

## Internal Processing of External Reference Services\*

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**The problem of selection of outside services to supplement the efforts of local personnel involves considerations of journal and patent coverage, promptness, quality of indexing, adequacy of abstracting, pertinence of article selection, and cost. A preprocessor which converts RINGDOC "Codeless Scanning" data on magnetic tape to a form acceptable to a direct access computer storage and retrieval system, called INQUIRE, and the use of the INQUIRE system as compared to several stages of an older system is described.**

Users of industrial information centers have access to two general classes of reference services: those prepared by local information center personnel (either as a general self-help device or a custom job, done especially for a specific user to meet a specific need) and those prepared by outside service organizations and acquired by the local information center for its users.

Thirty-five years ago the outside services were mostly within very general fields, such as chemistry, biology, and medicine. In the last 10–15 years, the outside services have become much more specific, and, with the greater use of computer techniques, reference service to specific subjects has become readily available.

The cost of scientific staff personnel and the cost of covering the greatly increased volume of published literature has required industrial information centers to seek means for sharing costs with other organizations, thereby providing an opportunity for the development of commercial information services. Without violating FTC regulations, such services perform cost-sharing for companies that could not legally cooperate directly. The pharmaceutical and the chemical industries, particularly because of their unique and extensive information needs, have provided opportunities for a prolific development and rapid growth of outside services covering the subject matter of interest to these users.

The major problem in the efficient utilization of these outside services, as a supplement to the efforts of in-house personnel of industrial information centers, is to identify those services that have the best combination of journal coverage, appropriate price, prompt delivery, adequate backlog of stored data, and appropriate machine-handling characteristics. No single service gives complete coverage of the information requirements of any one organization. A second problem involves the conversion of computer tapes to a common data base for operation on local equipment.

### OUTSIDE SERVICES

Since the more conventional commercial reference aids have been described in other papers of this symposium, we shall describe here some specialized in-house computer-based user services and the development of a computer program to efficiently convert an outside service data base into an in-house data base.

The Squibb Science Information Department subscribes to a number of services that furnish a data base on magnetic tape. No one of these services is in itself adequate to furnish full coverage of our needed information. Each is deficient either in depth of indexing or in journal coverage. These deficiencies are complicated by a large overlap in journal coverage. To further complicate the situation, no service has tape formats and available search programs compatible with those of any other, thus limiting the data processing and burdening the user by requiring him to purge the duplicates manually from the search results, an operation that would be done automatically if the data bases were compatible and could be merged and searched by a single program.

Two approaches to the solution of these problems have been taken. The first was to supplement the outside services by an in-house, in-depth literature indexing service. The second was the development of a program to convert a commercial data base to a format compatible with an in-house prototype of a Common Data Base. This latter action still leaves unsolved the problems of computer conversion of the indexing terms to compatible indexing concepts, computer identification and matching of citations in noncompatible formats, and variable composition.

### IN-HOUSE SERVICES

Some type of in-house scientific journal literature service has long been traditional at Squibb, as it has in most other pharmaceutical and chemical companies. When it began in 1928, this service consisted of abstracts of the current literature, printed by mimeograph and bound into a booklet that was issued monthly or bimonthly. This abstract publication entitled "Squibb Abstract Bulletin"

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was distributed to various departments in Squibb and to a number of subscribers outside of the company. The second output of this operation was a cumulative index file on  $3 \times 5$  cards, each with an abstract and complete citation. These cards were filed under subject headings and used for answering information questions, for more extensive literature searches, and for constructing demand and maintenance bibliographies.

The continuous production of the "Squibb Abstract Bulletin" and the index depended on the relative affluence of the Library budget. Budget economies, well known to all who have worked in profit-making institutions, forced abandonment of in-house produced abstracts and the development of labor-saving processing methods. An early step in that direction was the use of a Friden Flexowriter for automatically typing duplicate cards, each with its proper subject heading, from a paper tape produced by the keyboarding of the initial card image. An alerting bulletin was automatically typed from the same tapes.

This system was refined by utilizing a modified version of the CHY computer program, developed at Yale Medical School Library by F. G. Kilgour [Library Catalogue Production on Small Computers, *Am. Documentation* 7 (3), 124-31 (1966)] for the production of  $3 \times 5$  library catalog cards, to automatically type cards on the IBM 870 Document Writer in upper- and lower-case characters. Single-card image input resulted in a decklet of  $3 \times 5$  cards, each with its proper subject heading. In the final stage of refinement of this mechanized system, these cards were produced directly on the IBM 1403 chain printer at about 600 lines per minute by the use of an 80-character chain, also giving upper- and lower-case characters.

The cards were filed in three Diebold super elevator files, each holding approximately 250,000 cards. Individual cards with the desired references were removed from the file and included in bibliographies by typing or, in rush searches, by Xeroxing the individual cards on  $8\frac{1}{2} \times 11$  paper.

This same single-card image input provided an alerting bulletin with broad classification headings. This publication was called "Squibb-Products, Current References."

