

## Academic Information Management Scenarios: Library Roles

Scenarios are indicative, not prescriptive. Those in the previous chapter are broad-brush canvases of technology adoption. This section aims at describing some specific ways health sciences libraries can respond to research, medical care, medical education, and management needs for better information transfer in the AHSC. Each professional group is described separately because the information needs, uses, requirements, and expectations of each vary widely now. Although some literature exists that characterizes the differences in approaches to information by these professional groups, very little is known about the mental processes of information acquisition, processing, storage, recall, or use. The next decades offer extraordinary new opportunities to use the technologies not only to improve information transfer processes but also to begin to understand the process better. Until the recent development of artificial intelligence research, which attempts to represent human knowledge and decision processes through computer programs, human-information processing was a completely neglected area of intellectual inquiry. The quality of Stage 3 medical information management is likely to depend on research in this area of knowledge representation. One laboratory for such study and the place for field research should be the library or information management center as it evolves in the future.

Each scenario begins with a description of the typical library-user interaction process and then proceeds to Stage 1 and

Stage 2. The purpose of these scenarios is to show how the general scenario operates at a specific level and to illustrate some of the critical problem areas and planning issues that will soon confront the AHSC administrator and faculty.

### Research

Scientists create theories, derive inferences, design experiments, acquire data, analyze data, test theories, write papers, give talks, maintain bibliographies, and read papers. All of this in turn leads to more theories to continue the loop. The basic problem for the researcher is effective time use in information management, in monitoring a massive general data base on the one hand and in finding the specific relevant information in a narrow specialized area on the other. In both cases, the researcher is looking for needles in many haystacks. The library and the literature are only two of these haystacks.

### THE PRESENT

Researchers generally have some kind of communication network with selected colleagues and a current awareness system to keep up with new work. They need to search bibliographic data bases to find relevant information, to check collected data against standardized data, and to build personal knowledge files and reprint files. To carry out these information management tasks, the researcher subscribes to a few journals, has access to a selective dissemination of information system such

as the National Library of Medicine's SDI-LINE, writes for reprints, participates in an "invisible college," and goes to the library periodically to collect more information. In the library, the researcher arranges for data base searches, finds out about new sources, gets books and journal articles from the stacks and photcopies them, arranges for interlibrary loans of materials the library does not own, and browses for new ideas and associations. The researcher seeks information in short bursts of effort; it is time away from the bench, time-consuming, and frequently unrewarding drudgery.

Figure 1 is a schematic illustration of a typical literature search transaction. The researcher or research assistant tells the librarian, sends a message, or submits a form requesting a search on a topic of interest. There is sometimes an interview to clarify the topic. The librarian accesses

the appropriate data base and performs the search, sometimes on the spot. The product is frequently picked up later by someone or mailed to the researcher. The search result, usually available within 24 hours, is generally unmodified, with references being listed in random order. Sometimes duplicate and obviously irrelevant items are scratched out and highly relevant ones highlighted. From here on, the researcher or research assistant is unaided. Each must consult the card catalog, find the material, copy it, and index it for a personal reprint collection. An interlibrary loan, initiated for items not owned by the library, means new forms to fill out, a 10-to-14 day waiting period, and sometimes a charge ranging from \$1 to \$15. The research assistant usually substitutes for the researcher throughout most of these transactions. Each intermediary between the researcher and the information gener-

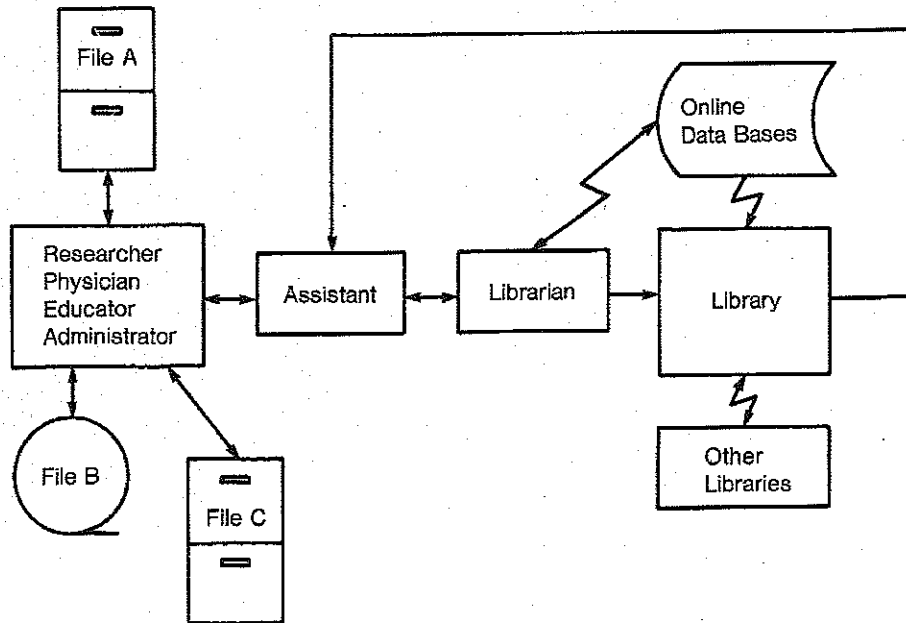


FIGURE 1  
Schematic diagram of typical information search transaction.

Library Roles

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ally dilutes the accuracy, the acceptability, and the timely availability of the results. In the literature search process, there are four largely independent loops (Figure 2).

Both the researcher and the library must keep manual records to maintain track of each step in the transactional loops. For the library, the purpose is to bill for services according to policy and provide information management system data; for

the researcher, the purpose is to ensure a quality, usable, personal data base. For both, the labor is redundant and time-consuming.

STAGE 1

In Stage 1, the objective is to establish a homogeneous transfer chain that reduces the researcher's time intensiveness and im-

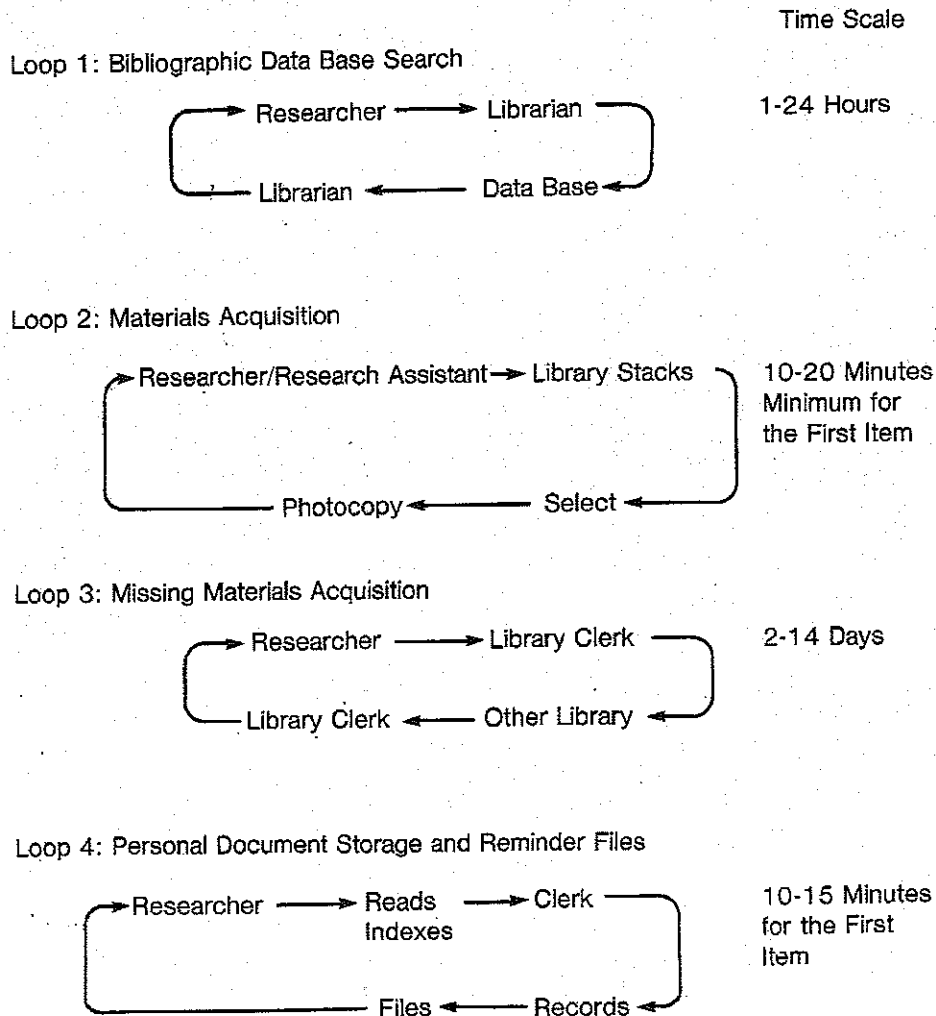
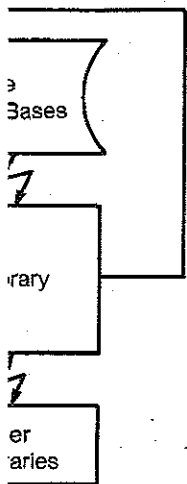


FIGURE 2  
 Transactional loops in typical search of library resources.



proves the speed of the loops or eliminates some.

Both the researchers and the librarians have personal communications terminals or microcomputers. In the search formulation the researchers and librarians discuss the problem to be solved rather than the topic area of the search. This permits librarians to offer more options for finding the most useful information as well as to define the search strategy. The discussion takes place over the phone while both terminals are connected to the subject heading lists so that there can be simultaneous consultation of the files. Having defined the search strategy, they switch over to the data base and begin the search. Researchers who search data bases regularly may choose to perform their own searches, reserving the interactive process for the unusual or unfamiliar data base (65). As they look at the items retrieved, the researchers select citations. Some of these are directed through a simple computer command into a temporary file for later retrieval from the library, and others are deposited into a personal file of items to be looked at later. All stored information contains the full bibliographic entry, along with the subject headings assigned by the source data base. Sometimes an abstract is available and is also saved. The researcher signs off when the session is complete, and a charge is automatically registered against a predetermined budget account.

In the library, a clerk sees on the work screen the citations the researcher requested. The clerk checks the library's online catalog. Articles available in the library are photocopied and delivered the same day. For materials that are not available, a request for copy is automatically generated and directed to the closest library in a network system that owns the materials. That library makes copies, sends them by mail or telefacsimile to the re-

### Information in Academic Health Centers

searcher, and bills for the service. A status report on the requests is sent to the researcher's computer. To control costs, the researcher specifies beforehand the levels of service desired.

