications. In order to give experience in this direction, study sheets or library problems have been designed to be used in

connection with certain sections of the book. An attempt has been made to arrange these sheets so that each student may be given an individual assignment without requiring an undue amount of effort and time on the part of the instructor. The sheets are prepared in blank form so that the assignment may be written in the proper place, leaving space for the student to record the information which he has found. Lists of typical assignments have been included.

The nomenclature adopted seems to the author to be that warranted by the usage designated in the standard dictionaries of the English language. This usage is somewhat at variance with that followed by certain writers, who have used the terms, in the course of the development of chemical literature, more or less loosely, and, in some cases, with a questionable degree of accuracy.

The author desires to express his indebtedness to various writers from whose works valuable facts and suggestions have been obtained. Among these publications may be mentioned the following: Sparks, "Chemical Literature and Its Use;" Eason, "Where to Seek for Scientific Facts;" Reid, "Introduction to Organic Research;" Mason, "The Literature of Chemistry;" Crane and Patterson, "The Literature of Chemistry;" and various articles which have appeared from time to time in the chemical journals. Valuable suggestions have been received from a number of the assistant editors of *Chemical Abstracts*, and from a number of other individuals. The Mellon Institute of Industrial Research and the Dow Chemical Company very kindly supplied photographs of their chemical libraries.

Any suggestion for the improvement of this book as a text for a course on chemical literature will be welcomed by the author.

M. G. MELLON.

LAFAYETTE, INDIANA.
September, 1928.

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CHAPTER I

INTRODUCTION AND GENERAL OUTLINE

> Very little advance in culture could be made, even by the greatest man of genius, if he were dependent for what knowledge he might acquire upon his own personal observations. Indeed, it might be said that exceptional mental ability involves a power to absorb the ideas of others, and even that the most original people are those who are able to borrow most freely.—*Libby.*

Someone has stated that information of a scientific nature can be obtained, in many cases at least, by one or more of the following procedures: first, by inquiring of the individual who knows; second, by performing the experimental investigations necessary to ascertain the desired facts; and third, by consulting the scientific literature where a record may be found of the published reports of others' work upon the subject in question.

While it may be taking the path of least resistance to resort to the first alternative, providing an individual possessing the information is available, and while it is frequently very desirable to obtain experimental facts first hand, there are many cases in which recourse to either one of these procedures is unnecessary or impracticable. In such instances, the chemist turns to the chemical library. The solubility curve for sodium chloride in water, for example, can probably be given by various individuals, or it may be determined with fair precision by rather simple means; but for ordinary purposes anyone requiring such data would consult solubility tables. It becomes a matter of utilizing recorded chemistry.

Before beginning a journey to some distant point, one usually gives at least passing consideration to the reason for his going

and to the means to be employed in reaching the desired destination. Similarly, before taking up the question of how to use the resources of a library, it seems desirable to give some attention to the kind of inquiries which one takes to such a place, and to the nature of the sources to be examined when one arrives. Since our concern is with chemistry and, therefore, chemical or technical libraries, we should have in mind the kind of questions which a chemist takes to the library. Having familiarized himself with the different sources of information relating to the several types of questions, the searcher is then in a position to make effective use of the material.

At this point, therefore, there is presented a classification of the types of questions for which the material in our various chemical publications may be expected to provide help in finding an answer. The outline proposed[1] is based upon a study of the questions and problems presented to the technological division of the public library in one of our largest cities, where, for eight or ten years, a record was kept of the more important inquiries submitted.

The individuals presenting these inquiries ranged in their chemical interest all the way from commercial research and consulting chemists to boys seeking directions for some chemical trick, or to women requiring popular presentations of subjects for meetings of their clubs. Considering their source, it is not surprising that the questions varied widely in character, just as the questioners varied in their chemical interests. One individual wanted something very specific, such as the spectral transmission curve for a 10 per cent aqueous solution of cupric nitrate; while another wanted to know "all about cement." Some wanted only a popular article or book, while others were satisfied with nothing less than the latest technical data.

An extended examination of the hundreds of questions included in this record—whether specific or general, popular or technical, limited or comprehensive in their nature—indicates that most of them may readily be grouped in rather well-defined divisions. The scheme which has been formulated for this purpose is given below. In it no particular significance is attached to the order in which the various divisions have been placed. There is included

[1] MELLON, *Special Libraries*, **17**: 275 (1926).

for each division a statement of the general nature of the inquiries belonging to it, together with several examples of typical questions.