Selective dissemination was still a considerable chore. Extra cards were produced by the computer and were sent to various staff members. The success of this operation depended on the indexer's knowledge of the interests of the various users. By its very nature, this service had to be limited to relatively few profilees with highly important, easily identified requirements. These SDI profile services tended to run only for a short time and were continued only if there was active feedback. The profiles, furthermore, had to be broad in character, easily identified, and not intricate or dependent on a deep understanding of a profilee's interests or requirements.

Under the impetus of the establishment of new computer hardware (IBM 360), it became necessary to either rewrite the CHY system or develop a new system more adequate to our needs. The high cost of operation of the card index system (all the cards need to be refilled after each use) and the excessive floor space requirement of the Diebold files, suggested the development of a book-form index, with multiple copies available to literature searchers and other users. We proposed that the system should have the capability of storing and retrieving bibliographic

and numerical data values, so that it could be used for internal research records, as well as for literature documentation.

After a careful re-evaluation of the current and future needs for scientific information systems at Squibb the development of a generalized information-processing system was determined to be essential.

Specifications were developed and estimates of in-house development costs were prepared. Next, a survey of available software packages was carried out. A number of these packages were compared with the prepared system specifications. The INQUIRE software package, marketed by Infodata Systems, Inc., of Rochester, N. Y., and Washington, D. C., met most of the specifications, was chosen for a full-scale evaluation in April 1969, and purchased three months later.

INQUIRE is a direct-access based information retrieval/data management software package written in PL/1 and available for use on IBM 360/40 and higher models operating under OS. It provides the four basic functions of a generalized information system:

- Locating and retrieving specific items for any size file using simple English language command statements.
- Organizing and formatting reports containing the retrieved information (including computation).
- File maintenance.
- Administrative control.

INQUIRE is composed of three subsystems:

- Loader System:
  - Input Data Editing
  - Initial File Creation
  - Bulk Additions to Files
- Command System:
  - Information Retrieval
  - Report Generation
  - File Maintenance
  - Administrative Control