The library is asked to supply search results in one of several formats: on paper in a certain order, on a floppy or hard disk that can be used in the researcher's particular microcomputer, or online to a file in a large central computer. A specific librarian is assigned to specific research teams and works as liaison to the teams. Conversely, a member of the research team is detailed to the library for an extensive training period in order to build a mutually compatible file control system.

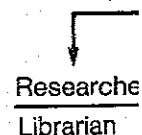
Information transfer loops in Stage 1 are reduced from four to two (Figure 3). Out of the bibliographic data base search transaction (Loop 1) comes selection of materials and the development of personal information files, eliminating all rekeyboarding of bibliographic information. Loop 2 becomes a materials delivery sequence in which the library, not the researcher, assumes responsibility for location, reproduction, and delivery, whether locally owned or not. The researcher gains a new management tool to track unfulfilled requests. Lower cost personnel time is used to carry out the tasks. The number of intermediaries between the researcher and information is reduced, and a mutually agreed upon process for information transfer management is developed.

#### STAGE 2

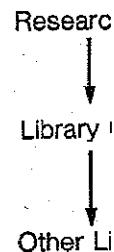
In Stage 2, the information environment has become extremely complex and dense. Nearly all information sources are available for online searching and retrieval and require the use of many different strategies, vocabularies, and search protocols. A significant number of journals, bibliographic data bases, and 1,000 or more numeric and information files are only

### Library Roles

#### Loop 1: Bibliographic



#### Loop 2: Materials



#### Transactional loops

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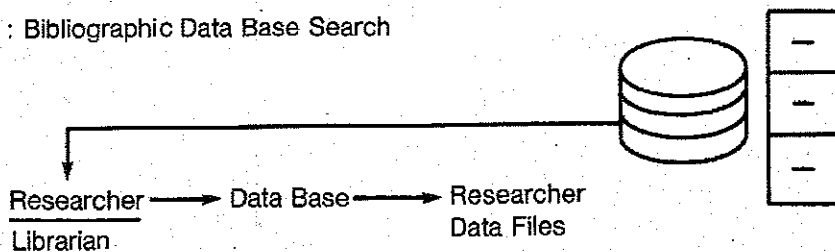
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Loop 1: Bibliographic Data Base Search



Loop 2: Materials Acquisition and File Maintenance

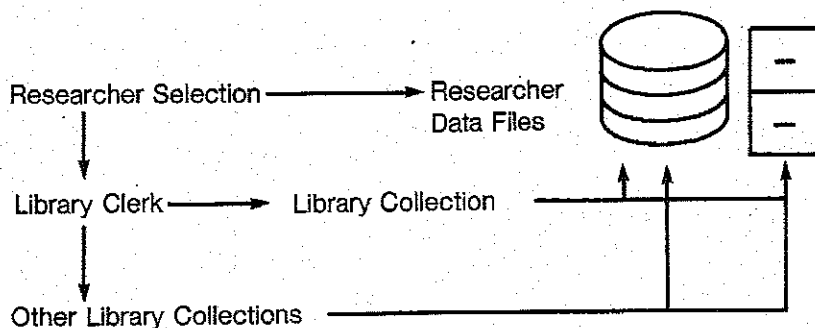


FIGURE 3

Transactional loops in search of library resources in Stage 1 of evolution of information technology.

available online from videodisk collections or other remote storage centers. Many files such as MEDLINE have been made "user-friendly" (accessible by inexperienced or infrequent users), but most require special subject knowledge or bibliographic skills to search the files effectively and efficiently.

The information broker has a significant and essential role. This person is a specialist in the use of multidisciplinary information files and is able to combine search results from multiple files using citation techniques and other concept-linking fea-

tures to produce highly organized and discriminating search results.

Because of this function and because the librarian/information broker is also an expert in the management of information systems, students consult the librarian as well as other faculty members prior to developing research proposals in order to learn about the intensity of work in the field and to get advice on appropriate information management methodologies to employ.

The library assumes responsibility for maintaining an institutional academic in-

formation base. It maintains active files of faculty research and instructional specialties. These are routinely checked against all online data bases for new information materials that should be scanned by the faculty. The library maintains authoritative files of most frequently cited articles and of citations judged by faculty members to be of high quality. This is done by operating a central videodisk file that replaces reprint collections as we now know them or by linking distributed networks of files throughout the AHSC. As literature searches are performed, there are simultaneous matches to the central academic information base, and retrieved items are tagged with quality indicators assigned by the faculty. This filtering system, which posts negative as well as positive evaluations, provides guidance to the novice researcher or the experienced faculty member undertaking to read in an unfamiliar subject. The central file becomes a bibliographic representation of the AHSC faculty's knowledge base.

The library also serves as a clearinghouse for ephemeral and fugitive documents that faculty members choose to make available as a part of the public record but are not yet part of the peer-reviewed archival record of knowledge. Interim project reports are an example. Garvey (66) suggests the possibility of including in the file manuscripts under review for publication. This permits simplified maintenance of faculty publication lists in consistent bibliographic form and fills in an important link missing in the present publishing chain. Many researchers, especially younger scientists who are not members of invisible colleges, interested in following the work of others could utilize these new files. Libraries thus provide an important new information source.

#### Health Care Practice

The physician is used in this section to represent a spectrum of health care prac-

#### Information in Academic Health Centers

tioners. The scenario can also apply to many other different types of practitioners who use the recorded literature base, such as pharmacists, nurses, and therapists.

#### THE PROBLEM

Physicians see patients presenting problems, form hypotheses, collect data, analyze data, test hypotheses, design treatments, and monitor responses to treatments. In addition, on the basis of these experiences, some physicians, especially those who are faculty members in academic centers, develop theories, derive inferences, design experiments, collect and analyze data, test theories, write papers, give talks, maintain bibliographies, and read papers; this leads to more theories.

Not a great deal is known about the ways individuals acquire and use information for problem-solving purposes (67). In general, in the first instance, physicians seek information to refresh their memories about specific conditions, to seek validation of a technique, to find new treatment modalities, or to continue their education. The nature of health care practice requires that reliable information be available quickly in easily comprehended and digestible formats and at the place where it is needed. Physicians keep up-to-date generally by scanning two or three high quality general journals, such as *The New England Journal of Medicine*, *the Journal of the American Medical Association*, *the British Medical Journal*, and two or three specialty or professional journals. The popular press provides a surprising amount of information, about 25 percent (68). Specific information is usually sought, by order of preference, from an office collection, through consulting a colleague, through seeking expert opinion, or by using a library (69). There is growing evidence that physicians use libraries and information in ways that vary with their education and work styles. For example, family-practice, community

#### Library Roles

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hospital-based physicians trained after 1969 and practicing in Massachusetts were found to use community hospital libraries more than their pre-1968-educated colleagues (70). Different specialties have different literature orientations (71). Surgeons and other specialists are less likely to use drug salesmen as prime information sources than other practitioners (72).

Physicians have little time for reading. The low rate of use of the literature is reflected in sometimes alarmingly slow diffusion rates of medical information. Kessler (73) found, 15 years after publication of six studies demonstrating the ineffectiveness of stilbestrol in preventing spontaneous abortion, that 50,000 women a year were still receiving the drug for that purpose; and, 10 years after controlled trials showed bed rest to be of no therapeutic benefit in treating acute viral hepatitis, he found that bed rest was prescribed for more than half the hospital patients with viral hepatitis.

The use of libraries by physicians varies from that of researchers. Clinicians seek specific information or data presented in a form easy to read and use; they are problem-oriented; information must be immediately at hand; and, information must come from unbiased or authoritative sources (74). They also need a quality filtered file. A recent study found more than two-thirds of the studies in the best medical journals contained unwarranted conclusions (75).

To cope with the factors inhibiting information use, librarians have devised several methods to take literature to the practitioner in the clinical setting. LATCH (Literature Attached to the Chart) is one method. A physician can request one or two articles on a clinical problem. These articles are selected by the librarian and attached to the patient's hospital chart. After their use, these articles are sometimes stored on the wards but more frequently returned to the library where they become

a resource for later use, sometimes by students and residents (76).

The clinical medical librarian represents a technique used most extensively at the University of Missouri-Kansas City School of Medicine but growing more common in other medical schools and teaching hospital settings. The clinical medical librarian (CML) attends teaching rounds as a regular participant and is responsible for bringing information that amplifies data or addresses questions raised in the rounds to the group. After their immediate use, these documents stay on the service for staff consultation, or they are returned to the library for later recycled uses (77-79).

#### STAGE I

The challenge of the first stage is far from being met if we agree with Anlyan (80) that it is "imperative that the medical student, the resident, and the practicing physician in 1985 have on-line, immediate access to the latest medical information available." The physician should have access on a 24-hour basis to needed information, whether from patient files, large clinical data bases from remote sites such as the ischemic heart disease data base at Duke University Medical Center, or a library. The physician, more than anyone, needs a filtered response system that transfers information and documents quickly.

In Stage I, the physician has an office computer. The hospital and the library have computers that interface. All three are linked by an electronic mail system. Some large hospital systems have facsimile equipment and TV circuits. In such settings physicians call or send an electronic message to the librarian, requesting certain information and specifying the criteria that should be used to select materials. They indicate the content level (facts, clinical trial, review article), the form (paper copy, floppy disk, direct transmission), time frame (within x hours), and the conditions

that apply to the sources (only certain journals published within certain years). Some physicians have stored these information response criteria with the library so that if they call the library when no one is on duty they can enter requests using a protocol that captures this information. Any of the information techniques used by the researcher described earlier are available to the physician.

