MELVYL® MEDLINE®*: A library services perspective†

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The MELVYL MEDLINE project resulted in the addition of a full five-year subset of MEDLINE to the University of California's (UC) MELVYL online union catalog. As one of the nation's largest MEDLINE end-user searching systems, MELVYL MEDLINE provides online bibliographic access to the biomedical journal literature for all UC personnel at over seventy library sites or by remote access. This paper summarizes the project's accomplishments, reports MELVYL MEDLINE use and its impact on library services, and provides insights for other end-user search systems. The project serves as a model for adding databases to the MELVYL catalog and demonstrates the potential for use by other disciplines of a specialized database when readily accessible. Evaluation results report high user satisfaction and high usage. However, many advanced searching features of the interface are little used by searchers. Effects on library services include marked increases in reference transactions and interlibrary loans, with significant declines in mediated search services. Future MELVYL MEDLINE enhancements include matching search retrievals to journal locations, linkage to an online document delivery system, and consideration of building a superset of databases by combining MELVYL MEDLINE with citations from another database in the MELVYL catalog.

In the spring of 1989 the University of California (UC) completed a three-year project that resulted in the addition of the MEDLINE database to the university's MELVYL online union catalog. Two aspects of this project make it of widespread interest to the health sciences library community. First, it is certainly one of the largest deployments of MEDLINE. UC's nine campuses have more than 152,000 students and over 212,000 faculty and staff; with MELVYL MEDLINE, all have access at no charge to a full five-year online file of biomedical journal article citations with abstracts. Today MELVYL MEDLINE is available in over seventy UC libraries through some 500 hard-wired terminals, through UC networks, and by direct dialup

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for UC faculty, staff, and students. Each month it supports over 47,000 search sessions, with users submitting over 204,000 search statements and displaying over 2.3 million records; in 1989 use totaled over 98,600 connect hours.

Second, the MELVYL MEDLINE project addressed the feasibility of providing journal citation access through the same user interface used for access to monographs in UC's MELVYL online union catalog. This catalog contains over 5.7 million book records and 640,000 records for periodical titles held in the UC system. Although enhancements were made to use MeSH®‡, the MELVYL MEDLINE interface is largely identical to that used to search the books catalog. This strategy encourages use of MEDLINE by members of the UC community, most of whom are familiar with the MELVYL search commands, and it simplifies maintenance of the database.

BACKGROUND

Planning for the MELVYL MEDLINE project began as early as 1983, when the directors of the five UC health sciences libraries initiated a university-wide project to make the MEDLINE database available; this was a first step toward implementing some of the recommendations of the 1982 Association of American Medical Colleges' study, *Academic Information in the Academic Health Sciences Center: Roles for the Library in Information Management* [1]. Libraries such as those in the UC system were increasingly turning to online catalogs to improve access to their collections, yet initial online catalog efforts were actually widening the gap between access to monographs and access to journal articles [2]. Automated catalogs provided improved access for monographs only; access to the journals that comprised the foundation of the collections in the health and life sciences was available only through a proliferating number of specialized online databases and a variety of printed indexes and abstracting services. The MELVYL online union catalog, implemented in 1982, provided the computing resources and telecommunications network for a centralized project to make the MEDLINE database available to all UC faculty, staff, and students without the duplication of efforts that would have resulted from independent projects to mount the database on each local campus.

The National Library of Medicine (NLM) awarded a Medical Library Project grant in March 1986 to support development work for the project. Project goals were to provide bibliographic access to the book and journal literature through one online catalog for library users in the health and life sciences and related disciplines; to develop a model online union catalog for a multicampus system with listings for both books and journal articles; and to encourage use of the published biomedical journal literature for research, teaching, and patient care by providing direct, user-friendly access to the MEDLINE database for library users.

PROJECT ORGANIZATION

The MELVYL MEDLINE project consisted of two principal activities—development of the software for the online database and deployment of MELVYL MEDLINE on all UC campuses. From its outset, the project was a collaborative effort of the UC Division of Library Automation (DLA), which was responsible for the software development and computer resources for the project, and the UC health and life sciences libraries.§ To coordinate this multicampus project, the DLA director and the biomedical librarian at UC San Diego served as the project's co-principal investigators. A task force of health sciences librarians with experience in instruction and in online searching planned and directed library involvement in the project. The MELVYL MEDLINE Task Force consisted of five librarians—three from the Biomedical Library at UC San Diego, including the task force chairman and the project's training coordinator, and two from the Biomedical Library at UCLA. In addition to advising DLA staff on their work in designing the interface, the task force coordinated the logistics of implementing MELVYL MEDLINE at over seventy library sites on all UC campuses, oversaw production and distribution of instructional and promotional materials, and designed and conducted the project evaluation. A librarian coordinator was appointed for each campus not represented on the task force to serve as a campus contact and to coordinate campus activities in training, promotion, and evaluation for the project. In addition, a Users' Advisory Council, consisting of six faculty and two graduate/professional students from the southern UC campuses, advised the task force on design of the system from the user's perspective.