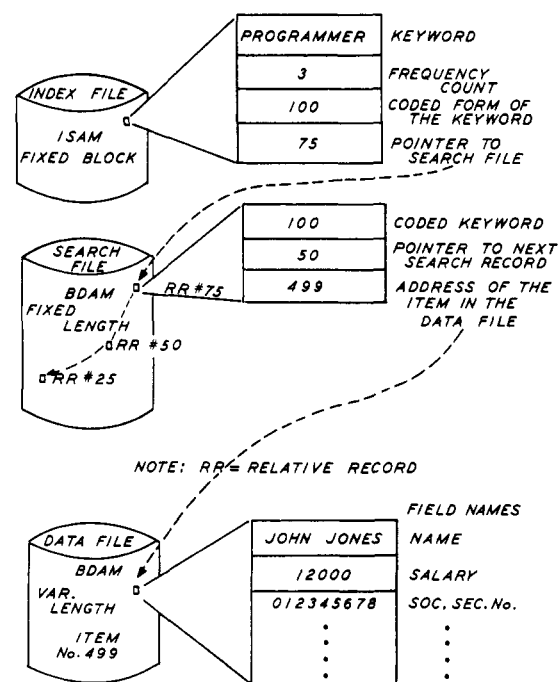


Figure 1. Diagram of INQUIRE file organization

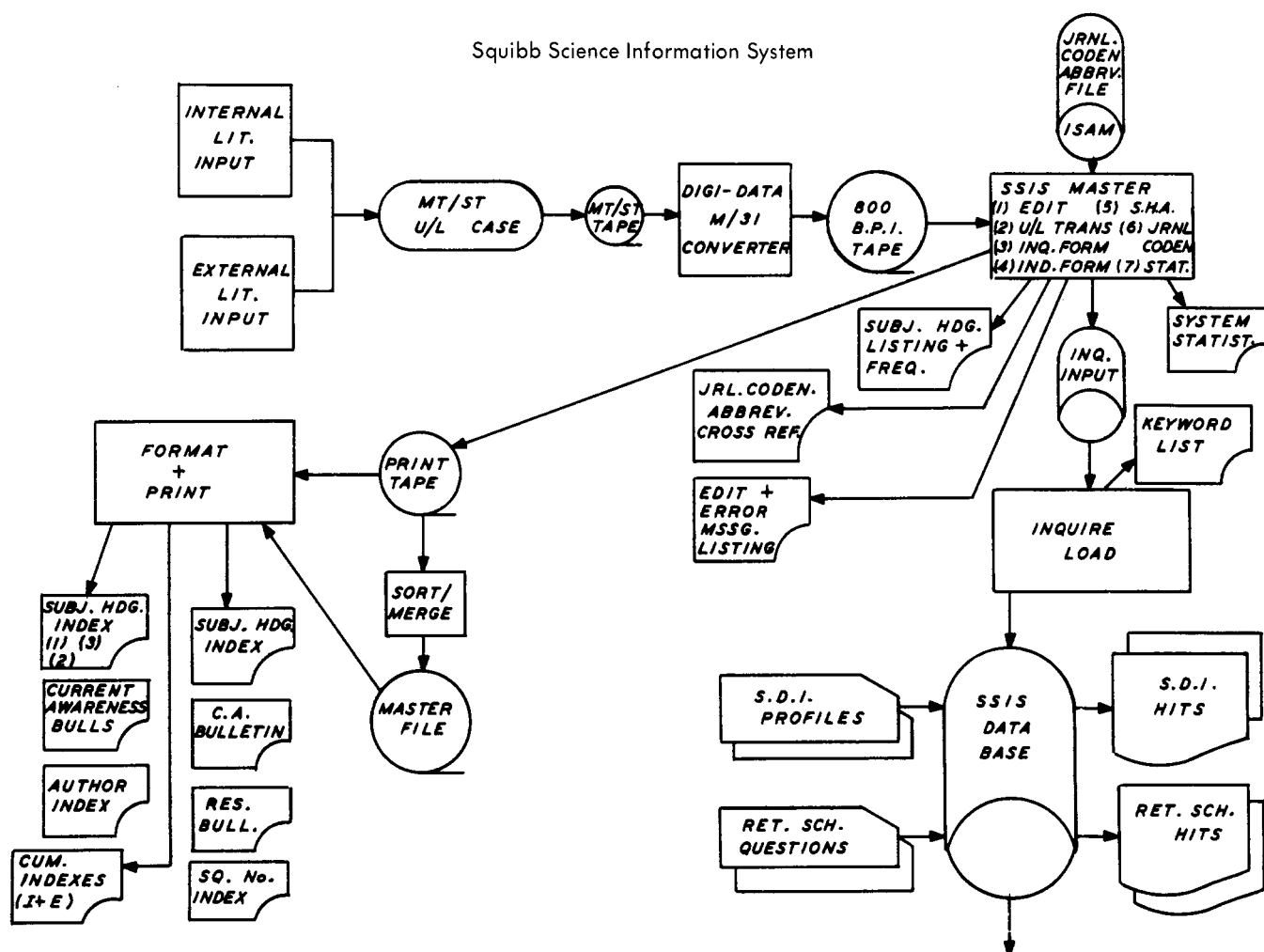


Figure 2. Simplified SSIS flow chart

Utility System: File Maintenance  
File Reorganization/Reloading  
Index File Printing

INQUIRE uses a multifile "chaining" or "threaded list" structure that allows very efficient searching of large files. The retrieval times for complex Boolean queries against a file of 45,000 records, containing about 27 million characters, are just a few seconds.

After its initial access into the data base via keywords, INQUIRE operates by means of search file pointers until it is ready to access the master file for text searching, field value comparisons, or master record printout. There is no reversal of the movement of disc access arms during query processing, which greatly enhances system performance.

A diagram of INQUIRE's file organization and structure is given in Figure 1.

The unique, highly valuable feature of the INQUIRE system is that it can operate as the central software package for a large variety of applications and specialized files. Preprocessing programs can be written to reformat the data from the desired source for loading into INQUIRE and at the same time may produce output for publication of alerting bulletins or indexes, etc.

Two such applications are described: Squibb-indexed journal literature citations and indexing previously stored on 3 × 5 cards produced by the CHY program and the Derwent RINGDOC and VETDOC "Codeless Scanning" data base received on magnetic tape in unformatted, variable length records and in somewhat variable sequence.

#### SQUIBB-INDEXED PUBLISHED ARTICLES APPLICATION OF INQUIRE

Articles on Squibb drugs detected either by scanning journals or tables of contents, or from alerting services, are indexed. Figure 2 is a simplified system flow chart of SSIS (Squibb Science Information System). The indexing and the citation is keyboarded on the IBM Magnetic Tape Selectric Typewriter (MT/ST). The resulting 100-foot magnetic tape is corrected after the hard copy has been proofread by the indexer and checked by the indexing editor. The corrected MT/ST tape is passed through a code converter (DIGI-DATA) and loaded onto computer tape.

The recoded records on computer tape from a number of MT/ST cartridges are read into the computer and handled by preprocessor software to produce the following sequence of outputs:

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## PAPERS ON SQUIBB DRUGS

11/09/70

### CINANSERIN

Cummings P.J., Calabresi P.  
Quantitative measurement of the cellular and humoral  
immunosuppressive effects of cinanserin.  
CLIN. RES. 17(2): 352 (1969)  
RINGDOC 34396J  
E000000366

### CLIOQUINOL

Agrop G., Dahlquist I., Pregert S., Rorsman H.  
Value of history and testing in suspected contact  
dermatitis  
ARCH. DERMATOL. 101(2): 212-215 (Feb 1970)  
E000000441

Lamberg S.I.

Symptomatic pitted keratolysis.  
ARCH. DERMATOL. 100(1): 10-11 (1969)  
RINGDOC 30055J  
E000000234

Stoughton R.B.