Figure 4 depicts the Stage 1 version of Figure 1. Two types of queries are typical: the generic problem and the case-specific problem. The generic query might run this way: "I am interested in American and European drugs to prevent spontaneous abortion that have been studied in the past 10 years. Find a review article; and if it is from any of the 10 journals I have in my

office, send the citation to my file A (CME reading file) and transmit the list of references in the review article to file B (bibliography for a book in progress). If it is from a journal I don't own, and if it is longer than 10 pages, send me a photocopy of the article; but if it is less than 10 pages, send a telefacsimile to my office. Also, select two articles on the use of stilbestrol in the treatment of spontaneous abortion. I only want reports of controlled clinical trials using a double-blind technique, which, in the opinion of yourself and others, is sound work. Transmit the citation along with an abstract or summary and the data displays to file H, record 000 in the hospital (want to make sure the residents read them) and to my file C, record 000 (office patient record file) and file D

Library Roles

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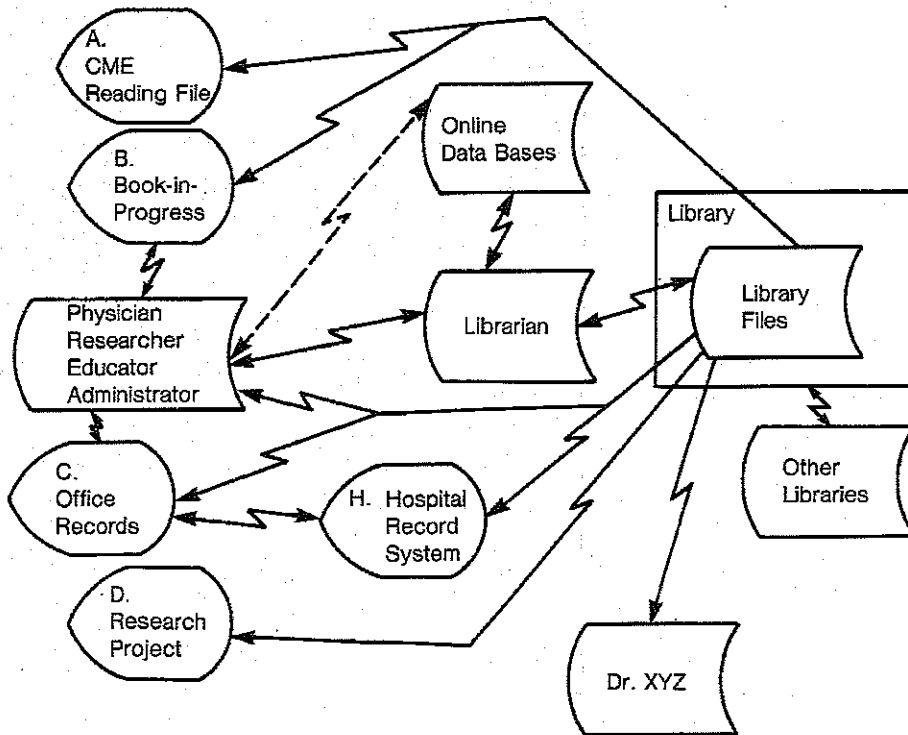


FIGURE 4 Literature search transaction in Stage 1 of evolution of information technology.

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section 000 (research project file). I need the articles by 6 a.m. tomorrow (it is now 5:30 p.m.). And, oh yes, I think Drs. X and Z will be interested in these articles. Let them know about them."

The case-specific query tends to sound like this: "I have a patient who has aortic stenosis, a left ventricular dysfunction, and a mean pressure gradient of less than 50. What is the outcome of an aortic valve replacement? What are the alternatives?" Or, "I have a patient who has a head injury and today has an increase in intracranial pressure. We have him on cimetidine as a routine prevention of G.I. bleeding. Could the increased intracranial pressure be a side effect of the cimetidine?" In both cases the librarian supplies the answer with references to the literature via internal telemail connections and sends telefacsimile copies to files as the physician desires.

It is unlikely that this Stage 1 scenario is in place anywhere, although the components exist in many places, and several libraries have sufficient expertise to build the necessary computer linkages to link in the details in this light sketch.

STAGES 2 AND 3

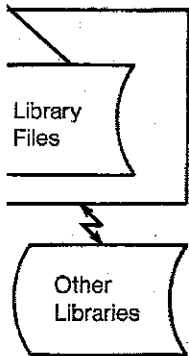
Stage 2 moves beyond delivering documents to the physician in the fastest way technology allows to delivering repackaged and synthesized selected information. The query is: "I have a 16-year-old boy in the hospital with a nasopharyngeal angiofibroma. What are the best of various management options available: surgery, radiation, cryotherapy, electrocoagulation, hormonal therapy, embolization, injection of sclerosing agents?" The librarian finds the relevant articles, extracts the salient results, and prepares a mini-review of the literature. Many of these reviews may exist in developing clinical knowledge bases. The librarian consults the files of other libraries to see whether the query has been

posed and answered elsewhere recently. In some cases, the query is answered by consulting the knowledge bases maintained by commercial publishers or medical societies and associations. The physician who wishes to use the knowledge bases directly may be instructed by the librarian through the use of connected terminals.

The library, as a result of extensive experience with LATCH and CML services in Stage 1, has developed specialized literature reference files for all clinical services. These are on videodisks in the library, and individuals call up information from terminals at offices or nursing stations for data display at any time.

The physician periodically and routinely reviews his patient files to identify areas for continuing medical education. The librarian participates in this process by preparing literature reviews. Again, as with the researcher, a close working relationship develops between the librarian and the physician as files become more complex and need to be integrated into a single system. More data are linked within the hospital services and between the physician's office files. Drug interactions data bases, for example, are linked to hospital and medical information systems so that potential problems can be instantly identified. The public research knowledge base is linked to the clinical knowledge bases for more ready dissemination of peer-reviewed results applicable to practice.

Eventually, moving into Stage 3, the knowledge bases of medicine become available for instant recall. Certain national data information files are maintained. For example, a register of serial numbers for pacemakers and other implanted devices helps to identify the patients quickly and easily in the event of need for rapid dissemination of new information. Information that is stored in files can be retrieved by human speech commands instead of keyboarded instructions,



technology.

and the output is displayed either visually or in audio format. At this stage the physician is assisted by computers as memory extenders and is linked to the best information and knowledge bases available.

### Medical Education

Although medicine as a profession is dependent on information, the control and management of the medical knowledge base are not deliberately taught in medical centers.

#### CHANGING EDUCATIONAL PREMISES

"The idea of a permanent education is bankrupt; re-education is constant." This theme has dominated the medical education literature for more than 20 years but has become most insistent in the last few years (48, 81-84). "Nowadays, nothing we learn lasts for the rest of one's life. Our forefathers relied for a whole lifespan on what they learned in their youth at school; we have to learn and relearn every five years, if we are not to be hopelessly out of date." This quotation from a novel by Goethe written in 1809 suggests the concept is far from new (85). The problem has taken on greater urgency in the face of continuing exponential growth of new knowledge and the increased acceptance that the core medical knowledge base is beyond the capacity of individual memory. "For at least 50 percent of their career [physicians are] prescribing drugs unknown when they were students, diagnosing diseases they never heard of as students, or performing operations not conceived of at the time of their graduation," writes Rall (86).

A second theme that receives equal emphasis is that those who are taught what to learn are prepared only for the present. Education for the future requires learning how to learn (38, 83, 87). The goal today, as it was for Comenius in the 17th century,

#### Information in Academic Health Centers

is to find a method of instruction by which teachers teach less but learners learn more. But this does not mean more in a quantitative sense. We have passed the point of absurdity in a quantitative sense. Students are expected to master approximately 75,000 facts or about 55,000 concepts in a traditional four-year curriculum (88). Students average 22 to 25 hours of study a week as freshmen and sophomores and 17 hours of study a week as juniors and seniors, according to a paper presented by G. D. Miller, M.D., and E. C. Miller, M.D., University of Nevada School of Medicine, at the AAMC's Research in Medical Education Conference in 1980. If there are 150 weeks of instruction, the student must learn 23.8 facts/17 concepts per hour.

The challenge is to learn in a more qualitative sense. The need to move away from indoctrination, the dependent learner mode of teaching, toward the decision-oriented adult learning process is gaining wider recognition (84, 89-91). This process favors the principles of active informed learning which results from self-recognition of learning needs and the ability to find and incorporate information with knowledge already held (92-94).

However strongly these ideas are stated and reinforced, their translation into practice is spotty. Academic programs that instruct students on how to develop a useful memory support system and a personal lifelong learning plan are rare. According to Houle (83), "The necessity to keep learning throughout life seems so obvious to the leaders of most professions that they believe its self evidence will cause it to be internalized within the value system and patterns of every practitioner. But an examination of the schools will show this idea is nowhere systematically and thoroughly communicated." Studies in medical education have noted that the profes-

#### Library Roles

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sion seems unwilling to sponsor a serious inquiry into fundamental questions about the educational paradigm (95, 96). However, the Association of American Medical Colleges has undertaken a three-year study, sponsored by the Henry J. Kaiser Family Foundation, of the undergraduate medical education continuum.

A third theme is the need to educate physicians to understand the design and use of computers to manage the knowledge base of medicine and its practice. Lewis (97), among others, says that "it is not possible to conceive of a scientist in the 1980s who does not have a broad perspective of perhaps the most important tool of science, the computer." The computer's impact in medical education is of two kinds. It has been used as a technology to assist instruction and the mastery of a body of knowledge. More recently, due to research in artificial intelligence systems, the computer has been used to represent the knowledge base of medicine itself. In this latter capacity the computer represents an extended memory for the profession, and it is expected to change the content and method of medical education by replacing fact acquisition with the broad study of decision processes and strategies underlying patient care (39, 98, 99).

Different premises for education have been articulated, but the clear path to reach those ends has not been. Jonas (100) argues that medical education has undergone a major change roughly every 100 years since 1800 when training shifted from apprentice to school-based study. The shift to scientific university-based programs occurred around 1900. The year 2000 should bring yet another shift. In the meantime, some immediately useful and simple steps can be taken to pave the way for a shift in approach to the information system-based educational paradigm that appears to be forming.

## THE LIBRARY RESPONSE

What can the library contribute to the education of the student to develop a systematic process of lifelong self-education? There are two aspects to the education issue. One is to learn the problem-solving and decision process skills needed to use the facts and content base of medicine effectively. The other is to learn how to develop and manage a personal knowledge base that exploits the computer as a personal tool. It is to this latter effort that the library and librarian can make a significant contribution. But a successful effort will require a multidisciplinary team approach involving medical educators, clinicians, basic scientists, and librarians.

The learning objectives for information management need to be placed strategically in the curriculum. In the first two years, medical students are largely dependent learners. They use the lecture as an aural textbook, the library as a study hall, and books, media, and computer-based systems as fact banks to be absorbed. Beginning in the third year, students are expected to function as adult learners. Most libraries find that students only want to learn how to use the library when they begin clerkships, if then, but find the need imperative as residents. Unfortunately, at that point they are not available to the library for passive learning, to which the library, as much as the school, is now geared.

The move into Stage 1 is pressing. The current focus in many schools on primary care puts students in training in many locations where information delivery systems are the weakest—in offices, ambulatory clinics, and community hospitals. Advances need to be made on several fronts at the same time.

Stage 1—Most manual files used in teaching are converted to digital data

bases. Course syllabi are available for on-line consultation by students. The library maintains all reading lists in the same data base. In addition to the bibliographic information, the file contains abstracts and summaries keyed to syllabi content. Of course, the library's own materials, books, journal articles, slides, and other media can be located through online catalogs. Each student has a terminal and personal file space on the medical center computer or owns a personal microcomputer. By the end of the second year, students are expected to have developed personal information management systems based on the principle of a personal textbook (101). Students know how to transfer information from many sources, including library files, into their personal knowledge systems. Maintaining and using such a file on a daily basis assists learning by forcing organization of materials in the mind and clarifying concepts (102, 103).