Types of Questions

A. Specific.—Those in which the information desired relates to a single phase of chemical activity. The following phases are easily recognized:

1. *Bibliography.*—Partial or complete lists of references, with or without annotations:
   e.g. References on the corrosion of alloys by ammonia.
   The literature on hafnium.
   List of popular articles on gas warfare.
2. *History and Biography.*—Events in the life of an individual or in the development of an industry; the influences operating, and contributions made, during certain periods; the beginning and development of a theory or an industry:
   e.g. Contributions of the alchemists.
   Life of Berzelius.
   Development of the artificial silk industry.
3. *Existence, Occurrence, and Source.*—The location of raw material; its form; compounds which are known:
   e.g. Occurrence of barytes in Canada.
   Commercial source of bromine.
   Fluorine substitution products of methane.
4. *Composition.*—Natural materials and artificial products; specifications, and standards; formulas and workshop recipes:
   e.g. Formula for automobile lacquer.
   Composition of electrolyte for Edison battery.
   Analysis of Pluto mineral water.
5. *Methods of Production, Preparation, and Manipulation.*—Laboratory and commercial processes; details of procedure; materials required; apparatus employed:
   e.g. Manufacture of stainless steel.
   Preparation of mayonnaise.
   Diazotization of organic compounds.
6. *Properties.*—Physical and chemical (including physiological action); general and specific reactions:
   e.g. Effect of carbon dioxide on individuals in closed rooms.
   Specific heat of calcium chloride brine of sp. gr. 1.33.
   Action of charcoal as a purifying agent.
7. *Uses.*—Laboratory and industrial; general and special applications:
   e.g. Uses of sawdust.
   Industrial applications of silica gel.
   Employment of alkyl bromides in synthetic chemistry.

8. *Identification, Testing, and Analysis.*—Methods available; interpretation of results:
   e.g. Detection of pasteurized milk.
   Testing of road materials.
   Analysis of flue gas.
9. *Patents and Trade-marks.*—Date of expiration; details of specifications, objects previously protected:
   e.g. Details of process for making synthetic methanol.
   Specifications for production of ascarite.
   Date of expiration of patent on Edison cell.
10. *Statistical Data.*—Production, consumption, cost, supply, price, market:
   e.g. Production and supply of helium.
   Statistics on lamp-black industry.
   Foreign activities in sulfur industry.

B. General.—Those in which the information desired relates to more than one of the above mentioned classes. In this case we encounter two variations in the questions.

1. Those in which there is clear indication of the particular classes which are involved:
   e.g. Preparation, properties, and uses of artificial stone.
   Occurrence and composition of natural zeolites.
2. Those in which no such limitations are expressed or implied:
   e.g. Efflorescence on stone and brick.
   Hydraulic cements.

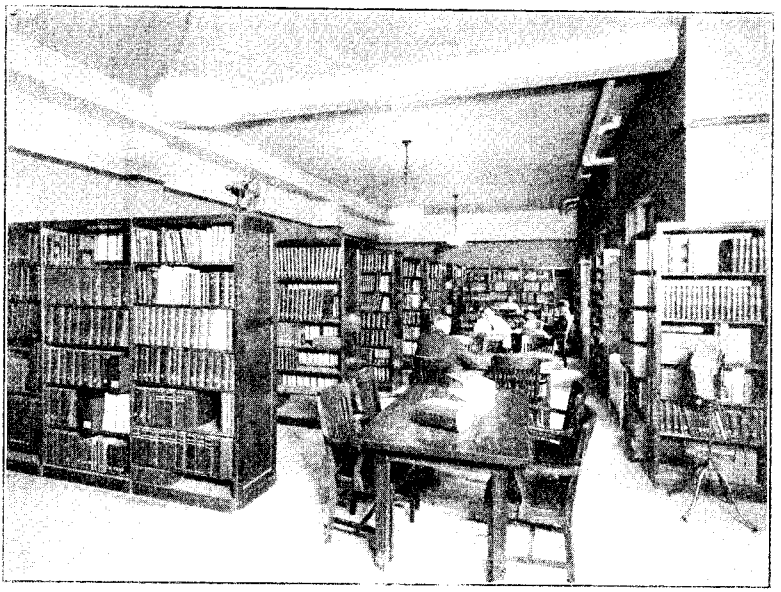
Having in mind the kind of questions a chemist takes to the library, we are next interested in the sources available likely to contain information of value for answering these questions. In considering this part of our problem, attention may be directed briefly, first of all, to the origin and development of those publications which have come commonly to be designated as the chemical literature, noting certain points regarding the state of knowledge and the conditions prevailing at the time the publications were issued. Such an examination furnishes some perspective for judging the comparative value of the records for present-day work.

