Sources of information in the fields of animal production and animal health.

II. Secondary information, data bases and data banks

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Summary: The multiplication of sources of information in both zootechny and veterinary medicine is making it more difficult to keep abreast of the literature. In selecting or retrieving a reference to a review article, a book or a conference proceedings, the conventional manual system for bibliographical retrieval becomes inadequate when there are large numbers of documents.

For the last century the research worker or librarian has had access to abstract journals in the veterinary field which review new publications on a monthly or quarterly basis. The detailed description of each document, together with an abstract (as in the case of Veterinary Bulletin of CABI), makes it possible to obtain relevant references. However, the delay between publication of the primary publication and the appearance of a citation or abstract in an abstract journal has become incompatible with current research, where speed of publication is a crucial factor for success. This explains the growing use of lists of contents such as Current Contents (ISI) which cover the broad subjects of animal production and animal health.

Parallel to the publication of printed documents, bibliographical data bases are offering an increasing range and volume of services. Thanks to modern methods of data processing and transmission, a research worker can now, without leaving the laboratory, select, sort and view bibliographical references on-line, or order copies of references from a wide range of years and subjects. Examples are provided from five major bibliographical data bases to demonstrate their potential value in the fields of animal production and animal health.

For direct access to numerical or factual data there are now data banks in these fields. Their origin is much more recent than bibliographical data bases because they require more sophisticated processing logic. Nevertheless, their development is now well under way within different organisations of developed countries. Veterinary data banks are still for the future, and they will provide aids to decision making of increasing effectiveness for research workers, clinicians, diagnosticians and epidemiologists.

KEYWORDS: Animal production - Bibliographies - Computers - Data banks - Diagnosis - Epidemiology - Information services - Publications - Research - Veterinary medicine.

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Veterinary periodicals and books provide information which can be used directly, constituting primary sources of information, which were dealt with in Part I of this article (10). The same applies to statistical data and information contained in various yearbooks and encyclopaedias.

With the extraordinary multiplication of documentary sources in the world today, researchers are usually required to use information services which record the output and alert potential users.

Tools which provide such "secondary" information have been in existence for a long time in veterinary medicine, and the first to appear were bibliographical bulletins.

**BIBLIOGRAPHICAL BULLETINS AND ABSTRACT JOURNALS**

Historically, the first bibliographical bulletin was the German *Jahresbericht über die Leistungen auf dem Gebiete der Veterinärmedizin*, first published in 1881, which became *Jahresbericht Veterinärmedizin* until it ceased publication in 1943.

The organisation **CAB International** (formerly Commonwealth Agricultural Bureaux) started to publish *Veterinary Bulletin* in 1931 (as a successor to *Tropical Veterinary Bulletin*, 1912-1930), followed in 1933 by *Index Veterinarius*. There is no doubt that these publications are excellent reference tools in the veterinary field. The first publication is selective and contains informative abstracts, while the second is more comprehensive but provides title-only citations. They cover over 1,000 periodicals of veterinary interest, as well as non-periodical literature.

Two more bibliographical bulletins may be mentioned, though they are less well known for linguistic reasons:


In 1976, Gray (12) published an exhaustive list of English-language bibliographical bulletins, reprinted the same year in *Quarterly Bulletin of the International Association of Agricultural Librarians and Documentalists*, 21, 103-109. This list amply illustrates the two different approaches of veterinarians: those engaged in a chain of vertical production related to a certain species of animal, contrasted with those engaged in horizontal disciplines not confined to a given species of animal.

The former category requires access to publications such as *Apicultural Abstracts* (1950-), *Small Animal Abstracts* (1974-), *Poultry Abstracts* (1975-) and *Pig News & Information* (1980-).

The second category would use publications like *Helminthological Abstracts* (1932-), *Nutrition Abstracts & Reviews* (1931-), *Microbiology Abstracts* (1965-) or *Virology Abstracts* (1967-).