Early in the first year, classes meet with the librarian who, as an instructional specialist, demonstrates different types of personal files used by different faculty members and points out the advantages and disadvantages of each. Students select the model that best suits their existing information use habits and skills. The models, although somewhat different in format and approach, have identical basic content and can communicate with other systems and files. Librarians and students who have already developed files work with younger students to add new materials and manipulate files to support best the student's style. When students encounter programming problems with their microcomputers, they call the library, which is able to help because it must interface its systems with many others. This expertise is reinforced through communications networks with other libraries, with medical center computing units, and with computer-user groups. The librarian, along with other

faculty members, leads student computer-interest groups.

The student wants to find more recent information on a subject than is given in a syllabus. Perhaps the student knows there is a self-guide to MEDLINE and other data base searching but would rather have personal assistance in using the system for the first time. The librarian connects the two terminals, using the procedures followed with researchers or physicians, and helps the student through the search strategy. The student learns about the multitude of data bases that represent the bulk of the scientific knowledge base and no longer have a printed counterpart in the library.

Problem-based learning techniques such as those in use at McMaster University School of Medicine, the University of New Mexico School of Medicine, and Southern Illinois University School of Medicine offer opportunities to involve the librarian in the teaching process in a substantive fashion (90). The librarian could participate, as do other nonmedical faculty members, in leading students through the group learning process. The librarian could contribute to the teaching syllabi. Students could learn about information and knowledge bases as sources for data useful to hypothesis generation and the decision process in the same way they learn the values and limits of clinical information gathering techniques such as laboratory tests.

These approaches, which teach information-gathering and processing skills, represent a quantum leap from the idea that training in bibliographic techniques may help address the problem of continuing use of the knowledge base (87).

*Stage 2*—Medical information science is organized as an academic department of the school of medicine. Faculty members hold joint appointments in clinical and basic sciences, as well as in university de-

### *Library Roles*

partments outside the main. The student varies from school doing practical in hospital and laboratories and others laborative research decision aids, or solving problems. students is dist more than one

The core work satisfies the aims of sustainable self-learning to operate in a network and to utilize electronic information storage and retrieval as a part of the work for student education consumer of information systems and services. advanced elective objectives include information requirements specification. The role of postdoctoral

As the second phase in medical education, the entire span of medical education for medical managers of health care and participation workers, including work with the knowledge process to develop medical education constitutes a student's training physician.

### *Management*

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partments outside the health sciences do- main. The strengths of such departments vary from school to school, with some doing practical research and development in hospital and medical information sys- tems and others working in advanced col- laborative research in disease mechanisms, decision aids, or instrumentation and mod- eling problems. Course time for medical students is distributed over a period of more than one year.

The core work for medical students sat- isfies the aims of computer literacy, sus- tainable self-learning, and personal ability to operate in a communications network and to utilize existing information and ci- tation storage and retrieval systems. Elec- tive work for students and residents pro- vides education at the level of the informed consumer of information-processing sys- tems and services. For the graduate or advanced elective student, educational ob- jectives include recognition of new appli- cation requirements and systems design or specification. Tool-building is the objec- tive of postdoctoral fellows.

As the second stage matures, knowledge bases in medicine expand and embrace the entire span of medical knowledge. Aca- demic physicians become the knowledge managers of the profession with the assist- ance and participation of many knowledge workers, including librarians. Students work with these academic information/ knowledge professionals to maintain and develop medical knowledge bases. This constitutes a major part of the medical student's training to become a practicing physician.

### Management

Giving the chief executive officer infor- mation, according to Simon, is like throw- ing water on a drowning man (104). Com- mon complaints are that information has to be extracted from large amounts of extraneous data, is frequently presented in

an inappropriate format, can't be found, or hasn't been captured (28, 105). Execu- tives need current, accurate information to maintain surveillance on the external en- vironment, and they want it concise for fast reading. Very little of the scholarly literature fits these requirements (106). In many respects, the executive and the phy- sician share similar approaches to infor- mation use. Both are decision- and action- oriented, time is a critical factor, and ac- curate, reliable data are essential. Both rely heavily on judgment, intuition, and the results of past experiences.

Most managers spend less than 15 min- utes a day reading periodical literature, even though periodicals constitute 15 per- cent of their incoming mail. One study found managers could use less than three percent of their time to be alone for reflec- tion and thinking (107). The executive wants a system structured to conserve his scarcest resources, time and attention. Nei- ther science nor management advances by piling up information; both move on by being selective and by reorganizing, syn- thesizing, and using it (104).

Time and again, data base managers of information systems are exhorted to attend to the meaning of the information they process and make the output more useful. In Stage 1, the problem of managing in- ternal organizational information files for use by the executive is that of the organi- zational data base managers; the problem of filtering the academic information base relating to managerial information inter- ests to optimize the executive's use of scarce reading time should be that of the librarian. This responsibility has so far received little attention in the academic health sciences center library. There is next to nothing in the health-related library literature that suggests efforts to fill an apparent gap in the information dissemi- nation chain; similarly, there is little in the health-related management literature that

suggests awareness of the capabilities of libraries to provide meaningful information services.

The executive needs (a) an organized and compressed surveillance of the published literature and (b) provision and analysis of background information that is pertinent and appropriate to policy development. Stage 1 library services can contribute to both these needs.

#### STAGE 1

Like the researcher, the physician, and the medical educator, the AHSC executive has established a subject interest profile and set of information delivery criteria in the integrated library system. All the typical services are available: quick answers to satisfy some immediate need for facts ("How many not-for-profit hospitals own and operate for-profit health related businesses?"); selective notification of new articles on topics of consistent interest; literature searches ("What's the latest work on strategic human resources planning?"); or advice and consultation on local personal information file development ("How can I ensure quick, easy access to the materials I read and want to keep for future use?").

In addition to these services, the executive wants literature analyses for use in planning sessions or policy debates. A typical question could be, "What alternatives for practice plan compensation are used? What are the trade-offs? What are common tenure practices for clinical faculty?" The executive specifies the format, length, and level of detail for the report. The librarian will prepare a review of the literature and a synopsis of the findings as requested. This type of service is exemplified by the Library of Congress Congressional Research Service, which provides extensive information support to members of Congress and their staffs to assist them in planning and drafting legislation. These services are not typical in academic librar-

#### Information in Academic Health Centers

ies, but they should be expected from a quality Stage 1 library.

#### STAGE 2

In Stage 2 the AHSC's internal files incorporate information from external public files in decision-support information systems. The AHSC executive and the executive staff refer constantly to a few general areas. The library screens and selects the current state-of-the-art documents and information in these areas to supplement the general knowledge of the administrators. This is a dynamic system that keeps up on a daily basis a briefing system. The library actively participates in contributing to the total institutional management information base.

#### Institutional Perspectives

Few can seriously doubt that an electronic-based society consisting of interfacing network systems is about to engulf us. The important question facing the AHSC executive is how to achieve Stage 1 technology development quickly and most effectively in an organization as complex as the typical medical center. The strategic planning questions include the following:

1. What are the long-range goals for information technology adaptation in the AHSC?
2. What should be the information management infrastructure of the organization?
3. What are the practical first steps to take?
4. Who should take the leadership?

Before considering approaches to these questions, it is important to consider the barriers to technological change.

#### BARRIERS TO CHANGE

Experience in industry has shown that the three major barriers to change in the area of information management are political,

#### Library Roles

technical, and behavioral problems in academic libraries to economic barriers to leadership.

*Political*—The many large-scale informational contributions of inexpensive typewriters and microcomputers. The typical AHSC of local, specialized, nonstandard in size, and defended by standardize their growth will of autonomy and individual systems integration.

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*Behavioral*— educational efforts many ingrained and attitudes. / tions that need to solve some o to address the i

### Library Roles

technical, and behavioral (21). Additional problems in academic institutions pertain to economic barriers and the question of leadership.

*Political*—The poor past performance of many large-scale centralized organizational information systems has undoubtedly contributed to the recent popularity of inexpensive yet powerful minicomputers and microcomputers across campuses. The typical AHSC is likely to be a maze of local, specialized information systems, nonstandard in software language, lacking compatibility and interfaces, but guarded and defended by their owners. Attempts to standardize these systems or to constrain their growth will raise troublesome issues of autonomy and resource allocation, especially when no clear advantage to individual systems is to be achieved through integration.

Indifference, apprehension, and outright hostility are found at all professional levels toward information technologies as represented by computers. This is hardly surprising. Knowledge is power. A change in who controls information, as well as in how information is controlled, threatens existing power hierarchies. The technologies that have been set in motion will ultimately change the nature of all work and the definition of all professions. Changes that are likely to disrupt existing organizational structures and arrangements will be cleverly and often unobtrusively undermined and sabotaged. The change must be nonthreatening and acceptable. It must also be wholeheartedly supported at the highest levels of the organization.

*Behavioral*—A broad-scaled, concerted educational effort is needed to unfreeze many ingrained information-use habits and attitudes. At present many organizations that need to adopt new technologies to solve some of their problems are unable to address the issues effectively. The issues

appear threatening and imply unacceptable risks to too many people in the organization. Argyris (108) characterizes such a situation as being unable to speak about the unspeakable. The problem is compounded by a scarcity of individuals skilled in the use of common microprocessors who are in a position to help educate the nontechnically oriented faculty and staff members and show them how technologies can simplify some aspects of their work and offer better alternatives for achieving the same ends.

*Technical*—The technical barriers to successful innovation in technology transfer are well identified in the business literature (109, 110). They relate to clarity of goals, skillful strategic planning, accurate assessment of readiness for change, and appropriate staffing of the change process.

*Economic*—In a contracting economy, academic financial resources are increasingly strained. Information resources management initially will entail add-on costs. Although computer hardware costs are decreasing rapidly, the human component of information systems operations will continue to expand. The newer proprietary information bases will mean greater information resource costs. The offsetting benefits, however, are significant. Technologies appropriately adapted will mean greater productivity, improved efficiency, and better science and medicine. It will be important to put the first investment into the highest payoff position.

