INFORMATION SOURCES FOR
RESEARCH AND DEVELOPMENT

THE USE OF BIOLOGICAL LITERATURE

SECOND EDITION

EDITED BY

R. T. BOTTLE

AND H. V. WYATT

THE USE OF BIOLOGICAL LITERATURE

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QUICK INDEX FOR INDEXING AND ABSTRACTING SERVICES

The major entry will be found on the page shown. For others see the full index.

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CHAPTER 1

INTRODUCTION

R. T. BOTTLE

The literature is used by biologists, but the printed word, however well illustrated, has never been their sole information source. Traditionally they have also used herbaria, zoos, films, collections of cultures, slides, more expert colleagues, etc., as information repositories. Recently, computer searchable tapes have become increasingly available for storing information so that individual workers can obtain that handful of pebbles from the beach which are hopefully of use to them. Although tape recorded news is not yet available for the bench biologist, cassettes called 'Chemical Executives Audionews', were introduced by the American Chemical Society in 1970 as a weekly service for the busy commuting executive in the chemical process industries. Although this book concentrates on printed forms of information, sections on these other forms have been included.

Biological information ranges from the near permanent to the transient, the former being typified by much taxonomic and morphological data and the latter by instrumentation and other techniques in the interdisciplinary areas. The interdisciplinary areas are those where research, and hence its artefact, literature, is growing the fastest and thus producing some of the more difficult information handling problems. (In 1969 the biochemical sections of *Chemical Abstracts* increased at 2·4 times the overall rate (ACS, 1970).) The major source of research funding in the life sciences is governmental and the US Government in particular. This funding is showing signs of levelling out after its recent increases. Surprisingly industrial support for basic research in the life sciences in the US has grown much faster than that for chemistry, doubling between 1961 and 1967, but even now amounts to only 5 per cent of Federally funded research (Fallwell, 1970). Nevertheless, it may well take up some of the slack which is being created by the more critical approach to government funding and the erosion of research capability by inflation. This may lead to a shift in academic research directions to the more applied areas of biological science. If this occurs, academic biologists will need to have more knowledge of the information sources such as patents, government publications, etc., which their colleagues in industry use from time to time. There is, however, no doubt that the increasingly competitive research situation will make the academic community feel more acutely a sense of urgency over getting information (which has long been felt by bioscientists in industry). They will need to learn what services are available and how to use them effectively. (If the potential users of information services are too ignorant to use them, then the vast sums of public money spent in their development will have been largely wasted—this is perhaps the fundamental problem in information work today.) With this in mind, OSTI appointed in 1969 several scientists to university libraries, to act as liaison officers on an experimental basis.

Just as one needs instruction in how to use a complex scientific instrument so one needs instruction in the use of biological literature. It is, if measured in terms of man-years taken to produce it, by far the most expensive tool available to the biologist, yet his use of it is often inefficient and ineffective. A thorough understanding of the literature is the key to its effective use—the editors hope that this book will help the new graduate to understand its structure and, through the exercises, to gain practice in its use. The need to train biologists in the use of the literature has been discussed by us elsewhere (Wyatt and Bottle, 1967) and we have also hoped that this book will stimulate more instruction, particularly to undergraduates. (Indeed a programmed learning guide for use in undergraduate biology courses has been developed based in part on our first edition (Kirk, 1969).) Somewhat more interest in these problems is being shown now than when the first edition appeared, especially in the US; for a general review of teaching science students to use their subject literature, see Bottle (1967).

The exponential growth in the volume of scientific literature and its associated problems have been discussed at the 'overkill level' in essays such as this ever since de Solla Price (1963) brought it to the attention of the scientific community. As well as volume, the cost of scientific literature, especially journals*, has risen disproportionately since our first edition. Individual research workers

* Statistics compiled by Blackwell's, Oxford, are normally quoted in the August issue of the *Library Association Record.* Other annual compilations appear in the *Bowker Annual*, etc. (The very low cost ($1 p.a.) of the *Journal of Irreproducible Results* (1955–) should not tempt librarians to increase their collection statistics by ordering it from P.O. Box 234, Chicago Heights, Ill. Although it is the official organ of the Society for Basic Irreproducible Research, the less than rigorous refereeing of the papers published will only prove a distraction to their scientist clients.)

no longer buy many of their own journals and are thus causing financial problems both for the libraries from which they demand them and for the publishers who, faced with increasing costs and static sales, are forced to raise their journal prices (One suspects that many of the still active, older researchers continue (tax-deductible) subscriptions started many years ago and that it is the younger scientist who no longer buys journals.) This trend has coincided with the increased use of xerography (whether or not it contravenes the Copyright Act); there are, of course, many other reasons, economic and social, which have contributed to this trend. The net result, however, is that increasing demands and costs are now creating a severe strain on most library budgets.