Bioassay of antimicrobials. A method for measuring  
penetration  
ARCH. DERMATOL. 101(2): 160-166 (Feb 1970)  
E000000436

### CLOXACILLIN

Buening H., Palitzsch D.  
What effect has antibiotic therapy on neonatal  
mortality?  
ARCH. KINDERHEILK. 179(2): 125-133 (1969)  
ger  
RINGDOC 28175J  
E000000349

### CYANOCOBALAMIN

Moser H.-J., Beard H.E.J.  
Comparative aspects of folate and vitamin B12-metabolism  
in man and other primates.  
SCHWEIZ. MED. WOCHENSCHR. 100(7): 347-348 (Feb. 14,  
1970)  
E000000260

### DIETHYLSTILBESTROL

Kuhn B.  
The role of topical hormone therapy in acne vulgaris-an  
evaluation of two decades of topical diethylstilbestrol  
therapy.  
CUTIS 5: 1124-1129 (Sept. 1969)  
E000000302

Malis I., Cooper J.F., Wolever T.H.S.

Breast radiation in patients with carcinoma of the  
prostate.  
J. UROL. 102(3): 336-337 (1969)  
RINGDOC 31979J  
E000000346

Wolf H.

The effect of female sex hormones and hydrocortisone on  
NAD biosynthesis from tryptophan in man.  
ACTA ENDOCRINOL. SUPPL. 61(Suppl. 138): 34 (1969)  
RINGDOC 28028J  
E000000239

### DINHYDROSTREPTOMICIN

Varpela E., Hietalahti J., Aro M.  
Observations on streptomycin medication during pregnancy  
and the fetal ear.  
SCAND. J. CLIN. LAB. INVEST. 23(Suppl. 108): 77 (1969)  
RINGDOC 30866J  
E000000253

### DINETHYL SULFOXIDE

Conaish S., Juhlin L.  
Site of action of methotrexate in psoriasis.  
ARCH. DERMATOL. 100(1): 99-105 (1969)  
RINGDOC 30069J  
E000000247

Figure 3. Part of page from the alerting bulletin Squibb  
Products-Current References

## LIBRARY INDEX

### ACETAMINOPHEN-CONTAMINATION

Kalatziis E.  
Reactions of acetaminophen in pharmaceutical dosage  
forms: its proposed acetylation by acetylsalicylic acid.  
J. PHARM. SCI. 59(2): 193-196 (Feb. 1970)  
E000000159

### ACETAMINOPHEN-STABILITY

Kalatziis E.  
Reactions of acetaminophen in pharmaceutical dosage  
forms: its proposed acetylation by acetylsalicylic acid.  
J. PHARM. SCI. 59(2): 193-196 (Feb. 1970)  
E000000159

### AMANTADINE-THERAP. USE IN PARALYSIS AGITANS

Parkes J.D., Calver D.M., Zilkha K.J., Knill-Jones R.P.  
Controlled trial of amantadine hydrochloride in  
Parkinson's disease.  
LANCET I(7641): 259-262 (Feb. 7, 1970)  
E000000107

### AMANTADINE-ADVERSE REACTIONS

Parkes J.D., Calver D.M., Zilkha K.J., Knill-Jones R.P.  
Controlled trial of amantadine hydrochloride in  
Parkinson's disease.  
LANCET I(7641): 259-262 (Feb. 7, 1970)  
E000000107

### AMINOSALICYLIC ACID-ANALYSIS IN TABLETS

Shishoo C.J., Devani M.B.  
Nonaqueous titrimetric determination of isoniazid in  
presence of excess of sodium p-aminosalicylate in dosage  
forms.  
J. PHARM. SCI. 59(1): 92-93 (Jan. 1970)  
E000000074

### AMPHOTERICIN B-ADMIN. INTRAVENOUSLY

Giddings T.H.  
Fatal reaction to Amphotericin B.  
TEX. STATE J. MED. 58: 183-186 (1962)  
NOTEBOOK fungizone  
E000000043

McCullough D.C., Harbert J.C.

Isotope demonstration of CSF pathways. Guide to  
antifungal therapy in coccidioidal meningitis.  
J. AMER. MED. ASS. 203(4):558-560 (1969)  
RINGDOC 27479J  
E000000058

### AMPHOTERICIN B-ADMIN. INTRAVENTRICULARLY

McCullough D.C., Harbert J.C.  
Isotope demonstration of CSF pathways. Guide to  
antifungal therapy in coccidioidal meningitis.  
J. AMER. MED. ASS. 209(4):558-560 (1969)  
RINGDOC 27479J  
E000000058

### AMPHOTERICIN B-ADVERSE REACTIONS

McCullough D.C., Harbert J.C.  
Isotope demonstration of CSF pathways. Guide to  
antifungal therapy in coccidioidal meningitis.  
J. AMER. MED. ASS. 209(4):558-560 (1969)  
RINGDOC 27479J  
E000000058

### AMPHOTERICIN B-ADVERSE REACTIONS-DEATH

Giddings T.H.  
Fatal reaction to Amphotericin B.  
TEX. STATE J. MED. 58: 183-186 (1962)  
NOTEBOOK fungizone  
E000000043