The work of the MELVYL MEDLINE project was accomplished in three phases, which roughly paralleled the three years of the project. First, DLA staff,

‡ MeSH is a registered trademark of the National Library of Medicine.

§ Libraries participating in the first deployment included the Biomedical Libraries at UC Irvine, UC San Diego, and UCLA; the Health Sciences Library at UC Davis; the UC San Francisco Library; the Medical Center Libraries at UC Irvine, UC Davis, and UC San Diego; the Bio-Agricultural Library at UC Riverside; the Biosciences and Public Health Libraries at UC Berkeley; the Science and Engineering Library at UC Santa Barbara; and the Science Library at UC Santa Cruz.

in conjunction with the task force, completed the specification and design process. Then, during the project's second year, DLA released a prototype database for review by health sciences library staff and subsequently made MELVYL MEDLINE service available in the UC health and life sciences libraries in October 1987. In the final phase, beginning in July 1988, MELVYL MEDLINE became available in all UC libraries and, by late fall of 1988, to UC faculty, staff, and students via direct dialup and computer network access.

YEAR ONE: THE DESIGN CHALLENGE

The scope and coverage of the database had been determined during early planning for the project. Because the five UC health sciences libraries held 80% of the journal titles covered by the MEDLINE database and 90% of those indexed for *Index Medicus*®**, project planners decided to lease a full MEDLINE subset containing citations with abstracts for all journals indexed for MEDLINE. MELVYL MEDLINE would then provide comprehensive online access to much of the UC health and life sciences libraries' holdings and, in turn, most of the journal articles cited in search retrievals could be supplied locally by one of the UC libraries. Since size of the retrievals and effects of searching a large MEDLINE subset on the MELVYL catalog could not accurately be determined in advance, project planners decided to limit coverage in the MEDLINE subset to the most current three years; this coverage corresponded to the current file in NLM's MEDLINE service.

With the scope and coverage of the database decided, the joint development team of DLA staff and the task force concentrated initial efforts on analyzing the MEDLINE record structure and content and on designing functional specifications. Principal design features included:

Database

MELVYL MEDLINE is a separate database that users can select within the MELVYL catalog. This approach, rather than having one database with merged records for books and journal article citations, was debated at length and chosen for a number of reasons: given the greater specificity of journal indexing, it would be better for users to search journal article citations separately from book listings that have much broader subject headings; retrieving journal article citations in some cases but not others would be confusing for MELVYL catalog users; maintaining MEDLINE's identity as a separate entity from the book catalog would promote its use, as it is a well-known information resource in the health and life sciences; and response time with two databases was considered better and the retrievals from searches considerably smaller than from a single database.

DLA staff also decided that it was more cost-effective to recreate the database annually to include new MeSH terms and snapshots of the previous retrospective years than to process annual NLM maintenance against an existing file. Recreating the database also ensured its quality, since the new tapes contained updates from NLM for all previous maintenance. As necessary, the DLA staff also selectively edits the database when requested to do so by NLM.

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Although initial planning allowed for database coverage of the current year's indexing plus two retrospective years, in 1990 the database was expanded to include four retrospective years. By 1990 the database, which covered indexing from 1986 through November 1990, required approximately six gigabytes of disk storage and contained over 1.5 million article citations. Preprocessing programs were written in PL/1, and loading programs used ADABAS utilities [3].

Design features

Given the intent to provide access to both books and journals through a single online catalog, the development team designed the MELVYL MEDLINE interface to closely parallel that for the MELVYL online catalog. Consequently, software development largely involved adapting the MELVYL user interface for MELVYL MEDLINE and creating batch programs for database loading and maintenance.

However, as discussion of the interface developed, it became apparent that creating a MELVYL MEDLINE command structure that closely paralleled MELVYL had implications beyond merely using identical commands. ADABAS, the software used to build the MELVYL catalog, could not support some of the functions used in other end-user implementations of MEDLINE. For example, ADABAS did not allow users to enter a subject term and see an alphabetical list of subject terms preceding and succeeding the entry term

** *Index Medicus* is a registered trademark of the National Library of Medicine.

in the subject index. This device is commonly used to reveal the controlled vocabulary for subjects from which users must select a term if they wish to retrieve results. It also was not practical to support adjacency searching in MELVYL MEDLINE; set searching, while possible, presented large programming problems.

More important, perhaps, adopting the MELVYL interface also meant adopting the basic philosophy of the MELVYL online catalog: the user is always in control of the search. In designing the interface, the development team was well aware, from its own research and that of others, that end users find the concepts of indexing specificity, subheadings, explodes, etc., extremely difficult to understand [4]. The team, therefore, considered a number of design elements that might have obviated the need for users to comprehend these features: automatically exploding terms; regrouping subheadings into "TREATMENT," "DIAGNOSIS," etc., thus eliminating the need to understand subtle differences in usage; mapping index terms; supplying automatic truncation; and combining several indexes into one.