As was pointed out in a recent brochure of the Institute of Information Scientists, 'information is a curious commodity, it costs money, but doing without it often costs more'. It is also often forgotten that information, like food, is perishable if not stored properly. Two parameters, time and subject matter, determine which method of information storage is most useful in a particular case. The oldest information storage method is the comprehensive treatise or monograph in which material is collected from a closely defined field of knowledge over a long period. After condensing and processing, which may include a critical evaluation of the material, it may be retrieved from storage through the layout of the treatise. The alternative method in common use is to store the information piecemeal (as articles) as it arrives at the Abstracting Centre, the month's catch being broadly classified for current use. Specific information is retrieved from the store through the (preferably, cumulated) subject indexes. Recent information, however, must await its appearance in the subject index before it can be readily retrieved. Apart from the small (but often influential) amount of information which is transferred orally, abstractors and indexers are increasingly becoming communication brokers between the information generator and user.

Biological and medical information, like that of the social sciences, is not, in the main, a mass of numerical data which maintains its validity indefinitely and in this respect it differs markedly from much of the information on chemistry and physics. It is particularly important, therefore, that biological information should be utilised as widely as possible while it is still fresh. Unfortunately, alerting services have not been at all highly developed until recently and much still remains to be done.

A further complicating feature of the literature of biology and also of medicine is its immense popular interest and the vast mass of popular literature which has sprung up in response. Such literature is outside the scope of this book, but, nevertheless, it may sometimes contain items of interest to many biologists. One does not need a formal training to observe Nature and many valuable observations have been recorded outside the literature of science, often, in unpublished diaries. For his book, *The Fulmar* (Collins, 1952), the late James Fisher compiled a *Bibliography of the Fulmar*—deposited with the Society for the Bibliography of Natural History, London—which cites 2378 references and 575 personal communications. Fisher informed us that about 40 per cent of these were non-biological, i.e. not traceable through the *Zoological Record*, and that in certain ornithological fields the percentage could well be higher. The interested reader could profit by analysing the sources of material for books such as *The Fulmar*.

The biological literature is used in three main ways:

(*a*) To find a specific piece of information (this may involve merely quick reference to verify known specimens or physical data, or may involve a lengthy search of the whole store of biological information if a detailed survey of a particular field is required).

(*b*) For background information or reconnaissance reading. (This is the first requirement when one starts work in a new field and has to bridge the gap between what one already knows and what it is necessary to know in order to work profitably in that field.)

(*c*) To keep up to date and informed of new developments, usually in a relatively narrow field.

It is this last problem which causes some of the greatest difficulties in using the literature effectively. Because of the scatter of information on a given topic one cannot get access directly to all which is relevant and must rely on secondary services to collect material into manageable packages. If one relies exclusively on such services to supply one's literature needs, direct contact with the literature is lost, and so is the opportunity for serendipitous browsing and the well-known stimulation and generation of ideas which this provides. A good strategy is therefore to use the appropriate secondary service(s) in either printed form or as an SDI service, to save oneself time in finding one's easily definable and routine literature requirements. At least some of the time saved should then be spent in serendipitous browsing. One should also try to estimate just how much relevant literature one is *not* intercepting due to incomplete coverage, inadequate titling and indexing, etc. This concept is discussed at greater length by Bottle and Seeley (1970). Ways of keeping up to date are further discussed in Chapter 3 and details of the more general secondary services are given in Chapter 7 but some of the more specialist ones are dealt with in the specific subject chapters.

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CHAPTER 2

LIBRARIES AND THEIR USE

F. EARNSHAW

Keeping in touch with new developments in science is by no means the simple task that it was 50 years ago, when the whole body of scientific knowledge was much smaller and less specialised. It is clear that libraries will have to cope with a greatly increased output of printed material in the years to come. Ways of keeping up to date include correspondence with workers in the same field and attending scientific conferences, but will inevitably involve scanning the literature, and here the scientist must make use of library services. The use of a library is undoubtedly more complex than it was 50 years ago. The apparatus of bibliographical research is in some ways like the apparatus in a laboratory; it cannot be used efficiently without both instruction and practice. Casual browsing, although a potentially profitable method when there is no particular or immediate objective in mind, is dangerous and inefficient in other circumstances. The reader must learn how to use the catalogues, indexes, abstracts and bibliographies which are his guide to the literature of his subject, for only with their aid can he be sure that he has surveyed effectively the field in which he is interested, or that he has discovered the relevant literature in the library he is using.