Figure 4. Part of page from manual index

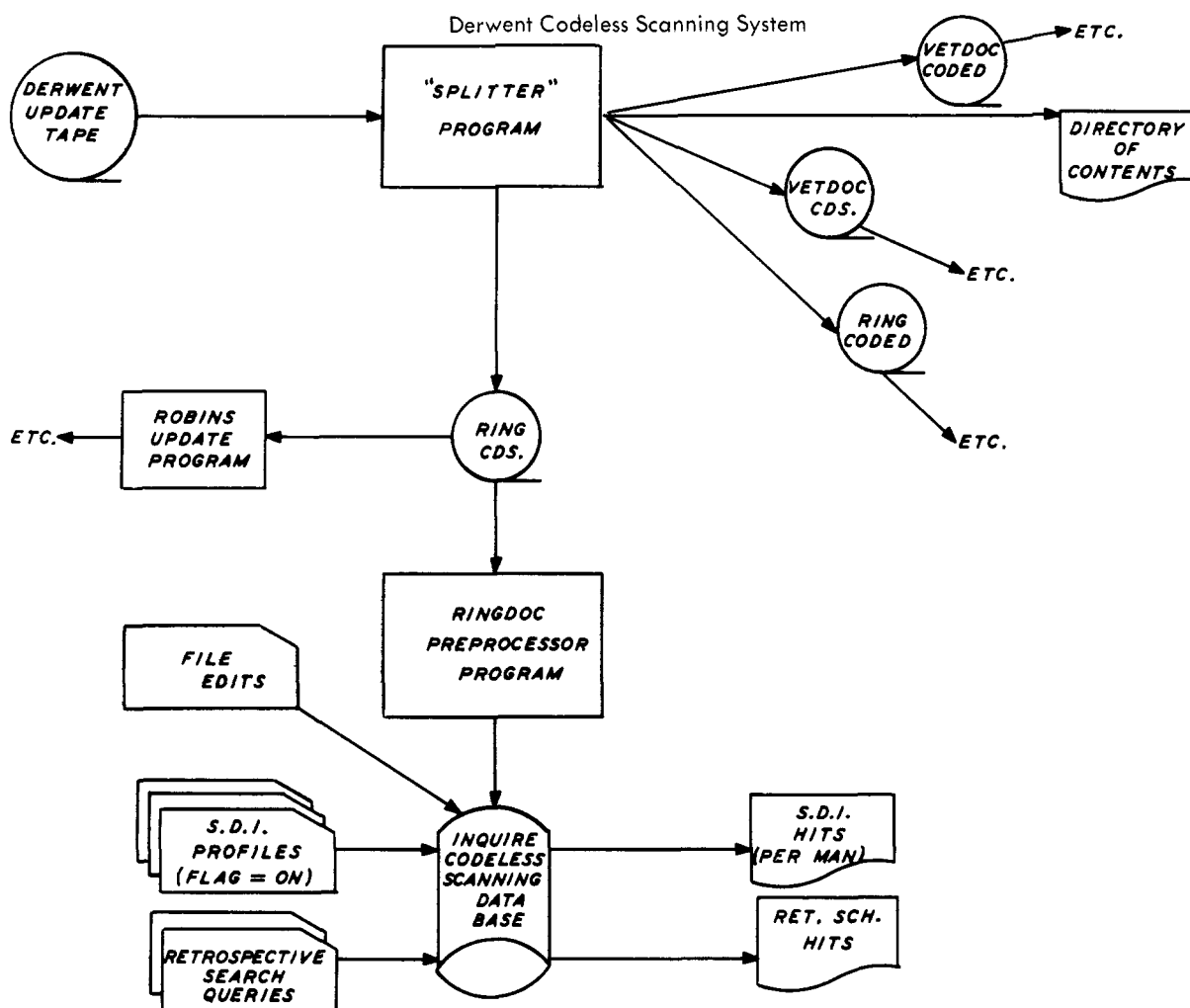


Figure 5. Simplified flow chart of Derwent-INQUIRE system

Alerting bulletin: *Squibb Products Current References* (see Figure 3).

Manual index: *Index to the Literature on Squibb Products* (see Figure 4). This index is the equivalent of the card index formerly produced on 3 × 5 cards. The citations are arranged under appropriate subject and author headings.

Loading of appropriate portions of the input onto disc storage by the INQUIRE system, ready for SDI and retrospective searches.

#### DERWENT RINGDOC "CODELESS SCANNING" APPLICATION

The only practical search method for the RINGDOC data base (1964 to date) has been a search of the coded files on magnetic tape. The "Codeless Scanning" file could be searched on a practical basis only by tedious use of the manual printed indexes. The only software program available for "Codeless Scanning" tape searching was so very slow and inefficient as to be completely impracticable. The biological terms in the coded file are extremely limited, and most of the biological information in the "Codeless Scanning" file was not accessible through any available effective search method. How to utilize this "Codeless Scanning" file seemed a proper goal for INQUIRE application.