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However, all of these strategies removed control of the search from the user, for they permitted the computer to decide for the user how a search should be performed; for example, a strategy that automatically exploded terms decided for the user that the term should be exploded. This approach was contrary to the approach of the MELVYL online catalog. The MELVYL catalog indeed permitted the user to employ a variety of sophisticated methods to narrow or expand a search; users could limit by language and date, combine terms in a variety of ways, and truncate as needed. However, the user always had to choose explicitly to employ these features; the online catalog rarely second-guessed the user by performing such functions automatically.

By keeping the user in control, the designers of MELVYL hoped that the user would always be able to understand why a particular search yielded a particular result; there would be no magic behind the scenes changing the terms that were entered and thus leaving the user puzzled by the results. To be congruent with this basic philosophy, the MELVYL MEDLINE interface also left the user in control. The only concession made to the complexity of MeSH was to create a keyword index that allowed the user to search terms from the title, abstract, and subject headings fields simultaneously and thus obviate any need to choose the correct field for a subject search.

A second series of design decisions revolved around the sophistication of the interface. Because the intended uses for MELVYL MEDLINE included advanced biomedical research and patient care, the interface was designed to permit skilled users to perform sophisticated searches. As noted earlier, adjacency searching could not be implemented with the MELVYL interface. However, most other features of NLM's MEDLINE were included in the design: explodes, subheadings, limits, tree structure searching, etc. The design team then established benchmark searches on NLM's MEDLINE and compared them with the MELVYL interface to assure that the same results would be possible on both systems.

A final important design decision related to the structure of the menu-driven "ASSIST" mode. Most use of the MELVYL online catalog was done via direct commands ("COMMAND" mode). However, the MELVYL catalog also had a menu-driven "LOOKUP" mode designed to help the novice user negotiate the system. The development team believed it would be desirable to retain a menu-driven system in MELVYL MEDLINE. There are always some new users of the catalog at UC's libraries; a menu-driven mode would help train new users in MELVYL MEDLINE as well as provide easy entry to the catalog for all users. The resulting "ASSIST" search mode for MELVYL MEDLINE improved upon the "LOOKUP" mode and served as a test bed of features for a future revision of the menu-driven mode for the MELVYL catalog. Unlike "LOOKUP," the "ASSIST" search introduced the most efficient (in terms of machine-processing time) search commands rather than less efficient (but perhaps simpler to comprehend) approaches. It also taught the user how to use the command structure by asking the user to type in the correct commands, rather than choose a command by number, and by exposing the user to some of the more sophisticated search features of the catalog (e.g., explodes and subheadings) rather than to only basic search commands. The resulting interface incorporated a menu-assisted "ASSIST" option for beginning searchers and a "COMMAND" option for frequent users. Both options contained online "HELP" and "EXPLAIN" screens to guide searchers.

As in the MELVYL catalog, MELVYL MEDLINE has two principal commands—"FIND," to search the database, and "DISPLAY," to display retrievals. Users can use the "FIND" command to search a variety of indexes including personal author, title word, exact

title, subject, exact subject, keyword (a combination of titles, abstracts, and subject headings), major exact subject (for the major point of the article), major subject (for the main subject word), journal, exact journal, tree number, date, and language. Users can also expand searches with the "EXPLODE" command; combine searches with the Boolean operators "AND," "OR," and "NOT"; and use the "BROWSE" command to review subject headings, journal titles, and author names. Searchers can display citations in a number of formats ranging from "REVIEW" (for titles and journal listings only) to "LONG" (for citations plus subject headings) to "SHORT ABSTRACT" (for citations plus abstracts).

To exploit the power of the MEDLINE database with its controlled MeSH vocabulary, several new features were developed. These included:

- combined keyword index: a pooled keyword index to provide access to keywords from the title, abstract, and subjects of the records in addition to specific keyword indexes for each field
- MEDLINE journal index: a keyword index for journal titles in the database that, when used in conjunction with the "BROWSE" command, made possible retrieval of articles indexed for a particular issue
- MeSH-related functions: functions providing access to MeSH information:
  - MeSH browse display that included subheadings; broader, narrower, and related headings; tree numbers; and scope notes
  - limit to major subject headings feature
  - explode function
  - tree number functions, including search by exact or truncated tree numbers
  - limit to check tags function
- NLM MEDLINE display: a display format that closely resembled a full MEDLINE display with NLM tagging. This format allowed users with commercial downloading programs to download MELVYL MEDLINE records using the NLM download parameters in these programs.

YEAR TWO: SYSTEM DEPLOYMENT

Collaboration between DLA and the task force continued throughout year two with major activities focused on release of a prototype database followed by implementation of MELVYL MEDLINE in the UC health and life sciences sites on each of the nine campuses. The project team initiated a training program, developed the evaluation methodology, and devised procedures for issuing passwords.