*Leadership*—The appropriate leadership and staffing for change is a key issue. The four typical broad-scale information handling units in the AHSC are (a) administrative data processing center—payroll, admissions, accounting, and purchasing; (b) academic computational services—testing, grading, research computing, and educational computing; (c) bio-communications centers—instructional materials development and distribution;

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Leadership is likely to come from one of these units or from an academic department that is heavily involved in biomedical information computing. The leader should

have a broad institutional perspective as a result of experience at a departmental level involving many functions of the AHSC; expertise in the principles and experience with the practice of information resources management; and understanding of networking concepts. Most importantly, the

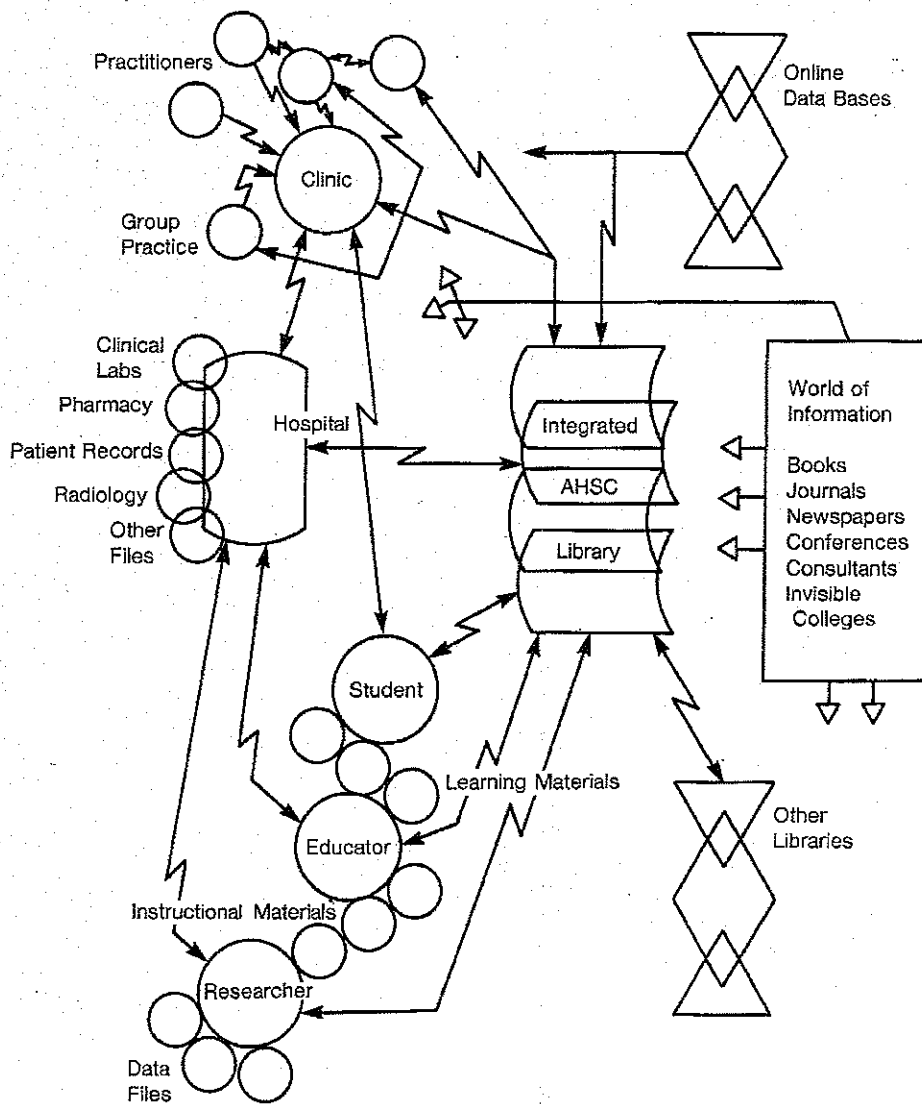


FIGURE 5  
Network system of information transfer in Stage 1 of evolution of information technology.

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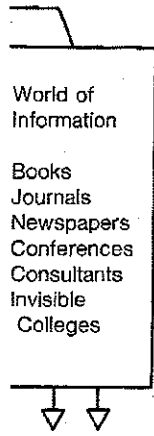
individual must have the confidence and unswerving support of the top AHSC leadership.

THE NETWORK CONCEPT

If the leadership of the AHSC determines an institutional goal to be the improvement of academic productivity by adopting computer technologies, what are the possible options in the AHSC organizational infrastructure for information resources management?

The options include no system, a centralized control system, a distributed sys-

tem off a mainframe computer, or a network system. The network concept appears ideally suited to academic organizations because decentralized management of files permits maximum local autonomy and diversity and minimum centralized controls. Networks are governed more than managed. Governance is aimed at coordinating and assuring that necessary standards for practice are developed and observed. Technical issues that need coordination include the use of common carriers and development of linkages and interfaces to the system. Substantive issues relate to the long-term objectives of the



Other libraries

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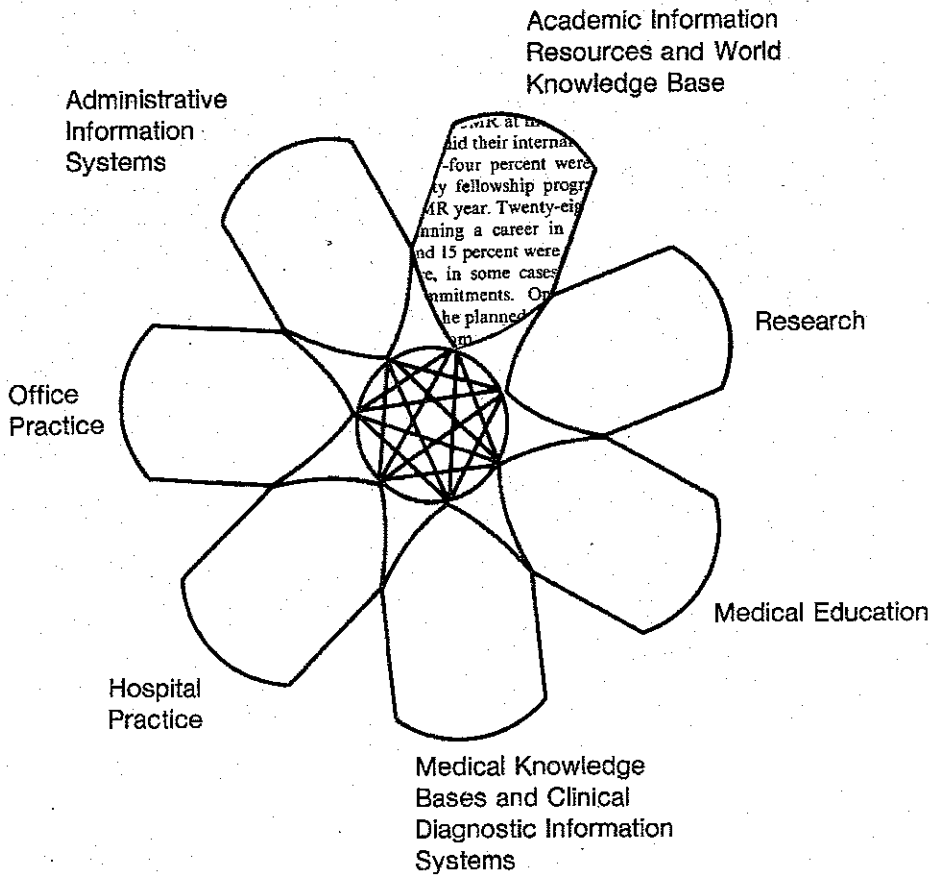


FIGURE 6 Information resources management network in Stage 2 of evolution of information technology.

network configuration and its supporting institutional goals.

The network concept has begun to spread in health care practice and in medical education. The Health Education Network for sharing computer-based instruction materials is one example. Another type of network is illustrated by a group of hospitals in California that pool common resources to gain better financial leverage (111). SUMEX-AIM connects scientists working on biomedical knowledge systems in Massachusetts, New York, Missouri, California, and Japan. According to one of its users, the network makes it easier to get the attention of a colleague 6,000 miles away than the dean of the medical school 60 meters away. Despite successful applications, the network concept is still in the very early stages of understanding and acceptance in the AHSC.

The adoption of a network concept within the AHSCs makes possible a series of interactive networks that link the world's knowledge base to the practice knowledge base in every physician's office,

### *Information in Academic Health Centers*

in hospitals, in professional schools, and in research.

Figure 5 illustrates a mature Stage 1 network in which the subsystems of the medical center are linked to local physicians and clinics through a network. In such a linkage, the information flow is homogeneous, lacks redundancy, and is reinforcing and mutually helpful. Confidentiality of data and security of the system are stable and reliable features. The physician captures initial patient data that have multiple uses in different files. Data from many sources—hospital laboratories, libraries, pharmacies, dietetics, or house-keeping—that apply to any one patient can be tapped or transmitted through the network.

In Stage 2, the physicians, faculty members, students, and staff members are linked to clinical diagnostic systems, such as CADUCEUS, to operational information systems, to knowledge data bases, and to libraries in a comprehensive information system network. Figure 6 illustrates a late phase of Stage 2, where all subsystems are interlocking as well as interactive.

## Chapter 4

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## Chapter 4

# The Changing Library as a Change Agent

The library is the logical and necessary place to begin a process of planned change. This chapter concentrates on the logic of the library's central role in advancing the academic health sciences center toward an integrated network system. Chapter 5 describes the necessity of changing the library regardless of other changes to an AHSC's information structure.

### First Step to a Network

Because its information resources management infrastructure is a microcosm of the medical center, the library is uniquely capable of demonstrating the advantages of linked internal files. The results could be dramatic and useful to every member and sector of the AHSC. Once its managerial and operational functions are automated, the library can serve as the institution's bridge to many external data bases and interface with other AHSC files to effect better information transfer and use. It can extend its technical information management services to all AHSC personnel and can offer the institution an opportunity to integrate new biomedical information management system approaches with present educational programs that in a practical way assist the student to develop life-long learning habits.

### STRENGTHS AS A CHANGE AGENT

The library can and should lead the AHSC's change in academic information resources management. The barriers identified earlier—political, behavioral, technical, and economic—are not major barriers as far as the library is concerned.

*Political*—The library is the most politically neutral of all the AHSC's information-handling units. It exists as an institutional resource to meet the information needs of all those engaged in supporting the AHSC enterprise. As a result, it tends to have a broader perspective on the AHSC as a whole than other information-handling units.

When the library seeks support for itself, it does so as an advocate of all who use or need information. This altruistic and democratic approach is not a powerful one. The library's advocates tend to be individuals rather than large groups. The library has support when the advocate is highly placed and powerful, but as a rule the library is vulnerable whenever financial resources are strained.

But even in a time of contracting resources, automating the library can clearly benefit all members of the academic center, especially the faculty. The frustration faculty members and others experience in obtaining information from the library can be dramatically reduced by improving the library's responsiveness through automated files.

*Behavioral*—So thoroughly have computers permeated library operations in academic health centers that librarians hostile to computer technologies are rare. Libraries have traditionally embraced technologies that release human beings from the repetitive, technical, and detailed record-keeping that has characterized so much of library operations. Many libraries are quick to find innovative uses of technologies when they have the financial resources. The majority of libraries now use

online computer-based information systems for cataloging, for data-base searching, and for management records. There is widespread interest in microprocessors and in the integrated library systems of the type being developed by the National Library of Medicine.

*Technical*—Technical factors are minor barriers. Clarity of goals, readiness for change, and appropriate staffing for the change process are well established. That the library is a microcosm of the medical center is one of its greatest strengths.