The simplified flow chart shown in Figure 5 illustrates the processing involved in the Derwent-INQUIRE application.

Under arrangement with Derwent Publications Ltd., magnetic tapes containing new RINGDOC and VETDOC data are received by air every week. Each mini-reel of tape contains approximately 1000 new literature references.

The SPLITTER program reads the new tape and separates the various files for further processing. The "Codeless Scanning" update file is passed to the preprocessing program, whose function is to extract and format data for INQUIRE input. Any data entered into INQUIRE must conform to a standard format and are defined to the system via a load table.

The preprocessing program was logically designed and coded to structure the "Codeless Scanning" data in a form acceptable to INQUIRE. The program consists of about 700 statements, and uses about 85 bytes of core. It is easily modified for small format changes that are sometimes made in the Derwent records.

The end result of the preprocessor operating on a data item of the structure given in Figure 6 is shown in Figure 7. Note that every keyword generated for the article surrogate has been loaded into the KEYS field. These

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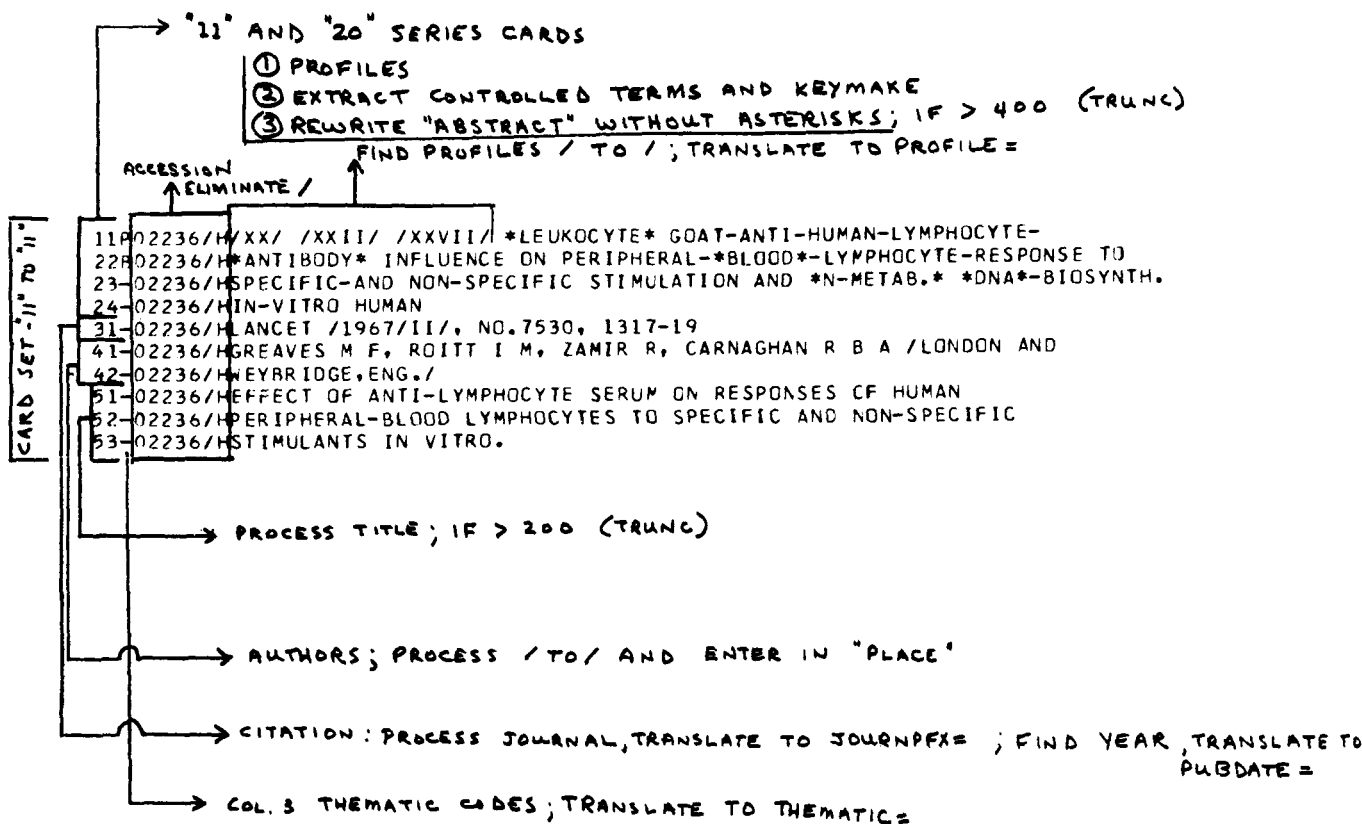