Training

Project funding supported a part-time training coordinator who produced masters of instructional materials for use in all libraries, as well as developed and conducted "Training the Trainers" workshops to teach librarians from each campus to serve as local MELVYL MEDLINE instructors. In October of the second year, the training coordinator taught a total of twenty-seven health sciences librarians in four training sessions, two each at UCLA and UC Berkeley for the convenience of the southern and northern campuses. From November to April, these local campus librarians held approximately 200 training sessions with a combined attendance of over 800 at UC life and health sciences libraries. In addition to these sessions, health and life sciences library staff provided numerous individual consultations and demonstrations. At the end of year two, the training coordinator surveyed the health and life sciences librarians and incorporated their recommendations into revisions of the instructional materials for use with the general libraries in the third year.

Evaluation process

DLA staff and the task force regularly reviewed transaction log data to monitor use of the system's searching features and system performance. In addition to this routine data analysis, they developed three additional formal evaluations to obtain information from MELVYL MEDLINE users about use of the database and the adequacy of the user interface. Due to the developmental nature of this project, all evaluations were designed to provide information on use of the system and its design features, rather than to measure impact of MELVYL MEDLINE on library services. The first evaluation was a questionnaire distributed online from April 26 through May 7, 1988, to terminals with access to MELVYL MEDLINE in UC's health and life sciences libraries. The project team later repeated the online questionnaire with all MELVYL MEDLINE users near the end of the project's third and final year. In addition, to obtain more detailed information on use and acceptability of the system, reference desk staff at each of the health sciences libraries distributed surveys from service desks from October 31 through November 11, 1988. A later section reports these evaluation findings.

Password access policies and procedures

Extensive activities began in the second year to prepare for implementing dialup and computer network access to the MELVYL MEDLINE database in the fall of the third year. To comply with the terms of the lease of the MEDLINE database, DLA implemented a password system to restrict dialup and network access to UC faculty, staff, and students. Unlike many online library systems, remote access to the MELVYL catalog does not require passwords, so it was with trepidation that the project team faced the

daunting task of issuing passwords to a potential user population of thousands. DLA staff worked with each campus to identify networks, subnets, or individual time-sharing hosts used exclusively by UC personnel; these were programmed to receive MELVYL MEDLINE without password requirements. Then DLA issued blocks of passwords to libraries on each campus for distribution to UC personnel without direct access to MELVYL MEDLINE through one of the identified UC-only access points or to those who wanted to access MELVYL MEDLINE via an uncontrolled access path.

The task force established general guidelines for password eligibility and expiration dates, which ranged from one to four years or indefinite (for tenured faculty only); each campus assigned expiration dates and established procedures within the parameters of the guidelines. Each password applicant signed a statement acknowledging that the database was restricted to UC use only and that the password was authorized solely for the applicant's individual use. Implementation of password access progressed surprisingly smoothly. By the end of the 1988/89 academic year, over 3,500 passwords had been issued to UC users on the nine campuses, and by spring of 1990 over a quarter of all MELVYL MEDLINE sessions were via remote access.

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YEAR THREE: FULL IMPLEMENTATION

In many ways deployment of the system in the health and life sciences sites during the second year was a dress rehearsal for the challenge of making MELVYL MEDLINE available at all UC library sites in July 1988. Since MELVYL MEDLINE was the first (and only) journal citation database on the online catalog, it had widespread use throughout the UC libraries.

As work progressed on refinements for the interface, training for nonhealth sciences library staff began. The training coordinator developed a more in-depth workshop for general library staff, as many had little or no experience with MEDLINE or MeSH. Like those the previous year, the workshops were each held twice for the northern UC campuses and twice for the southern UC campuses; forty-five participated as trainees. By the end of the third year nearly 2,500 faculty, staff, and students had received training on the nine campuses, with many more receiving informal instruction at library service desks.

PROJECT EVALUATION

As noted earlier, project staff used four instruments to evaluate the project: transaction log data, two online questionnaires, and a printed questionnaire. DLA staff compiled data for the transaction logs and reported use statistics weekly to the task force. The first online questionnaire was given in year two at the health and life sciences libraries with access to MELVYL MEDLINE (response rate: 45%). The second was given to all MELVYL MEDLINE users near the end of the third and final project year (response rate: 33%). Since the software used for the online questionnaires could support only multiple choice questions, library staff in UC's eight biomedical and medical center libraries distributed a printed questionnaire (response rate: 73%) at these sites one year after the system had been introduced.

User acceptance

User reaction to the system was overwhelmingly positive. Use rates were high (Table 1) and have continued to grow at health sciences and nonhealth sciences libraries alike since the project was completed. The vast majority of respondents were affiliated with the university; graduate students, a category that included medical students, accounted for the highest proportion of users (Table 2). More than 90% of users reported that they were either satisfied or very satisfied with MELVYL MEDLINE, and more than half said they intended to use the system again at least weekly. By the end of the first year in the biomedical and medical center libraries, two thirds of all users reported that they had used the system more than six times; close to one third had used it more than fifteen times.