The Origin and Development of Chemical Literature

We find ourselves today in the midst of a great volume of published material of chemical significance and importance. What was its origin? Why do we have it? Who was responsible for it? How did it reach its present form? These and simi-

tic questions probably do not often disturb the average chemist. They do have some interest, however, in spite of the fact that definite answers are not at once forthcoming.

Numerous works have been published dealing with the historical aspect of various phases of chemistry. Some have been devoted to the activities and contributions of a certain individual; some deal only with the origin, development, and significance of an idea or theory; some deal with special indus-



Chemical library of the Mellon Institute of Industrial Research, Pittsburgh, containing approximately 10,000 volumes, mostly from 1900 to date.

tries, with divisions of chemistry, or with countries; and some aim to present a more or less comprehensive view of the whole field. But, curiously, none seems to be available having as its primary aim the presentation of an account of the development of chemical publications as such.[1] In most works of a historical nature, at least occasional references are found to a considerable number of publications. But the aim, however, is usually not to call

[1] OSTWALD, "Handbuch der allgemeine Chemie," Vol. I, "Die chemische Literatur und die Organisation der Wissenschaft."

attention to the publication itself but rather to some individual's idea or contribution contained therein.

Even a superficial examination of the material that is available makes certain that it is a long story which recounts the course of man's development to the point of appreciating the significance of the modern scientific method and of applying it to a study of himself and of his environment. Even now, in the words of Millikan:

> Man himself is just . . . emerging from the jungle. It was only a few hundred years ago that he began to try to use the experimental and the objective method, to try to set aside all his prejudices and his preconceptions (as Hugh Black has said, to reject the idolatry of the traditional), to suspend his judgment until he had all the facts before him, to spare no pains to see first all sides of the situation and then to let his reason and his intelligence, instead of his passion and his prejudice, control his decisions. That is called the scientific method.

We now realize that, as a result of the combined contributions of many individuals, there has been acquired a powerful tool in the scientific method, and there has been accumulated an enormous collection of facts, recorded in many places and touching many phases of human activities. The greatest number of significant contributions have been made in the fields of knowledge encompassed by the natural sciences, in which chemistry occupies a commanding position. The written records of these developments include a multitude of facts, experimentally determined, together with discussions, interpretations and theories involving the facts. In our present effort, our interest centers on the *publications containing the accounts of the facts and theories*, rather than on the facts themselves, on the methods by which they were discovered or obtained, or on the ultimate effect of the theories developed to account for the facts.

When did man begin to apply to his ideas the test of experimental verification? The answer must remain uncertain. Perhaps it is even not significant. We are convinced, however, that the adoption of the experimental method marked a very important advance in the attainments of the human race; and we are partially aware of the marvelous material changes that have accompanied and grown out of its application in industrial and scientific research work.

What disposal the first enthusiastic workers made of the results obtained by this method we can only guess. It seems entirely probable that no organized work, as we now undertake it, was done, and that no written records were made, perhaps for centuries. One can imagine some individuals jealously guarding any new information, especially if they were alchemists, and the discovery seemed to offer hope of obtaining the long sought gold; others, perhaps, told their friends in the community. Writing letters to friends, describing the discoveries, must have taken place as a closely related development.

History does not show us by its records the rate of this development, but from them we do know the progress had been sufficient that Francis Bacon, about 1600, formulated a "program for establishing research as a means of regenerating learning in the service of humanity." This included the foundation of a College of Research whose function was to foster the New Philosophy (the experimental and scientific method), and the provision for the publication of such discoveries as were to be given to the world.