Figure 6. RINGDOC data item recorded

ACCESSNO	06809K	00104845
TITLE	NEUE SESQUITERPENE AUS BRICKELLIA GUATEMALIENSIS /1/. UEBER EIN	00104846
	NEUES SESQUITERPENLACTON AUS PLUCHEA DIOSCORIDES DC.	00104847
CITATION	TETRAHEDRON LETTERS 1969, NO.58, 5109-10	00104848
	9, NO.58, 5111-12	00104849
JOURNPF	TETRAHEDRON LETTERS	00104850
PUBDATE	1969	00104851
AUTHORS	BOHLMANN F, ZDERO C	00104852
PLACE	BERLIN, GER./BOHLMANN F, GRENZ M /BERLIN,	00104853
PROFILES	PHARMACODYNAMICS	00104854
THEMATIC	CHEMISTRY	00104855
ABSTRACT	COND.RING BENZOFURAN EPOXIDE C-ESTER POLYOLEFIN ALCOHOL POLYOLE	00104856
	FIN C-ESTER 2 NOVEL O-ACYL-NEROLIDOL-DE. ISOL. AND STRUCT.DET.	00104857
	BOTANY PLUCHEA DIOSCORIDES HETEROCYCLE OXEPIN NAPHTHALENEN	00104858
	SESQUITERPENE-LACTONE ISOL. STRUCT.DET.	00104859
KEYS	THEMATIC=, PROFILE=PHARMACODYNAMICS, THEMATIC=CHEMISTRY, COND.RING	00104860
	, BENZOFURAN, EPOXIDE, C-ESTER , , , 2 NOVEL O-ACYL-NEROLIDOL-DE	00104861
	R. ISOL. AND STRUCT.DET. , PLUCHEA DIOSCORIDES HETEROCYCLE , ,	00104862
	OVFL SESQUI,-	00104863
FLAG	1	00104864
END		00104865

Figure 7. End result of preprocessor operation on a RINGDOC "Codeless Scanning" item

are the terms under which the item is indexed for direct retrieval.

## KEYWORD LIST

The preprocessed data are loaded into INQUIRE and the appropriate files are organized and built. An IN-

QUIRE utility program produces a keyword list, which lists alphabetically every keyword in the data base, together with its frequency count. Extracts from a few pages of the keyword list are given in Figure 8. These illustrate the general format and the appearance of various entries having common prefix keys.

ASTHENIA	18
ASTHMA	70
ATP	77
ATROPINE	150
AUTOMATIC-ANALYZER	21
AUXILIARY-INGREDIENT	10
AZAPHENOTHIAZINE	1
AZEPINE	41
AZETIOINE	16
AZIDE	9
AZIRIDINE	66
AZO	38
AZCMETHINE	34
AZULENE	18
B-COMPLEX	20
BABESIASIS	1
BACITRACIN	9
BACT.	400
BACT.CLOSTR.	20
BACT.E.COLI	184
BACT.MYCOBACT.	35
BACT.SALM.	28
BACT.SPIROCHAETA	1
BACT.SPIROCHAETALES	3
BACT.STAPH.	105
BACT.STREPT.	59
BACTERIUM	4
BARBITURATE	164
BIARIUM	10
BASAL-METAB.	7

Figure 8. SSIS keyword list from Derwent-Ringdoc file  
(5/1/70)

## KEYWORD AND DATA FILE MAINTENANCE

Another advantageous feature of the INQUIRE system is the ease with which both keyword and master records can be corrected or updated through the use of the maintenance commands of the INQUIRE system.

## RETRIEVAL

The RINGDOC "Codeless Scanning"-INQUIRE application is used to provide SDI, as well as retrospective searching, in a batch-processing environment. SDI is regularly scheduled as new tapes are received, whereas retrospective searches are run on a 24-hour on-demand basis. The system is run on an IBM 360/40 with 128K bytes of core and a 2314 disc unit.

```

INQUIRE - COPYRIGHT 1968 INFODATA SYSTEMS INC.      PAGE 1
05/07/70

FIND SILICON AND INFLAMMATION, TAB ACCESSNO 1 AUTHORS 10 CITATION 70 TITLE 1
, HEADER 'RINGDOC CODELESS SCANNING FILE - 1968 AND 1969', SUBHEAD
'RETROSPECTIVE SEARCH FOR I. LEVETT'.

```

Figure 9. Straightforward retrospective search question

```

RINGDOC CODELESS SCANNING FILE - 1968 AND 1969      PAGE 1
RETROSPECTIVE SEARCH FOR I. LEVETT                  05/07/70

ACCESSNO  AUTHORS      CITATION
TITLE
-----
00102J  GORDON A H, KOJ A      BRIT.J.EXP.PATHOL. 49, NO.5, 436-47 /1968/
CHANGES IN THE RATES OF SYNTHESIS OF CERTAIN PLASMA PROTEINS FOLLOWING TISSUE DAMAGE DUE TO TALC INJECTION. A STUDY USING THE PERFU
SED RAT LIVER.

00043J  SHANAHAN R W          ARCH.INTERN.PHARMACODYN. 175, NO.1, 186-92 /1968/
LOCAL ACTIVITY OF ANTI-INFLAMMATORY AND IRRITANT AGENTS ON RAT PAW EDEMA INDUCED BY CARRAGEENIN.

ITEMS RETRIEVED      2
PROCESSING TIME -    5.0 SECONDS

```

Figure 10. Output from question in Figure 9

```

INQUIRE - COPYRIGHT 1968 INFODATA SYSTEMS INC.      PAGE 1
05/07/70

FIND AMPICILLIN AND GYNECOLOGY AND PUBDATE=1968 OR PUBDATE=1969 AND
'JOURNPFX=BRIT.MED.J.' AND AUTHORS CONTAINS COLE AND TITLE CONTAINS
'URINARY TRACT', TAB ACCESSNO 1 AUTHORS 10 TITLE 70 CITATION 10, HEADER
'RINGDOC CODELESS SCANNING FILE - 1969', SUBHEAD
'RETROSPECTIVE SEARCH FOR P. ROSKOS'.