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Users found the system to be user-friendly. A large majority (82%) of users said that the system was easy to learn and easy to use, and transaction logs indicated

Table 1
MELVYL MEDLINE sessions

	January–June 1989	January–June 1990	% change
Medical campuses			
Library sites*	146,456	181,405	23.9%
Remote access	27,018	63,852	136.3%
Other UC sites			
Library sites†	29,857	33,624	12.6%
Remote access	12,896	20,209	56.7%
Total	216,227	299,090	38.3%

* Included all libraries at the five UC campuses with health science professional schools—UC Davis, UC Irvine, UCLA, UC San Diego, UC San Francisco.
† Included all libraries at UC Berkeley and the smaller campuses at UC Riverside, UC Santa Barbara, and UC Santa Cruz.

Table 3
Frequent problems reported in MELVYL MEDLINE searches* (n = 988)

Problem statement	Times reported (%)†
Needed older citations	394 (39.9%)
Did not know commands	349 (35.3%)
Too many irrelevant citations	300 (30.4%)
Unable to retrieve all citations on topic	202 (20.4%)
Needed citations on topics not covered	187 (18.9%)
Needed more recent citations	145 (14.7%)

* Frequent problems were defined as those occurring in more than 50% of the respondent's searches.
Excludes library staff; data were derived from 988 survey respondents who had used MELVYL MEDLINE. Printed questionnaires were distributed in November 1988 in the Biomedical Libraries at UC Irvine, UC San Diego, and UCLA; the Health Sciences Library at UC Davis; the UC San Francisco Library; and the Medical Center Libraries at UC Irvine, UC Davis, and UC San Diego.
† Respondents could choose several categories.

that over 80% of all searches were done in the direct "COMMAND" mode, rather than in the menu-driven "ASSIST" mode. Almost half of all "COMMAND" mode searchers reported seeking no help from online or printed aids or from staff during their sessions. Users did experience some problems in their searches. Other than the need for older literature beyond the three-year file provided at that time, problems in knowing the correct commands and in retrieving too many irrelevant citations were the most common (Table 3). At the same time, users indicated that MELVYL MEDLINE had substantially improved bibliographic access to the biomedical journal literature; 80% (789 of 988) said they could find journal articles more quickly, 54% (534 of 988) said they found more relevant material in the library, and 38% (378 of 988) said they used the published literature more often (Table 4).

Design features

The evaluation also indicated some areas in which the design was flawed. As noted earlier, designers were aware of the difficulty users experience in using such relatively sophisticated searching features as explodes, indexing specificity, subheadings, and controlled vocabulary. Evaluation results showed that design concerns were well founded; MELVYL MEDLINE users made little use of MeSH. Although professional searchers relied heavily on the appropriate use of MeSH, MELVYL MEDLINE users consistently searched with keywords. Only one fourth of all searches used a subject heading index (Table 5). A review of transaction logs for subject headings searches found that half of these searches retrieved no results; this observation suggested that these searches were actually keyword searches erroneously entered in the controlled vocabulary index. Therefore, more than 80% of the searches for topical material in MELVYL MEDLINE contained keywords rather than controlled vocabulary headings.

Table 2
MELVYL MEDLINE users* (n = 2,173 respondents)

	Number (%)
Faculty	404 (18.6%)
Housestaff	249 (11.5%)
Graduate/medical school students	738 (34.0%)
Undergraduates	505 (23.2%)
Health professionals	107 (4.9%)
Other	170 (7.8%)
Total	2,173 (100.0%)

* Excluded library staff; based on 2,173 responses to an online questionnaire distributed to all MELVYL MEDLINE users February 26–March 12, 1989. Data were reported earlier in UC's DLA Bulletin 1989 Fall;9(2):14–6.

Table 4
Changes produced by MELVYL MEDLINE* (n = 988 responses)

Statement of change	Number in agreement (%)†
I can find journal articles more quickly	789 (79.9%)
I can find more relevant material in the library	534 (54.0%)
I use published literature more often	378 (38.3%)
I read more outside my specialty	182 (18.4%)
No change in my use of the library	50 (5.0%)
Other	23 (2.3%)

* Excluded library staff; data derived from 988 survey respondents who had used MELVYL MEDLINE. Printed questionnaires were distributed in November 1988 in the Biomedical Libraries at UC Irvine, UC San Diego, and UCLA; the Health Sciences Library at UC Davis; the UC San Francisco Library; and the Medical Center Libraries at UC Irvine, UC Davis, and UC San Diego.
† Respondents could choose several categories.
Data were reported earlier in UC's DLA Bulletin 1989 Fall;9(2):14–6.

Table 5
Distribution of searches in MELVYL MEDLINE* (n = 572,447 search commands)

Search type	Number (%)
Author	97,153 (17.0%)
Keyword:	
Keyword in title	46,630 (8.1%)
Keyword index	229,025 (40.0%)
Subject heading†	144,036 (25.2%)
Other‡	55,603 (9.7%)
Total	572,447 (100.0%)

* Based on transaction log data January–March 1990.
† Included all searches using MeSH terms: subject word, subject heading, major subject, exact subject, explodes, tree searches, and selects from thesaurus browse.
‡ Included journal title, date, and language searches.