To many individuals, the library's importance rests in its role as a repository of the world's knowledge; to many more it is a refuge, a quiet and tranquil place for study and research. These two powerful features of the library—as a large general resource yet a place where it is possible to establish temporary "personal space"—tend to dominate ideas of the library's role. Its multifunctional character is often overlooked. But like its parent AHSC, the library as an agency has education, research, service, and managerial functions, each of which is supported by separate

information files. And again like its parent center, the library's files are largely fragmented, single-purpose, heterogeneous mixtures of manual and automated processes. The size of the files is not trivial (Table 1). The integration of these files will need to take place before much that is described in the Stage 1 scenarios can occur.

The library, as any business, must account for all its resources at all times. The average health sciences library is large enough to present a challenge in its conversion to computerization but not so large a one as to create significant problems or to require an enormous investment in time, money, or personnel.

*Economic*—Until the advent of mini-computers and large microcomputers, the average health sciences library was at a disadvantage, as it was too small to justify the large mainframe academic library systems. This has been a mixed blessing. On one hand, health sciences libraries escaped the trap of inflexible, limited, and obsolete proprietary systems; on the other hand, few files are in machine-readable form.

TABLE 1

Average Annual Data Pertaining to a Health Sciences Library, 1980-81

Activities	Quantity
Total recurring expenses	\$790,536
Hours available	7 days a week to public 4,930 hours annually
Personnel records	9.8 FTE professional staff* 15.8 FTE support staff 5.4 FTE hourly staff
Serial controls	2,334 titles 20,000 approximate annual pieces
Card catalog	357,827 cards in file 12,380 annual cards filing
User files	3,721 primary users
Entering and exiting building	267,360 accesses/departures
Circulation records	250,846 loans/uses
Reference transactions	14,562 information questions
Interlibrary loans	9,774 borrowed and loaned items

\* FTE = full-time equivalent.

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TABLE 2

## Start-Up Hardware Costs for Two Similar AHSC Library Systems, 1980-81

Georgetown University Medical Center Dahlgren Memorial Library (Local ILS development)*		University of Maryland Health Sciences Library (NLM ILS system)*	
Equipment	Cost	Equipment	Cost
Minicomputer system	\$ 73,000	Minicomputer system	\$124,100
CPU 256KB memory		CPU 384KB memory	
2 254MB disc drives		2 190MB disc drives	
2 magnetic tape drives		1 magnetic tape drive	
Communications subsystem		Communications subsystem	
Operating system	\$ 17,000	Operating system	\$ 15,000
Peripherals	\$ 11,750	Peripherals	\$ 27,950
7 video monitors		13 video monitors & cable	
2 printers		1 memory terminal	
2 bar code readers		3 printers	
1 microprinter		4 bar code readers	
Total	\$101,750†	Total	\$167,050†

\* ILS = Integrated library system.

† Additional expenses: Annual maintenance (approximately 1 percent of equipment list price), site preparation (air-conditioning, telephone lines, etc.), installation and delivery, supplies.

The minicomputer-based integrated library systems became available only within the last two years, at the time that severe budget depressions began to affect libraries. As a consequence, the development of computer-based AHSC libraries with network capabilities has proceeded at a snail's pace.

The automation of a medium-sized health sciences library requires only a moderate investment and can deliver quick value. For the average library a computer system can cost less than \$150,000 in hardware. The costs reported by two medium- to large-sized health sciences libraries which are developing prototype library information systems are shown in Table 2.

## BARRIERS TO CHANGE AGENT

While individual libraries and librarians may have the capabilities to carry out the desired change-agent role in many academic medical centers, they labor under two major handicaps. First, their status in the organization may be insufficient to make their role as a change agent obvious. Second, stereotyped notions persist about

libraries and librarians, reflecting times when libraries were passive repositories, and the work of the librarians in them seemed both mysterious and unimportant.

Anyone who looks closely at the library today will find a different organization and very different people from the stereotype. Over the past decade, there has been a quiet revolution in the approaches to library management. As a consequence, the library is uniquely suited to take the lead as a change agent in bringing about a coordinated AHSC academic information resource. First, about six years ago, librarians realized that knowledge of modern management techniques and strategies was indispensable for all professional librarians. Through continuing education programs sponsored by the major library associations and the use of selected executive management programs, most senior librarians have become familiar with modern management practices. Second, the need to optimize the use of resources fostered network and consortium development, which has sharpened negotiating skills and tolerance for group-processing among librarians. Third, librarians are

comfortable with information concepts and information-management processes.

Despite strengthened skills in information management, despite the new opportunities that powerful computer technologies offer to overcome many of the most frustrating problems in information handling of the past, and despite the fact that the library—and no other information handling unit—has either the designated or elected responsibility for the stewardship of the academic knowledge base, many librarians and AHSC executives perceive the library to be less capable of responding to the challenge than other units in the AHSC. This perception should lead to strengthening the library so that it can carry out its responsibility. To invite other professionals to undertake the solution of problems outside their fields of expertise is to invite costly redundancies, reinvention of techniques, rediscovery of principles already known, and lost opportunities. The retooling, reorienting, and revitalization of the library certainly will require a coalition of interdisciplinary and multidisciplinary talents, but the conceptual leadership should come from the professional group responsible for the storage and retrieval of academic information—from librarians and information scientists. It is time that the AHSC faculty, staff, and administration recognize the role of academic information in the AHSC and engage their talent and resources in the complex cooperative task of managing the information to further the goals of medical education, research, care, and management.

#### Managing the Change Process

Several vital steps are necessary in bringing about the desired information network.

#### GOALS

The first step toward achieving a Stage 1 AHSC network environment is to set new

#### *Information in Academic Health Centers*

goals for academic information resources management. At a minimum, all AHSC administrators should aim toward these goals:

1. Establish a network capability by automating all managerial and operational functions of the library.
2. Use this capability to have the library serve as the institution's bridge to external data bases.
3. Interface the library's system with other AHSC information systems in order to optimize the transfer of information between data bases.
4. Extend the library's technical information management services to all AHSC personnel.
5. Commit the institution to educational programs that use and integrate these new information system capabilities.

#### GUIDING PRINCIPLES

The second step in planning is to determine the principles that will guide the library's managerial and operational policies. The principles can be defined under three general rubrics: system access, information services, and functional responsibilities. Definite policies need to be established and a consensus reached by all levels of the AHSC as to the possible expectations of information users and the responses of the information providers. Members of the AHSC should be made aware of state-of-the-art information services and understand what opportunities are available.

The principles of system access are:

1. The library system must focus on the individual's information requirements. The system should be engineered to recognize and accept human constraints. It should be flexible enough to accept variable information use habits, such as natural language commands, as well as machine specific command vocabulary. The

#### *The Changing*

system should have control so that information is available between systems.

2. The library system with units in the AHSC that recorded word processing should be among machines that are not communication.

3. Information directly accessible and not of repeated studies is inversely from it. The information accessibility "perceived" a source of:

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system should accommodate existing systems that individuals use for data base control so that information transfer between systems is uncomplicated.

2. The library system must interface with units and programs throughout the AHSC that need and use the public recorded world knowledge base. The interface should be among staffs as well as among machines. Individuals and units that are not integrated into organized communication networks are dysfunctional.

3. Information must be simply and directly accessible. The system should be accessible at the convenience of the user and not of the system or the library. Repeated studies show that information use is inversely proportional to the distance from it. The greater the distance from information the less it is used. Perceived accessibility to information exceeds "perceived value" as a factor in choosing a source of information (41).

Information must meet certain criteria to have value and utility. The information tendered by the library in carrying out its responsibilities, therefore, should meet these requirements:

1. Information must be timely. In addition to being up-to-date, information must be available at the time and in the place where it is immediately useful.

2. Content must be appropriate to the need. If a fact is sought, the fact should be forthcoming; nonessential or irrelevant information should be filtered out.

3. Form and format must follow function. If information is required in graphic form to make the communication functional, information in print form would not be appropriate. A printed description of a color, for example, is less appropriate than a color sample. In certain instances, a videotape of an operation is better than static drawings.

4. Information should be problem-oriented. Information should be perceived as

supporting decision-making purposes. It should, therefore, be organized and presented in a manner that contributes to solving a problem.

The management of academic information resources extends beyond the physical organization of resources generally associated with libraries. In the management of the library data base, six essential functional responsibilities must be met. None is complete without the others.

1. *Curatorship.* The library must maintain a repository of resources that meets the primary information needs of the AHSC enterprise. It is responsible for acquiring, organizing, advertising, and making available books, articles, journals, media, and other content through direct lending, interlibrary loan, or other transfer methods.

2. *Education.* The librarians actively participate in the AHSC educational program by instructing individuals in the concepts of information management, in the development of personal information systems, and in the acquisition of skills in using sources of information and the tools through which information can be found.

3. *Access.* The library supports the transfer and use of information. Transfer services include the provision of documents through lending, photocopy, or other delivery methods. Utilization services include providing specific facts and information from the library's resources and searching bibliographic data bases to locate books and documents relevant to information questions.

4. *Research.* The library has a responsibility to study the fundamental nature of biomedical information storage, organization, utilization and application in learning, patient care, and the generation of new knowledge.

5. *Brokering.* From both external and internal sources, librarians locate and select information appropriate to solving a

specific information problem, analyze it, and repackage it to facilitate its use.

6. *Technical consultation.* The library provides technical information relating to the storage, transfer, retrieval, and interfacing of bibliographic information systems to all AHSC personnel.

The organization of the library, its staffing, budgeting and operations, and planning and systems design, are determined by setting the goals and the strategies derived from these guiding principles.

#### PLACE IN AHSC ORGANIZATION

To develop an academic information resources management network, the library's goals must be extended, strategic decisions made about the principles around which the library will be organized and managed, and the technology for operating the library brought to a state-of-the-art level. To accomplish these ends, the director of the library will need (a) to be aware of and involved in planning at all levels of the AHSC in order to interface the library's information systems to AHSC programs and services and (b) to have the authority to negotiate with department, program, and service chiefs throughout the AHSC and the university. These functions and responsibilities suggest the need for a position and a title at the executive level of the AHSC.

Given the diversity of academic health sciences centers, no one title could serve all. The title, however, should reflect the functional level. For example, the vice president for finance or the dean for financial affairs bears responsibility for the management of the institution's financial resources and must participate in the governance of the institution. That office now coordinates many of the organizational information subsystems of the AHSC. In like fashion, the vice president for academic information systems or dean for academic information affairs should bear

#### Information in Academic Health Centers

responsibility for the management of the institution's intellectual information resources and participate in the governance of the institution. Both of these positions are essential to managing two fundamental capital resources in the AHSC.

#### Managing the Innovation

The chief executive officer or the strategic planning team will need to take a series of steps. A leader must be identified. A preproject team must be appointed and charged with several tasks. These tasks include (a) defining the goals to be met by a change to the library, (b) determining the changes to be made, (c) assessing the readiness for change in the AHSC and the library, (d) assessing the risks of the change, and (e) identifying the change-project team. The team will need to be given the resources, the authority, and the timetable for accomplishing the tasks.