```

Figure 11. Very specific search question

```

RINGDOC CODELESS SCANNING FILE - 1969      PAGE 1
RETROSPECTIVE SEARCH FOR P. ROSKOS          05/07/70

ACCESSNO  AUTHORS      CITATION
TITLE
-----
05206J  WILLIAMS J D, THOMLINSON I L, COLE J G L, CCPE E      ASYMPTOMATIC URINARY TRACT INFECTION IN GYNAECOLOGICAL OUTPATIE
BRIT.MED.J. /1969/1/, NO.5635, 29-31        NTS.

ITEMS RETRIEVED      1
PROCESSING TIME -    4.2 SECONDS

```

Figure 12. Output from the question in Figure 11

SDI profiles are developed by the user together with an information scientist. The keyword list is used as the basis for every profile, allowing access to the RINGDOC surrogates via controlled "indexing terms," journal names publication dates, profile groups, and thematic groups. Profile terms or synonyms not available in the keyword list may be sought in the text of the title and in the "indexing abstract" portion of the record, as can authors' names. Although text searching does require more computer time per query because of string matching, it is an essential part of the retrieval process and is frequently used. The economy of storing fewer keywords can outweigh the added cost of text searching.

Figure 9 illustrates a straightforward retrospective

search query for all citations dealing with "silicon" and "inflammation." Again, the user has specified a customized format for the bibliography. The hits are shown in Figure 10. A specific search was structured for a user with only bits and pieces of a reference (see Figure 11). This query searched keywords, year of publication, journal, author, and title. Figure 12 shows the output for this search. As is shown by query examples, the user is allowed any degree of specificity he needs.

Further details are presented in a paper by Stephen J. Frycki entitled "Information Transfer from Source to User Utilizing a Pharmaceutical Data Base," presented May 8, 1970, at the Seventh Annual National Colloquium (in press).

## Personal Use of Industrial Information Services: A Case Study of the Use of Information\*

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### Question 1: What single tool do you use most in searching the literature?

*Chemical Abstracts* is the source I use most frequently in searching the chemical literature because it is the most comprehensive in its coverage. Beilstein, however, is a very close second. For information on whether a compound is known, which is one of the most common types of information desired, I look first in Beilstein if I think the compound is likely to be known in the older literature. For such a search, Beilstein has the advantage over *CA* of having a single formula index and one that differentiates isomers, which the early *CA* indexes do not.

### Question 2: Where and how do you draw the line between your own literature searching and literature searching done for you by an information person?

Whether I carry out a literature search myself or have it done by an information scientist depends on three considerations. First, this decision has to be made only at institutions where information services are available. Having been a university professor, I am quite used to doing all my own searches.

The second consideration is the nature of the search. Searches which I would assign to any information scientist include:

Easy but lengthy searches, such as references on a list of specific compounds. In contrast, an easy quick search, as for a single compound, I would do myself so as to have the results immediately.

A well-defined search. The poorly-defined searches and complex ones I would do myself so that I could continuously

modify the scope of the search as I became familiar with the literature.

A search not important to me. Searches for patents on classes of compounds or specific compounds constitute the major type. I regard patents as being primarily legal, not scientific, documents, and hence I have little scientific interest in them.

The above examples are searches to be given to any information scientist and exclude the complex and therefore the most important searches. The decision as to who does these types of searches is based upon the third consideration, namely, the relative abilities in searching the literature of the information scientist and of myself. Generally, an experienced information scientist is more skillful than a laboratory chemist in using the tools of literature searching but less knowledgeable in the technical information itself. For the more important and complex searches, therefore, I decide on an individual basis whether I or a specific information scientist is more likely to do the better search.

### Question 3: Are any of the current awareness services useful to you?

I have tried most of the current awareness services available to chemists, so that those which I do not use have been consciously rejected.

The services I use are:

*Current Contents.* This is the one indispensable service for me.

*ASCA.* This is a very helpful service. Its major deficiency, in my opinion, is that the keywords are taken only from the titles of papers. Since titles often fail to include the most important keywords, *ASCA* fails to select such papers.

*Ringdoc.* Presently I use *Ringdoc* for abstracts on biological activity of organic compounds. The major advantages of

\* Presented before the Division of Chemical Literature, 160th Meeting, ACS, Chicago, Ill., Sept. 16, 1970.