Table 6
Awareness and use of MELVYL MEDLINE features*

Feature	Aware of feature Number (%)	Reporting use Number (%)
Limits:		
To language	613 (68.3%) (n = 897)	421 (49.3%) (n = 854)
To human subjects	490 (55.1%) (n = 890)	281 (32.9%) (n = 855)
Explode subjects	391 (44.4%) (n = 881)	194 (23.4%) (n = 830)
Browse:		
Subjects	731 (81.3%) (n = 899)	482 (58.1%) (n = 830)
Journal issues	526 (59.8%) (n = 880)	234 (28.4%) (n = 823)

* Excluded library staff; data derived from 988 survey respondents who had used MELVYL MEDLINE. Number of responses (n) varied because some respondents did not answer this question or answered it incompletely. Printed questionnaires were distributed in November 1988 in the Biomedical Libraries at UC Irvine, UC San Diego, and UCLA; the Health Sciences Library at UC Davis; the UC San Francisco Library, and the Medical Center Libraries at UC Irvine, UC Davis, and UC San Diego.
† Respondents could choose several categories.

In part, the preference for keyword searching may reflect a lack of awareness of the features that had been added to MELVYL MEDLINE to allow users to use MeSH successfully. Many were unaware of the "EXPLODE" command or the command to limit to human subjects, commands not found in other MELVYL catalog files (Table 6). Almost 20% had never heard of the "BROWSE" command, available in the MELVYL catalog, which had been enhanced in MELVYL MEDLINE to provide online access to the MEDLINE thesaurus. An unexpected result of adopting a familiar books interface for searching the journal literature appeared to be that users did not learn the commands specifically added for journal article searching.

At the same time, several findings suggested that the high percentage of keyword searching reflected user preference for this approach. First, even those users who said they were aware of MeSH-related commands stated that they rarely made use of them. Second, the keyword index was a new feature in MELVYL MEDLINE, not present in the MELVYL catalog, yet users quickly adopted it while ignoring other new MeSH-related features. Finally, in the menu-driven mode for MELVYL MEDLINE, users were given an explicit choice between locating subjects through keywords or by browsing subject headings. The keyword approach was described on the screen as a "quick and dirty" approach to searching, while locating subjects by browsing MeSH was described as a more comprehensive search. Transaction logs showed that users chose the keyword approach over browsing seven to one.

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Thus, the MELVYL MEDLINE interface, which did not promote use of MeSH, appeared to have fostered a keyword approach to searching. From the users' perspective, this approach seemed quite satisfactory; from the professional searchers' perspective, it was a cause for concern. If users were not taking advantage of the powerful retrieval that using MeSH can provide, it is likely that they were experiencing low levels of recall and precision [5]. The design decision to adapt a familiar interface, as intended, made the system easy to learn, decreased the need for training, and probably contributed to its widespread use. At the same time, it did little to promote use of sophisticated MEDLINE search techniques.

Effect on services

The effect on library services from the introduction of MELVYL MEDLINE has been significant and varied. Tables 7–9 show the effect of the system on three measurable outputs: database accesses, interlibrary loans (ILLs), and reference transactions. Reference transactions and ILLs underwent marked increases after the system was introduced in November of 1987. Overall, UC health sciences libraries experienced a 23% increase in reference transactions and a 38% in-

Table 7
Staff-provided MEDLINE searches*

Campus	1983/84	1985/86	Change (%)	1986/87	1988/89	Change (%)
San Diego	933	1,319	+386 (+41.4%)	748	347	−401 (−53.6%)
Davis	956	1,062	+106 (+11.1%)	1,163	562	−601 (−51.7%)
Irvine	2,550	2,391	−159 (−6.2%)	1,609	902	−707 (−43.9%)
Los Angeles	1,477	1,469	−8 (−0.5%)	1,019	513	−506 (−49.7%)
San Francisco	786	711	−75 (−9.5%)	666	234	−432 (−64.9%)
Total	6,702	6,952	+250 (+3.7%)	5,205	2,558	−2,647 (−50.9%)

* Data for 1983–1986 from *Annual Statistics of Medical School Libraries in the United States and Canada*, 7th through 9th editions. Houston, Texas: Association of Academic Health Sciences Library Directors, 1983/84–1985/86. Data for 1986–1989 reported by libraries.

crease in ILLs between 1986/87 and 1988/89. This compared to a drop of 2% in both reference transactions and interlibrary borrowing during the three years preceding the project. On the other hand, staff-provided MEDLINE searches dropped an average of 51% between 1986/87 and 1988/89, as compared to an increase of 4% in the three preceding years. MELVYL MEDLINE was not, of course, the sole factor influencing these changes. However, the changes were remarkably similar to those reported from Washington University, where staff experienced a 23% increase in quick reference questions and an 18% decline in staff-provided searches after introducing their BACS®††/MEDLINE end-user system [6]. Moreover, aside from a reduction in serial subscriptions in response to budgetary stringencies (which may well have affected ILLs), MELVYL MEDLINE was the only consistent factor across all campuses and, therefore, was probably responsible for most of the changes in use of services.