To this divergence of approach may be added the intrinsic division between vegetable and animal within veterinary medicine, with agronomy and production systems on the one hand, and human medicine and the fundamental biological sciences on the other.
These remarks help to explain why veterinarians are interested not only in veterinary journals but also in specialist journals related to their particular research field. Garfield (9) showed that many of the references cited by authors in veterinary journals come from non-veterinary journals such as *Nature, Proceedings of the Society for Experimental Biology & Medicine, Science, Journal of Biological Chemistry* and *Lancet*.

Consequently, there is a need for access to bibliographical bulletins from fields outside animal health and animal production, particularly medical, biological and agricultural publications. Such sources are given in Gray’s list of 1976, and they include the following:

**Medical sciences:**
- *Excerpta Medica* (1947-)
- *Index Medicus* (1941-) of the National Library of Medicine (NLM), USA

**Biology:**
- *Biological Abstracts* (1927-)
- *International Abstracts of Biological Sciences* (1954-)

**Agriculture:**
- *Bibliography of Agriculture* (1942-) of the National Agricultural Library, United States Department of Agriculture
- *Agrindex* (1975-) of FAO.

Gray’s list is still considered exemplary, but it is useful to add some other references:

*Tse-tse and Trypanosomiasis Information Quarterly* has been published since 1978 by *Tropical Diseases Research Institutes* (formerly the Centre for Overseas Pest Research (COPR)) in Great Britain and the *Institut d’Elevage et de Médecine Vétérinaire des Pays Tropicaux* (IEMVT) in France, with the support of FAO and WHO.

The *Centre de Documentation Scientifique et Technique* (CDST) of the French *Centre National de la Recherche Scientifique* (CNRS) publishes the following bibliographical bulletins of relevance to veterinary medicine:

*Sciences de la vie: biologie fondamentale et appliquée* (Life sciences: fundamental and applied biology)

*Sciences de la vie: sciences médicales* (Life sciences: medical sciences).

These two publications cover fundamental aspects of biology and medical sciences. The following should also be mentioned, although they are more restricted in scope:

T260: *Zoologie fondamentale et appliquée des invertébrés* (Fundamental and applied zoology of invertebrates)

T280: *Agronomie*

produced in collaboration with the *Institut National de la Recherche Agronomique* (INRA);
The Technical Institutes of France, which link together research and development, also publish bibliographical bulletins. The *Institut Technique de l'Elevage Bovin* (ITEB) has published a current-awareness bulletin on cattle breeding since 1968. The *Maison Nationale des Elevateurs* (MNE) has published a current-awareness bulletin (*Bulletin Signalétique de la MNE*) in collaboration with the *Institut Technique du Porc* and the *Institut Technique des Ovins et des Caprins* since 1972. This bulletin, concentrating on production and general pathology of ruminants and pigs, as well as on the processing of their products, involves the scanning of 410 titles, half of them in languages other than French. This documentation service can supply not only references to the literature but also primary information on microfiche which can be used for updating files (3). Recently all the bibliographical references of MNE have been incorporated into a bibliographical data base available on-line through the telematic service *Minitel*.

The need for this wide coverage in no way reflects on the quality of the services offered by the collection of bibliographical bulletins mentioned above (23).

Taking a sample of references from *Advances in Veterinary Science and Comparative Medicine*, *Annales de Recherche Vétérinaire* and *Deutsche Tierärztliche Wochenschrift*, Gray (11) found that 99.3% of them were cited by at least one of the following secondary journals: *Veterinary Bulletin*, *Landwirtschaftliches Zentralblatt* Abteilung 4 (now *Agroselekt* Reihe 4) and *Biological Abstracts*.

Inversely, this implies that exhaustive coverage provides access to multiple sources of secondary information. This point will be discussed further in connexion with bibliographical data bases.

The production of a bibliographical bulletin, particularly when it contains abstracts of the documents cited (journal articles, books, etc.) rather than just titles, inevitably creates a delay between publication and citation in the bulletin, and this delay can amount to six months. *Lists of contents* of journals have been developed to overcome this delay.