Readers who wish to pursue the techniques involved in using libraries effectively, should consult the works listed at the end of this chapter.

Classification

There is no doubt that every scientist would find it most convenient if all books which he was ever likely to need, whatever their subject, were grouped together in one section of the library. Librarians have a great deal of sympathy with this point of view, but they know that the result would be chaos. The most effective arrangement of books is by subjects, but although this sounds simple, it is far from straightforward in practice; the subject classification of books is based on, but very different from, a classification of knowledge, for books are physical objects which, whatever their contents, can only occupy one place in a library. Many books, of course, do not fit neatly into one place in the classification schedules; for example, is a book on the physiology of reptiles to be placed with all other books on physiology in the section for 'Animal physiology', or is it to be placed with all other books on reptiles in the appropriate section of 'Animal taxonomy'? A physiologist would find the former method advantageous, but a student of all aspects of reptiles would undoubtedly prefer the latter. The linking of two subjects is a concept which can be expressed in some classification schemes, and it is possible where necessary to make entries in the library catalogue under both subjects, but the book can only occupy one place. The general principle on which the librarian works is to classify the book according to its main subject emphasis, putting it where it will be most useful, and to create an index (in the form of the library catalogue) which reveals the decisions made. In this connection the biologist must remember that a book entitled *Mathematics for Biologists* is likely to be considered as a book on mathematics, not on biology.

It is inevitable that any division of knowledge into 'subjects' is by and large an arbitrary one, since for the sake of consistency only one kind of grouping can be made.

It is increasingly difficult to keep classification schedules in pace with the development of knowledge. The rigid boundary between pure and applied science, which is still maintained in most schemes for the arrangement of books, has become particularly unrealistic. In some schemes, biology, botany and zoology are grouped together, but are inconveniently separated from agriculture and animal husbandry. New interdisciplinary subjects appear from time to time and are particularly difficult to place; radiation biology, molecular biology and mathematical biophysics are but three examples. Most classification schemes (the Universal Decimal Classification is a good example) have a system of regular amendment and revision by subject experts, which ensures that eventually provision is made for new subjects and new developments. In spite of this the schedules of many schemes have, for example, fallen behind modern taxonomy.

Bearing in mind that librarians, as shown above, are working with imperfect and out-of-date tools, let us now examine some of the more common classification schemes. Perhaps the most widely used system is the Dewey Decimal Classification which is found in most public libraries and in certain university and college libraries. In this scheme the whole field of human knowledge is divided into nine sections, denoted by arabic numerals 1 to 9, with a tenth section, denoted by the numeral 0, for general works. A three-figure minimum is used, as follows:

000	General Works	500	Pure science
100	Philosophy	600	Technology
200	Religion	700	The arts
300	Social sciences	800	Literature
400	Language	900	History

Sub-division of subjects is by the use of the decimal point after the third figure, giving nine further divisions at each stage (cf. Table 2·1). The classes of most interest to biologists are as follows:

500	Pure science	580	Botanical sciences
510	Mathematics	590	Zoological sciences
530	Physics	610	Medical sciences
540	Chemistry	630	Agriculture
550	Earth sciences	660	Chemical technology
560	Palaeontology	663	Drinks stimulants
570	Anthropological and biological sciences (including biochemistry)	664	Food technology

The scheme uses arabic numerals and in theory the classification numbers, based on the use of decimals, are capable of infinite expansion. In practice, the process of expansion, made necessary in some cases by the introduction of new subjects, leads to many long and unwieldy numbers. Moreover, the use of arabic numerals limits the number of main subject classes to ten, and is therefore directly responsible for some of the long numbers. This scheme was introduced in 1873, and as its main outlines have not been changed it is now out of line with contemporary thought and the distribution of current publishing activity. There is a distinct lack of space for some species in the zoological schedules; the same space is allowed for reptiles as for insects, although there are 850 000 species of the latter compared with 4000 of the former. In spite of its imperfections the scheme works, however, and many large libraries are so firmly wedded to it that to change to another scheme would be a huge undertaking.

An internationally standardised adaptation of the Dewey system is the Universal Decimal Classification, usually known by its initials as UDC. This scheme is popular in the USSR and is widely used in the UK and in many other countries in government, college and