The qualities and requirements of the leadership have already been addressed. What has not been discussed so far is the importance of preproject planning and the staffing of the innovation team.

#### PREPROJECT PLANNING

An institutional self-study is a critical first step in initiating a long-term evolutionary change through a discrete, manageable, and pivotal change with the library. The self-study should be in two parts. The first part requires an inventory of current information technology capabilities for forming an academic information resources management network. This assessment will include determining (a) the technological status of libraries in health profession schools and teaching hospitals, (b) the use of computers in research laboratories and offices to maintain bibliographic systems, (c) the use of computers for text-editing and processing of manuscripts for publication, (d) the use of computers for interinstitutional and intrainsti-

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the management of the actual information resource in the governance of these positions requiring two fundamental tasks of the AHSC.

#### Staffing

The officer or the strategic officer need to take a series of tasks to be identified. A preliminary team should be appointed and assigned the tasks. These tasks include: (a) determining the goals to be met by the library, (b) determining the resources available, (c) assessing the risks in the AHSC and the change team will need to be met, (d) determining the authority, and the plan for accomplishing the tasks.

The requirements of the library have not yet been addressed. The subject discussed so far is the subject of planning and the change team.

#### Change

The study is a critical first long-term evolutionary discrete, manageable, with the library. The study is in two parts. The first part is an inventory of current library capabilities for library information network. This assessment involves (a) the technology of libraries in health and teaching hospitals, (b) the use of computers in research laboratories to maintain bibliographic use of computers in processing of manual, (c) the use of computer and intrainsti-

tutional exchange of communications and data, (e) the availability of human resources and skills in computing, (f) the network capabilities of existing units, (g) the identity of institutional "information gatekeepers" and the systems that support them, and (h) the use of existing networks by faculty members, students, staff members, and practitioners.

The second part involves an assessment of long- and short-range academic information system needs and requirements by (a) charting the flow of information between units, (b) identifying the technologies that could improve productivity, effectiveness, and economy of these practices, and (c) projecting the impact of potential applications of information technologies on areas of intensive-information-processing and use and on areas of high priority and needs.

From these self-studies, the general goals of the institution as an information system can be articulated, the specific goals for the library can be derived, and the network capabilities of the academic information network can be defined. Plans can be made regarding units with capabilities for early linkage with the library to demonstrate a positive and ready impact. Other areas of high need, such as linkage of physician-office systems, might be selected because other goals would be reinforced or enhanced.

Assessing the readiness for change and the risks of change in both the institution and the library is essential in order to plan a budget for and to design the innovation team approach. The scope of work in the conversion of manual systems will vary enormously from library to library depending on the quality of its current records, the depth and scope of the collections, and the number and skills of the present staff. McFarlan describes a portfolio approach to measuring the dimensions of risks that help determine whether

the benefits are great enough to offset the risks, what the effect of failure will be on other parts of the organization, and what the management approach should be for the environment (112). There is sufficient experience with some large-scale library automation efforts to demonstrate that conversion is neither overwhelmingly difficult nor complex, although it does require a highly structured approach to minimize risks.

#### STAFFING

The makeup of the self-study team is as crucial to the project's success as the innovation team itself. Experienced system developers advise involving potential users of the systems in the early stages of goal-setting and design. The change to the library can affect the entire AHSC in a relatively short time. Involvement of all key AHSC information-handling units in the self-study is highly desirable. But even more important perhaps than political issues of representation and technical expertise is the matter of behavioral roles in the self-study team.

Roberts (113) presents compelling evidence that innovation efforts frequently fail because of gaps in the change team. Management has concentrated on providing technical capabilities and overlooked the critical importance of several behavioral functions on innovation teams, he writes. Five behavioral roles are essential to successful innovation management. The team needs (a) an idea generator, someone who stimulates the team, propels, and infuses it with intellectual energy; (b) an entrepreneur, someone who champions the cause and persuades others in the organization of the importance and value of the project; (c) a project leader, someone who plans and organizes and moves the work forward; (d) a gatekeeper, someone who serves as an internal information re-

source and possesses a high level of technical competence in the project area; and (e) a sponsor or coach, someone who is often a senior person who facilitates and guides the work informally and buffers the team within the organization. The presence of these behaviors may not be essential at all times throughout an innovation project, but all are needed at crucial stages.

These roles will certainly be significant

### *Information in Academic Health Centers*

in the preproject stages. To steer through the complex and sensitive environment of the AHSC and accomplish the tasks set for it, the study team will need particularly strong idea generators and entrepreneurs as well as highly placed sponsors. To carry out its final task of identifying the project team for the library conversion, the study team will need to be informed and aware of these critical roles themselves.

## Chapter 5

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## Chapter 5

# The Challenge for Today's Health Sciences Library

Automating the operations and management of the library is not a panacea. It is, however, a necessity. The longer an AHSC waits to build an intellectual information resource network system to support the work and learning of its faculty, staff, and students, the greater material disadvantage these individuals will experience in relation to colleagues and peers both now and in the future. The longer AHSC libraries go without fully integrated computer-based operations, the more inadequate they become at putting information into practical reach of AHSC personnel. Many AHSCs have put off until tomorrow what is needed for today.

This chapter discusses the readiness for change in AHSC libraries generally. The guiding principles described in the previous chapter serve as the framework for the discussion. Three key factors are associated with a library's readiness to move rapidly into Stage 1: (a) its present network interaction capacity, (b) recognition of its multifunctional responsibilities, and (c) its integration within the institution.

### Network Capability

Network capability can be defined as the ability to access the network, the ability to participate in and contribute to a system, and the ability to use a network. Today all libraries are able to access computer-based network systems. MEDLINE, BIOSIS, SCISEARCH, and other data bases are familiar examples. Access is the most rudimentary of network capabilities, requiring no automation capability of the library other than a terminal to serve as the communication and printing device. However,

the ability to use a network to take information from the system and to put it to practical application within the library's environment does require on-site computational capabilities. In this sense, few AHSC libraries have any technical network capability.

In order to discuss the network capabilities of AHSC libraries, three general types of library network systems need to be considered: system-to-library networks, library-to-library networks, and library-to-user networks. These three major network systems are presently discontinuous and heterogeneous. To link these networks and to strengthen them, the AHSC library must in the first instance be able to use system-to-library networks. From this will come the ability to participate and contribute to library-to-library networks and to achieve the long-term goal of linking the user to information through a multitude of systems.

### SYSTEM-TO-LIBRARY NETWORKS

System-to-library networks are chiefly "bookkeeping" systems that classify intellectual artifacts for management and control. The early stages of computer technology produced machines capable of storing and manipulating data in quantities beyond the retention and computational capacity of human minds. Numerical manipulations gave way to managing more informative data and to producing text information or interpreted data. Today, the key concept in computer applications is information services, chiefly in an interactive network mode. The computer has in this analogy moved from being simply

a giant calculator to being a bookkeeper and to becoming a decision-support system.

Two types of system-to-library networks predominate. The first has already been mentioned, one-way access in which libraries draw from a central data base system. The other type is a participative network where centralized files are augmented by hundreds of participating libraries, which contribute work in standardized formats for use by others and from which libraries draw authoritative records for their own uses. These networks, such as OCLC and the National Library of Medicine's SERLINE, support the standard record-keeping functions of cataloging, serials controls, and interlibrary loans.

Every AHSC library and most teaching hospital libraries should be using one or more of these networks for standard record-keeping functions. They allow libraries to gain control of their files and build machine-readable records at very low costs. They are also capable of saving 20 percent of book-processing staff time (114). Many AHSC libraries have yet to take this first step. The 1979 Grefsheim survey (115) found that 81 of 93 libraries (87 percent) participated in a major bibliographic network. Of the 81, only 50 had data in standard cataloging formats that are a sine qua non for shared data bases; only 26 had magnetic tape representations of their catalog covering three or more years; only two libraries had their entire collections' records in standard Library of Congress machine-readable cataloging (MARC) format.

Converting manual cataloging files to machine-readable form for the average library can be accomplished within a reasonable amount of time and for low cost. The University of North Carolina-Chapel Hill Health Sciences Library estimates that in one year one full-time equivalent (FTE) professional librarian and three FTE stu-

dents can convert 36,000 manual records to standard machine-readable records using the OCLC system. The average AHSC library in 1980-81 reported owning 143,000 volumes. The number of monographic titles in that number might have approached 40,000. If the library had captured the previous four years of cataloging on tape, the retrospective cataloging load might have equaled only 30,000 titles. Accordingly, the typical library will need 3.3 FTE additional personnel for one year to handle the converting task. Two libraries, the George Washington University Himmelfarb Health Sciences Library and the University of North Carolina-Chapel Hill Health Sciences Library, estimate a cost of \$1.05 to \$1.15 per book title for retrospective catalog conversion by technical support staff using OCLC in nonprime time. The resulting data base gives the AHSC library the ability to participate in library-to-library networks and to begin to establish the library-to-user network in the AHSC.

#### LIBRARY-TO-LIBRARY NETWORKS

The NLM Regional Medical Library Network represents the chief example of the library-to-library network system. Through a hierarchical transfer chain, the stronger libraries share their resources with the lesser-endowed libraries. From the apex of the hierarchy, the National Library of Medicine, documents flow through AHSC libraries to the most remote community hospital library. Although this network is effective, it is still based on labor-intensive, manual record-keeping and paper-based communications. Access to network resources is slow and increasingly expensive.

The need for this type of network is incontrovertible. Finite limits such as space and money usually regulate the amount of resources an institution can ac-

#### Challenge for Library

quire, although these have been challenged. Is there a substitution that ruined the library? The tide pulled generally, and today the tide is receding. The combination of increasing operation with an ever-expanding staff has meant little growth. American periodicals cost by 250 percent or more while the value of titles associated to one-half of the same period (116). Studies of academic research libraries show that resources more than doubled, but books bought has actually decreased by 25 percent (117). Tight budgets, purchases first and then cancellations, resulting in collections and more similar ancient language materials in areas of low and very expensive materials are targets for cuts in tight budgets.