Within the animal health field, the list of contents used most often is *Current Contents* produced by the *Institute for Scientific Information* (ISI) of the USA.

The first series of *Current Contents* to contain articles relevant to animal health was *Chemical, Pharmacomedical and Life Sciences*, which commenced publication in 1958. This was subsequently subdivided into *Life Sciences; Clinical Practice*; and *Physical, Chemical and Earth Sciences*. A series entitled *Agricultural, Food and Veterinary Sciences* ran from 1970 to 1973, when it was replaced by *Agriculture, Biology and Environmental Sciences*. The contents of the last-named are drawn from over 1,000 journals and some 300 books, and it appears weekly. In the same category of documentary product is the *Productions animales* section of the French *Bulletin Signalétique*, produced by the *Centre National de la Recherche Zootechnique* of INRA, at Jouy-en-Josas. Each week this bulletin lists about 700 references, taken from 1,245 international scientific and technical journals. There is an alphabetical list of the journals scanned for each issue.
The progress made in information science and telecommunications in the 1970's has made it possible to have access from a distance to vast files of bibliographical information kept at large computer centres, by using software which facilitates retrospective searches of many thousands of references. This system was pioneered between 1963 and 1965 in the USA by the National Aeronautics and Space Administration (NASA) and the Defense Department, which developed scientific and technical data bases, which were subsequently marketed by private information services. It then became possible to search large numbers of references. This could not be done using the printed documentary aids without laborious manual compilation or mechanographic assistance. Information science thus considerably improved access to the literature and created the possibility of making searches on several criteria and across different disciplines. Interactive searching is done with the aid of a keyboard, a screen and a printer by following a precise strategy. The elements indexed are combined by using boolean logic with the operators "and", "or", "not"; the elements chosen may be keywords, authors' names, date of publication or any other searchable field in the bibliographical records.

A new intermediary developed, the central host, which makes the file of a database producer available to an end user searching from a remote terminal (Fig. 1).

The first hosts were in North America, but during the past 12 years there has been rapid development in the creation and implementation of bibliographical data bases in Europe, and in access to them by telecommunications networks, the first of which was Euronet (4).

In France there are now a dozen central hosts providing over 100 data banks (19). In Europe as a whole there are 30 data-base suppliers providing access to some 250 data bases. In the USA the oldest data-base supplier is Dialog Information Systems (formerly Lockheed Information Services) which makes no fewer than 250 data bases available.

A world catalogue of data bases, which is updated regularly, is EUSIDIC Data Base Guide, edited by Alex Tomberg and published by Learned Information, Oxford, UK. This work contains particulars of some 2,000 data bases.

Fortunately, not many of these data bases are relevant to animal production and animal health, but it is necessary to place the specialised services, such as those for veterinary medicine, in a general context. Whatever the subject field, information has become a primary product which is marketed commercially on a worldwide scale, with access provided by international telecommunications networks.

Bibliographical data bases originated as a by-product of the computerisation of the printed abstract journals, and the veterinary field was no exception. Publications such as Index Veterinarius, Veterinary Bulletin and other abstract journals of CAB International, published in Great Britain, were the basis for on-line files available from 1972.

SEACHING THE LITERATURE FROM A CENTRAL HOST: PRACTICAL ASPECTS

Before a search can be made, it is necessary to obtain a password from the host, which entails signing a contract. Various sorts of terminal are available, such as an
FIG. 1
Procedures for connecting to a host computer
(Dewèze, 1983)

electronic typewriter (provided with a serial interface), a purpose-made terminal with keyboard and screen, or one of the many microcomputers. Each sort has to be connected to the telephone line through a modem (modulator/demodulator), and special telephone numbers (requiring a password or a network user identity number) are provided for access to the telecommunications networks. National networks include Transpac in France, PSS in UK and Datex P in the Federal Republic of Ger-
many. They operate at two transmission speeds, 300 and 1,200 bauds (bytes per second). If a microcomputer or screen terminal is used, it is useful to have a printer for printing out the results of the search. For access to a network in another country (such as Tymnet and Telenet in the USA, or Euronet), it is necessary to have the access number of the network. This arrangement is shown diagrammatically in Fig. 2.