As might be imagined, variations in activity of this magnitude had considerable effects on staffing and services. Rochelle Clary commented in *Medical Reference Services Quarterly* that providing MELVYL MEDLINE necessitated exploring staffing alternatives, reordering priorities, learning to work with new software, and developing a better understanding of end-user needs for information [7]. As in other implementations of MEDLINE, additional staff were needed at reference service points, and sessions to teach use of the database needed to be added to already crowded instructional schedules [8]. More mundane effects were also apparent, as additional printers required additional staff attention, and the password system required publicity and staff training for implementation. While no data were available from the nonhealth sciences libraries, anecdotal evidence suggested that these sites, too, found an increase in reference questions and a need to provide additional instruction after implementing MELVYL MEDLINE [9].

A chief goal of the project was to increase use of the biomedical literature. Although it was obvious that achieving this goal would have marked effects on public services, in many instances the magnitude of the effects took libraries by surprise. All UC health sciences libraries had offered mediated searching of MEDLINE for many years, and most had many active

†† BACS is a registered trademark of Washington University, School of Medicine Library, St. Louis, Missouri.

Table 8
ILL borrowing*

Campus	1983/84	1985/86	Change (%)	1986/87	1988/89	Change (%)
San Diego	1,485	1,904	+419 (+28.2%)	1,737	2,443	+706 (+40.6%)
Davis	1,181	1,270	+89 (+7.5%)	1,384	1,802	+418 (+30.2%)
Irvine	3,624	2,330	−1,294 (−35.7%)	2,466	3,467	+1,001 (+40.6%)
Los Angeles†	1,175	1,155	−20 (−1.7%)	965	1,585	+620 (+64.2%)
San Francisco	2,302	2,959	+657 (+28.5%)	3,205	4,196	+991 (+30.9%)
Total	9,767	9,618	−149 (−1.5%)	9,757	13,493	+3,736 (+38.3%)

* Based on data reported in *Annual Statistics of Medical School Libraries in the United States and Canada*, 7th through 12th editions. Houston, Texas: Association of Academic Health Sciences Library Directors, 1983/84–1988/89.
† Change due in part to change in user fees charged for ILL borrowing requests.

Table 9
Reference transactions*

Campus	1983/84	1985/86	Change (%)	1986/87	1988/89	Change (%)
San Diego	25,135	20,645	−4,490 (−17.9%)	23,598	29,483	+5,885 (+24.9%)
Davis	15,886	15,708	−178 (−1.1%)	16,821	21,498	+4,677 (+27.8%)
Irvine	25,381	34,264	+8,883 (+35.0%)	28,839	45,735	+16,896 (+58.6%)
Los Angeles	58,846	53,817	−5,029 (−8.5%)	49,997	48,873	−1,124 (−2.2%)
San Francisco	18,033	16,575	−1,458 (−8.1%)	21,399	27,534	+6,135 (+28.7%)
Total	143,281	141,009	−2,272 (−1.6%)	140,654	173,123	+32,469 (+23.1%)

* Based on data reported in *Annual Statistics of Medical School Libraries in the United States and Canada*, 7th through 12th editions. Houston, Texas: Association of Academic Health Sciences Library Directors, 1983/84–1988/89.

end-user searchers as well. However, availability of MEDLINE on the public online catalog vastly increased its use, and even with a relatively user-friendly familiar system, the instructional and reference attention required by end users vastly increased as well.

The MELVYL MEDLINE project accomplished the goal of providing online bibliographic access to the biomedical journal literature for thousands of UC faculty, staff, and students without the costly duplication of efforts that would have resulted from individual campus installations.

DISCUSSION AND CONCLUSIONS

The MELVYL MEDLINE project has been an unqualified success in several respects. Most important, it accomplished the goal of providing online bibliographic access to the biomedical journal literature for thousands of UC faculty, staff, and students without the costly duplication of efforts that would have resulted from individual campus installations. It also demonstrated the broad applicability to other disciplines of a specialized database such as MEDLINE when it is readily accessible on an online catalog.

Moreover, implementation of MELVYL MEDLINE established methodology and policies for implementing additional databases on the MELVYL catalog that may prove useful to other institutions as well. The project's organizational structure, with centralized training support and a small task force of librarians working directly with the design team, was so successful that it served as the model for a subsequent initiative to add the *Current Contents*®‡‡ database on the MELVYL catalog. Key elements of the MELVYL MEDLINE training program also served as a model for this later initiative. These included provision for the training coordinator as a task force member and centralized development of instructional materials. As an active participant in the design process, the training coordinator was well informed about software changes and system enhancements and could quickly alert local campus contacts to changes and revise instructional materials. In addition, through constant work with the database, the coordinator also uncovered software problems and recommended system refinements. Centralized development of the instructional materials insured overall quality control for the information distributed, prevented duplication of efforts on the individual campuses, and expedited MELVYL MEDLINE implementation at multiple sites.