Although Bacon did not see his project actively undertaken, his work did produce noteworthy results. The trend of the times became directed more and more toward intelligent experimentation. His "New Atlantis" was intended to be the introduction of an imaginary picture of his college of research in practical operation. This production, according to H. G. Wells, may be considered as one of the ten books which have been most instrumental in shaping and directing human activities. Wells writes that it

> ". . . formulated the conception of a House of Science, incessantly inquiring and criticising and publishing, that should continually extend the boundaries of human knowledge; it replaced unorganized by organized scientific research, and did so much to insure the unending continuity of scientific inquiries; and it contains the essential ideas of the modern scientific process—the organized collection, publication and criticism of fact . . . Of the supreme importance of the book itself as the seed of the Royal Society and most European academies, there can be little dispute. Like the rod of Moses, it strikes the rock of human capacity, and thereafter the waters of knowledge flow freely and steadily.

The need of social contact among those devoted to such inquiries began to manifest itself. About fifteen years after Bacon's death a group of

. . . divers worthy persons inquisitive into Natural Philosophy and other parts of humane learning, and particularly what has been called the "New Philosophy" . . . began by agreement to meet weekly in London to treat and discourse of such affairs.[1]

Out of the efforts of this group, meeting for the purpose of discussing and sharing their intellectual interests, there was founded the Royal Society, already mentioned. Commenting on the significance of this event, Strachey states that:

If one were asked to choose a date for the beginning of the modern world, probably July 15, 1662, would be the best to fix upon. For on that day the Royal Society was founded, and the place of science in civilization became a definite and recognized thing. The sun had risen above the horizon; and yet, before that, there had been streaks of light in the sky. The great age of Newton was preceded by a curious twilight period—a period of gestation and preparation, confused, and only dimly conscious of the end toward which it was moving.

This organization—the Royal Society—stands first in at least two respects; it was the first society of its kind to survive, and it was the first also to publish the proceedings of its meetings.[2] This publication was first printed in 1664 as the *Philosophical Transactions* of the Royal Society, and it has had a continuous existence since that date. Even today one will find the first volume of these records interesting.

Of particular significance to chemists is the fact that Robert Boyle was one of the most active pioneer members. He

. . . refers to himself as a member of the Invisible College, composed originally of scientific men bound together as an esoteric sodality without name or meeting place and having for its sole end the alleviation of the physical and spiritual ills of humanity.[3]

The time when Boyle and his associates brought about the formation of the Royal Society may be taken as the date of the

[1] LIDDELL, *Science*, **60**: 25 (1924).

[2] "The Accademia del Cimento, founded at Florence, in 1657, . . . was the first scientific society of any importance . . . Although it lived but ten years, it enriched the world by leaving a volume of important records of experiments, chiefly in pneumatics."—*Mellor.*

[3] LIDDELL, *loc. cit.*

dawn of chemical literature as we now know it. A simple beginning it was, this first systematic recording of scientific papers and discussions, and the preservation of these contributions for posterity; but now the practice is so universal, and the contributions are so numerous, that one is amazed to find more than twelve hundred periodicals publishing information more or less closely related to the work of the individual engaged in chemical and related pursuits.

> Since 1665, when this first scientific journal put in its appearance there has been an accelerated increase in the number of journals of interest to the chemist, and the bulk of the accumulated material has become almost staggering in its proportions . . . The vastness of the chemical journal literature, its rapid and continuous advance upon the frontiers of our knowledge, and its essentially unorganized state, are . . . arguments why the chemist should see to it that he learns how best to make use of the means which have been provided to make this sea of information navigable.[1]

In 1650, then, we had no scientific journals. At present more than twelve hundred are regularly abstracted by *Chemical Abstracts*. Let us examine some of the intervening developments in chemical publications.

It has already been noted that several methods of communicating ideas were probably used during the centuries preceding the appearance of the *Philosophical Transactions* of the Royal Society. Following the inception of this initial serial publication, however, the practice of making a permanent record of individual's contributions started to spread. Gradually, various European academies came into existence, each founding, sooner or later, its own publication. The general condition of affairs during this period necessarily made progress slow. There was still much confusion in the ideas regarding chemical matters. Over a century had to elapse between the founding of the Royal Society and the work of Lavoisier. Following his discoveries, there appeared, in 1778, the first chemical journal, Crell's *Chemisches Journal*. Others followed some years later.

By 1820, the volume of the material appearing had reached a stage where it seemed desirable to collect and summarize the

[1] CRANE, *Ind. Eng. Chem.*, **14**: 901 (1922).