**Fig. 2**

Components in an interactive information system  
(Dewèze, 1983)

Components of the cost of an on-line search in France include the cost of telephone access to the national network (based on time spent), the cost of using an international network (based on time spent and volume of information received, independent of distance), which is payable to the central host, and royalties to the data-base producer (including the number of items printed out or ordered off-line).

The cost of using a given file varies considerably, e.g. from 10 to 146 Accounting Units an hour in the case of the Information Retrieval System of the European Space Agency (ESA-IRS), but the average is £40-60 (or 400-600 F) per hour.
There have been various studies of the different types of service and their cost, e.g. (15, 5). In general a computer search may be no cheaper than a manual search, but it is quicker and may have a better recall ratio, though it can be less precise. Certain types of search, involving a combination of a number of concepts, can be performed solely by computer. Simple searches may be done best by consulting printed indexes.

Financial analyses of the salary costs seem to show that the cost of on-line searches is greater than that of manual searches (8, 6).

VETERINARY BIBLIOGRAPHICAL DATA BASES

As mentioned above, the bibliographical data bases are derived from the printed bibliographical bulletins. This remains largely the case, but there are now numerous data bases which have no printed equivalent, and the total number of data bases currently available to science and commerce demonstrates this “explosion”. Our preceding remarks about the multidisciplinary needs of those engaged in animal production and veterinary medicine still apply, and it would be difficult to prepare an exhaustive list of all data bases which might contain relevant material.

There has been some comparison of data bases with regard to their coverage of the literature and the degree of users’ satisfaction. To date, the best in the veterinary field was that conducted under the auspices of the European Commission by Brodauf et al. (2). Veterinarians within the European Communities were invited to submit questions, which were then put to five main bibliographical data bases and, when appropriate, to some additional data bases. The results are summarised in Fig. 3.

It emerged quite clearly that to obtain exhaustive replies to the questions, more than one data base had to be consulted. Each data base supplied some references which were unique to itself. An examination of the specific files provided by CABI (Index Veterinarius, Animal Breeding Abstracts, Dairy Science Abstracts, Nutrition Abstracts & Reviews) showed that they did not supply all of the references judged relevant. Thus it was necessary to consult the principal medical, biological and multidisciplinary files, along with the veterinary ones, in order to obtain a satisfactory response.

Of the five bibliographical data bases already alluded to (CABI, BIOSIS, AGRICOLA, MEDLINE and PASCAL), it is recognized that the first four contain material of prime veterinary interest (20). Consequently, we shall refer to them only briefly below, while giving slightly more attention to PASCAL (in French and English), which is little known outside French-speaking countries; we also wish to mention VETDOC. More detailed examples of use may be found in the Appendix (pp. 19-24).

CABI Abstracts. This data base, which started in 1972, contains the references printed in 47 abstract journals. Its advantage is the excellent veterinary coverage provided by Veterinary Bulletin, Index Veterinarius, Animal Disease Occurrence and Small Animal Abstracts. Abstracts are provided for each file except Index Veterinarius. An irritating feature up to 1984 was the duplication of references appearing in more than one abstract journal, although this can be overcome by confining the search to just one subfile (17). Since 1984 there is only one record for each item of literature, even if it appears in more than one abstract journal. A controlled vocabulary is available to assist searching the veterinary subfiles. The cost of these files on-line is $55 per hour (from Dialog, USA) or 68 Accounting Units (from ESA-IRS, Italy);
(a) CAB (Commonwealth Agricultural Bureaux. References were mainly obtained from Index Veterinarius but were supplemented by references from Animal Breeding Abstracts, Dairy Science Abstracts, and Nutrition Abstracts and Reviews).

(b) CAIN (CAtaloging and INdexing System, National Agricultural Library, United States).