The project also provided insight into effective means of obtaining information from the users' perspective. In particular, it revealed that a users' group such as the Users Advisory Council was not especially helpful in a fast-moving development project. Given the complexity of organizing faculty and students from three campuses for meaningful involvement, the project team found the council structure too cumbersome and unresponsive to needs. Far better was the task force members' informal enlistment of interested library users to provide feedback when needed. The project team learned, too, that transaction log data were more useful in identifying problems with the database than were the questionnaire data. The latter documented success of the project and the need to expand the years of database coverage, but the transaction log data revealed far more about how the database was being used and what features needed enhancements and improvements.

The project's major design question remains whether, in designing the interface today, one would provide the full array of options that are available now in MELVYL MEDLINE but seldom used. As discussed earlier, most end users did not take advantage of the

‡‡ *Current Contents* is a registered trademark of the Institute for Scientific Information.

sophisticated features of any searching interface, and the nature of the MELVYL interface perhaps further encouraged a simplistic keyword approach to searching. For librarians and frequent searchers, however, some of these searching capabilities are invaluable in improving the relevancy of search retrievals. Undoubtedly, the preferred approach is to allow for introducing levels of complexity into an interface in stages with evaluations of trade-offs at each decision point.

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Work to make MELVYL MEDLINE more responsive to user needs continues. From the project's evaluations it was clear that users were eager to have additional years of the database, and beginning in 1990, the database was increased to a five-year file. Another enhancement scheduled for spring 1991 linked search retrievals from MELVYL MEDLINE to the MELVYL catalog's periodical holdings file, CALLS (California Academic Libraries List of Serials). Users had the option of displaying journal locations and call numbers for each citation. Implementation of set searching capability is also underway. In MELVYL MEDLINE's original design, searchers could build on a preceding search statement, but they could not combine numbered search statements. Because of its perceived complexity, set searching will be an optional selection in MELVYL MEDLINE, rather than the default search technique. Both set searching and linking to CALLS functions will also be available on other MELVYL databases.

Two additional enhancements are under discussion that would expand the capabilities of MELVYL MEDLINE. Recognizing the potential for merging databases in the online catalog, DLA staff have begun considering the feasibility of enriching and updating MELVYL MEDLINE by combining it with the *Life Sciences* and *Clinical Medicine* files from MELVYL *Current Contents*. Keywords from *Current Contents* citations would be merged into the keyword and title word indexes of MELVYL MEDLINE; *Current Contents* journal information would be normalized to match MEDLINE journal titles and then added to the MELVYL MEDLINE journal title file. For those seeking biomedical information, this merged superset would provide one unified database, rather than separate files, as well as more current citations than are presently available in MELVYL MEDLINE alone.

The second enhancement, for which a pilot project is underway, is a document delivery request system for the MELVYL catalog. With this feature, online catalog users would be able to transfer a retrieved citation from a MELVYL MEDLINE search into an online message form requesting a photocopy of the article. The program would then route the request to the user's local campus document delivery system to be filled from the campus library collection or requested on ILL from another campus. Plans also call for linkage to an outside vendor as a second document delivery option, especially for items not available within UC.

During the six-year time span of this project, tremendous change has taken place in computing and networking capabilities. It is hard to realize now that, at the inception of planning for this project in 1983, only three choices existed for locally mounted MEDLINE systems—the early versions of miniMEDLINE SYSTEM®, PaperChase℠, and CITE MEDLINE. Today's networking capabilities afford ready access to MELVYL MEDLINE from offices, homes, and laboratories, as well as from UC library sites throughout the state of California. Its implementation built upon resources already in place for UC's MELVYL catalog by using the same telecommunications network, library terminals, and mainframe computing equipment. As this project demonstrates, health sciences libraries must look not only within their own local institutions, but beyond to state, regional, and national resources as well, in deciding appropriate configurations for implementing access to electronic databases. UC is one of many institutions developing guidelines and procedures to assist in this decision-making process.

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§§ MiniMEDLINE SYSTEM is a registered trademark of Dahlgren Memorial Library, Georgetown University Medical Center, Washington, D.C.; PaperChase is a trademark of Beth Israel Hospital.

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FROM THE *BULLETIN* – 50 YEARS AGO

Afterthought or a memorandum on medical poets

By Merrill Moore, M.D.

We do not exactly know what happens to the physician who becomes a poet. It may be an atypical kind of development that he undergoes. Part of him becomes mature as a professional man but part of him (what the psychoanalyst would call the infantile) remains childish or child-like and plays with poetry. It is fortunate for the physician that he has this outlet. His poetry is probably more important to him than it is to other people as an emotional interest or an expression of his feelings and inner personality which most of the time he has to repress behind the facade or mask of his professional personality.

This may be what makes the writing of poetry especially interesting (and literary production in general interesting) to physicians and it may be the point that distinguishes them from their fellow-poets who are not physicians.

We should study the physician who is a poet more as well as all poets. We should study all poets more and all physicians and all people and their personalities for that matter if we are ever going to know what poetry really means and what poetry really is.

Bull Med Libr Assoc 1941 Jun;29(4):200-1