(c) MEDLARS (MEDical Literature Analysis and Retrieval System, National Library of Medicine; now known as Medline).

(d) PASCAL (Programme Appliqué à la Sélection et la Compilation Automatique de la Littérature, France).

(e) BIOSIS (BIOSciences, Information Service, Biological Abstract Previews, United States).

**FIG. 3**

*Overall performance of five main veterinary information retrieval systems*  
(Brodauf *et al.*, 1977)

The blocks above the horizontal line show those references which an information retrieval system produced which were produced by that information retrieval system only. Those below the line show references produced by two or more information retrieval systems. In both cases the number of relevant references is shown by shading.
they are also available from DIMDI, Cologne, Germany, and Bibliographic Retrieval Services (BRS), New York. The most recent (i.e. not yet published) records can be searched via CABI.

**AGRÍCOLA.** This originated in 1970 under the name CAIN, and it corresponds to the *Bibliography of Agriculture* of the National Agricultural Library of the US Department of Agriculture. A search can be made on broad subject categories, and on the words in the title (for there is no abstract and no controlled terms) (14). It includes all documents of the USDA, and is relatively cheap ($39 per hour from Dialog).

**MEDLINE** is subdivided by date into a number of files, the earliest of which is 1966-1974. Since 1971 it has indexed 3.5 million items drawn from 3,000 periodicals published throughout the world. Fifty-nine veterinary journals were in the 1986 list of journals scanned.

In order to research a subject, it is necessary to consult the controlled vocabulary *Medical Subject Headings* (issued annually) which contains many veterinary terms, listed in section C22 of the classified part, e.g. foot and mouth disease appears as C22.380. The veterinary coverage tends towards small rather than large animals. It is relatively inexpensive ($36 per hour from Dialog) and is available from various hosts.

**BIOSIS.** Since 1970 this data base has combined *Biological Abstracts* with *Biological Abstracts/Reports, Reviews and Meetings*. It covers the world literature on biology, biomedical research, including taxonomy, and some aspects of veterinary medicine. It does not cover clinical papers. In the veterinary field BIOSIS is strong in parasitology, public health, nutrition and toxicology. It covers some 9,000 periodicals. Indexing is done by concept codes, biosystematic codes and keywords. It costs about $84 (from Dialog) or 105 Accounting Units (from ESA-IRS) per hour.

**PASCAL.** This data base of the Centre de Documentation Scientifique et Technique of CNRS (France) was rearranged in 1984 into two files:

PASCAL M, an interdisciplinary data base with an annual intake of over 300,000 records from 4,000 international scientific and technical periodicals. Veterinary and medical sciences are covered from the aspect of fundamental and applied biology.

PASCAL S comprises specialised data bases created in collaboration with specialist organisations. The files of greatest interest to the veterinary sector are those already mentioned, to which may be added:

T235 *Tropical Medicine*; T53 *Anatomy*.

These data bases are available on-line at a cost of 400 F or (through ESA-IRS) 62 Accounting Units per hour.

**AGRIS.** Initiated in 1974 by FAO, this data base receives input from an international network of agricultural information centres. Each participating country contributes the literature of its own country, and has access to the whole data base. It uses software similar to that developed for the International Atomic Energy Agency (Vienna). 117 national centres and 14 regional organisations participate in AGRIS (7). This system and its worldwide network have an impact beyond that of a documentation service. It is an essential tool for providing information to developing countries, and acts as a stimulus to countries to set up their own system for agricultural
documentation (18). After the first ten years there are already over a million references available on-line. It was at first indexed by subject categories, but in 1985 the system was changed to using keywords from a multilingual agricultural thesaurus, AGROVOC. This multilingual approach is a valuable asset in comparison with other, monolingual services. It is capable of supplying references relevant to animal production and animal health, and can be of value for retrospective searches in the field of veterinary medicine. If accessed through ESA-IRS it costs 57 Accounting Units per hour; it is also available from DIMDI and direct from Vienna.

VETDOC. This is produced by Derwent Publications Ltd. (UK) and specialises in pharmaceutical products. It was included in the European Commission veterinary survey of 1972-74 (1). It provides good coverage of publications from the pharmaceutical industry, and is reasonably up-to-date (21).

DATA BANKS

DEFINITIONS

Whereas data bases provide only secondary information, data banks provide a direct approach to information, supplying the user with the facts or data required. In the field of animal health, this information may be factual (diagnostic procedures, drug composition, names of bacteria, etc.) or numerical (number of animals, of outbreaks of disease, prices of drugs, normal values for blood composition, etc.).

CONCEPTION

About 15 years have elapsed since conditions became ripe for the creation of veterinary data banks, and the initial enthusiasm and optimism have given way to critical analysis (13). In fact, the methods of data processing available, and the choice of hardware and software, have not always met the initial expectations.

In the field of animal production and animal health, various problems were at first underestimated and must now be overcome in order to provide reliable data:

- the diversity of methods for selecting samples of animal populations and for taking samples for testing;
- the heterogeneity of materials and testing techniques, coupled with an absence of reference values or standard units;
- variation in the interpretation of events and the use of descriptors which may be too general or redundant.

On the last point, there have been some attempts at standardisation by national organisations (e.g. SNOVET Code of Nomenclature of the American Veterinary Medical Association) and international organisations (AGROVOC thesaurus of FAO, Veterinary Multilingual Thesaurus of the European Commission, Multilingual Thesaurus of the Network of Feed Information Centres).

INTERPRETATION

Apart from the difficulties of collecting and recording data, it is necessary to verify their coherence and the quality of the data processing. In practice, the analyst has to examine relationships of causality within the field of animal health, as demonstrated by the following (13):
- A given symptom may be produced by different causes. Example: ruminal atony.

- The same pathogen can produce different symptoms or even different diseases. Example: IBR/IPV herpesvirus.

- The isolation of a pathogen or the finding of a certain biochemical value does not always imply the existence of a disease. Example: the carriage of *Salmonella dublin* by cattle.

- A description of symptoms does not constitute a diagnosis. Examples: diarrhoea and abortion.

Such considerations are particularly important for the investigation of multifactorial diseases. For these reasons, any scheme for forming a data bank has to be examined carefully for technical and human factors which affect the generation and utilisation of data.

**THE PRINCIPAL VETERINARY DATA BANKS**

Following a symposium organised by the Veterinary Services of the United States Department of Agriculture in Washington in 1978, an international survey was launched to establish a catalogue of existing data banks throughout the world (22). This resulted in the publication in 1982 of an *International Directory of Animal Health and Disease Data Banks* by the National Agricultural Library (25). Particulars were received for about 80 data banks in 20 countries, classified as follows:

- epidemiological data banks: 30
- data banks of clinical and laboratory data: 38
- data banks on research projects: 9.

Since then, computer hardware and software have become very much cheaper, the memory available in computers has increased enormously, and special systems have become available for data-base management and more and more powerful “expert systems”. This progress has encouraged the launching of new data bases, and increased access to them by users as a consequence of the new possibilities for decentralisation and interconnection of files. Ever more aspects of animal health are being covered by data banks, such as multifactorial diseases in the various farm animals, reproductive diseases, toxicology, hereditary diseases, diseases of economic importance (e.g. *Animal Disease Occurrence* of CABI), etc.

The objectives set by the data bank producers vary:

- data banks for a large circle of users, such as practising veterinarians and farm managers or breeders;

- data banks for a closed circle of professionals, who use the information for decision-making: epidemiologists, geneticists, economists, research workers, marketing managers, etc.

Few of these data banks are distributed by central hosts in the same way as bibliographical data bases, because they require a different processing logic. Despite the modest development of veterinary data banks on the national and international scale,
their technical and economic impact will increase progressively in developed coun-
tries as a consequence of the richness of their information, their superior reliability
in the medium term, the enormous saving in the time required for problem solving,
and their value in forecasting future events.

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REFERENCES

(See p. 24)