Preservation of the total intellectual resources require planning and management on the part of institutions and their responsibilities for their resources. Some instances of rational policies on a regional basis. AHSC libraries in Texas, Oklahoma, and Louisiana formal agreements that are possible for acquiring the resources of certain publishers for the entire region. To succeed, we need good technical communications and shared records. The library-to-library networks in addition to sharing the resources, the means of acquisition through forms of

vert 36,000 manual records machine-readable records system. The average AHSC 1980-81 reported owning 100,000 records. The number of monographs that number might have 100,000. If the library had capacity for four years of cataloging prospective cataloging load would be only 30,000 titles. A typical library will need 3.3 full-time personnel for one year to convert the task. Two libraries, Washington University-Himmler Library and the North Carolina-Chapel Hill Library, estimate a cost of \$100 per book title for retrospective conversion by technical support. OCLC in nonprime time. A data base gives the AHSC a way to participate in library networks and to begin to establish a library-to-user network in the

LIBRARY NETWORKS

ional Medical Library Network is the chief example of a library network system. A hierarchical transfer chain, the network share their resources with other libraries. From the hierarchy, the National Library of Medicine, documents flow to libraries to the most remote hospital library. Although the network is effective, it is still intensive, manual record-keeper-based communication network resources is slow and expensive.

this type of network is limited. Finite limits such as budget usually regulate the resources an institution can ac-

quire, although these limits are seldom challenged. Is there an example of an institution that ruined itself spending on its library? The tide pulls the other way, generally, and today the tide is definitely receding. The combination of inflation and increasing operational costs, associated with an ever-expanding publication base, has meant little growth on a number of fronts. American periodicals have risen in cost by 250 percent over the last 10 years, while the value of the dollar has depreciated to one-half of its value over the same period (116). Statistics of the major academic research libraries for the past 10 years show that resource budgets have more than doubled, but the number of books bought has actually decreased by 20 percent (117). Tight budgets squeeze book purchases first and then journal subscriptions, resulting in collections that are more and more similar and narrow (118). Foreign language materials, lesser-used materials in areas of low scholarly intensity, and very expensive materials all are prime targets for cuts in tight budget periods.

Preservation of diversity and range in the total intellectual resource pool will require planning and meaningful commitment on the part of institutions to sharing responsibilities for a knowledge base. Some instances of rationalized collection policies on a regional basis exist. The AHSC libraries in Texas, Arkansas, Louisiana, Oklahoma, and New Mexico have formal agreements that make each responsible for acquiring the relevant output of certain publishers for the benefit of the entire region. To succeed, these efforts need good technical support for rapid communications and accurate, easily accessed records. The foundation of library-to-library networks is a computer record of the resources of each AHSC library. In addition to sharing this record of existing resources, the means to transfer information through forms other than photocopies

must be available. An alternative to today's model of interlibrary loan is desperately needed. Library collections are being worn out and library staff members made to serve where automatons would be more appropriate in current manual interlibrary loan processing. Recent efforts to develop a national periodicals system failed to arouse the support of concerned parties—librarians, publishers, and academic users (119). Efforts should be made to explore the problem and to design alternative microfiche, videodisk, or digitized information transfer approaches.

LIBRARY-TO-USER NETWORK

The library-to-user network is the goal of Stage 1 technology applications in the AHSC library; it bridges the gap between the user and the information wanted by making the transfer of information through multiple systems both rapid and practical.

The PaperChase retrieval system at Beth Israel Hospital in Boston is an example of an effective use of a network base to develop a library-to-user service. Horowitz and Bleich (120) stripped from the MEDLARS tapes the indexing for the most recent five years of the 250 journals available in the Beth Israel Hospital Library and mounted this data base of about 400,000 items on a local minicomputer for round-the-clock self-service access by faculty and students. The software system allows users to search the file using normal vocabulary. Search printouts are organized alphabetically by the journal title so the user can easily locate materials on the shelves. The basic PaperChase concept is a natural library-to-user service concept based on a system-to-library network data base, yet the system was built not by a library but by a research group that expanded a small personal system into an institutionally useful one.

## THE OPPORTUNITY

People often expect that Stage 2 results from Stage 1 technologies and are disillusioned and disappointed with the implementation. The introduction of each new technology in library and information management holds promise of different ways to manage the quintessential individual process of transforming information into personal knowledge. Experience suggests, however, that Stage 2 ideas for transformative activities like PaperChase arise out of an entrepreneurial perception of opportunity during Stage 1 implementations. New ideas spring from people in working environments.

For decades, resources and energy have been devoted to improving the information transfer chain by attempting to compress the volume of the information base. Less attention has been paid to the overall institutional knowledge base, the main portion of which is the responsibility of the library. This cornerstone of the academic center has been largely conceived of as a kind of intellectual cafeteria. We must bring different skills to the library for teaching and knowledge-base development, new technologies for managing the knowledge base, and fresh concepts of the relationship of information to learning for sustaining lifelong learning.

Previous assumptions about the purpose of computation in a library setting should be subjected to close examination. Computation for bookkeeping purposes is early Stage 1 and should give way to computer-supported service systems. Distributed systems with local autonomy can foster ingenuity and productive advances toward interactive user-focused network systems. The National Library of Medicine and other funding agencies should consider these types of efforts favorably.

Distributed systems like PaperChase offer opportunities to respond to data base retrieval needs more precisely and with

*Information in Academic Health Centers*

greater economy and effectiveness. The ordinary information needs of students and faculties should be met locally, and the library catalog should provide access to all the materials available in the library, for example, books, journal articles, and audiovisual materials. Local library indexing of journal articles was done in the 19th century when labor was inexpensive and the journal base smaller. Separate files for books and journals developed over time because the growth in the knowledge base simply outstripped available resources to maintain a unified catalog. Until recently the technology has not been available to make the library catalog the effective instrument it should be for providing access to local collections. PaperChase is simply an example of how a full record of the materials available in the library can be achieved. With such a capability, the use of expensive remote centralized online systems like MEDLINE and its back files can be reserved for the wide-ranging and extensive searches typically required in research. Communication costs as well as the need for interlibrary loans would be reduced. To divide the world knowledge base into two sections, that is, what is available locally and what exists, has its dangers; parochialism, ignorance, and complacency are the worst. But these dangers can be avoided if libraries are properly funded to ensure high quality local and regional collections.

**Multifunctional Responsibilities**

The four irreducible and interrelated functional responsibilities in the AHSC library are curatorship, education, service, and research. Most academic users are familiar and comfortable with the curatorial roles of libraries. Faculty members and students who make a point of their independence from a library, who spend four years of college or many years teaching without once crossing the library's threshold, think

*Challenge for Librarians*

of the library's curatorial functions only. Many people live in this way with can be said to be question. Because scarcity, of the population storehouses, it is not service, education, and go unrecognized and

The AHSC librarian the nadir of the early quist (2) could charge tradition:

Medical school . . . in the process of learning medical literature in the proper management expensive, and some years late, and some. Because there has well-trained, imaginations, there . . . is no to pluck likely cand opening up. Because been made so frugal library collections . . . they should be . . . tenance has been medical school library state of deplorable cause of the lack of graphical apparatus information in the become sufficiently pensive as to be bre

Today, there may be in library collection that the nation's is weakening. Many may no longer be adequate, but data suggest not properly equipped technologically advanced. Today the demand imaginative medical information than it should be, between managing the base and the teaching

ty and effectiveness. The nation needs of students could be met locally, and log should provide access als available in the library, ooks, journal articles, and erials. Local library index- ticles was done in the 19th bor was inexpensive and smaller. Separate files for nals developed over time th in the knowledge base ed available resources to ed catalog. Until recently as not been available to / catalog the effective ind be for providing access ns. PaperChase is simply ow a full record of the ole in the library can be uch a capability, the use ote centralized online sys- INE and its back files can he wide-ranging and ex- typically required in re- ication costs as well as rlibrary loans would be de the world knowledge ections, that is, what is and what exists, has its ialism, ignorance, and the worst. But these dan- d if libraries are properly : high quality local and ns.

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ole and interrelated func- ties in the AHSC library ucation, service, and re- lemics users are familiar with the curatorial roles y members and students t of their independence ho spend four years of years teaching without ibrary's threshold, think

of the library's curatorial or archival functions only. Many pass through academic life in this way without harm; whether they can be said to be educated is another question. Because so many, if not a majority, of the population perceive libraries as storehouses, it is not novel to find that the service, education, and research functions go unrecognized and unused.

The AHSC libraries today are far from the nadir of the early 1960s when Bloomquist (2) could charge without fear of contradiction:

Medical school . . . administrators . . . are in the process of learning the fact that the medical literature is important, and that the proper management of it is complex, expensive, and essential. We are thirty years late, and some have not yet learned. Because there has been no demand for well-trained, imaginative medical librarians, there . . . is no reservoir from which to pluck likely candidates for the new jobs opening up. Because expenditures have been made so frugally, medical school library collections . . . fall far short of what they should be . . . . Because proper maintenance has been deferred for so long, medical school library quarters are in a state of deplorable inefficiency . . . . Because of the lack of foresight, the bibliographical apparatus which is the key to information in the medical sciences has become sufficiently cumbersome and expensive as to be breaking down.

Today, there may be no glaring shortfall in library collections, but the data suggest that the nation's total resources pool is weakening. Many AHSC library facilities may no longer be dilapidated and inadequate, but data suggest that libraries are not properly equipped for efficiency in a technologically advanced environment. Today the demand for "well-trained, imaginative medical librarians" and other medical information specialists is still less than it should be, for the relationship between managing the medical information base and the teaching and practice of med-

icine and clinical research is not well understood.

#### CURATORSHIP

The decade of the 1960s saw revitalization of AHSC libraries and strengthening of their resources, chiefly through the stimulus of the Medical Library Assistance Act (MLAA). In the first five years of the act, the National Library of Medicine awarded some \$40 million across a spectrum of programs. In 1968-69, the only year construction funds were appropriated, the NLM awarded \$11.25 million to 11 institutions, inaugurating an unprecedented period of library construction and renovation (7). Grants were made to enrich library collections, to train large numbers of new library personnel, and to help stimulate better utilization of the medical literature through historical studies and secondary indexing publications (121). The Regional Medical Library Program was established, linking more than 2,000 libraries in 11 geographical regions into a mutually supporting document delivery network.

The spurt in growth begun in the late 1960s was unevenly sustained through the end of the 1970s. On the whole, the total national resource information pool continued to grow: the median number of volumes in AHSC libraries increased by 161 percent from 54,779 to 143,011 volumes between 1961 and 1981; the average number of serial titles increased 37.5 percent, from 1,698 to 2,334; the number of professional librarians increased from an average of 4.1 to 9.8 (139 percent); and operating expenses soared from \$57,471 to \$790,536, that is, by a factor of 13.75. The use of online bibliographic services, unknown in 1970, has reached remarkable levels, ranging from 21 (Morehouse School of Medicine) to 8,979 (University of Texas-Galveston) searches, with an annual average in 1981 of 2,440 data base searches.

Despite these figures, other evidence suggests the narrowing in the nation's resource pool as libraries struggle with declining budgetary growth rates and increasing inflation. The number of serial titles published continues to expand, yet the total number of current serial titles in the nation's health sciences libraries in 1979 was 6,000 titles less than it was in 1973 (122). From 1980 to 1981 the average number of serial titles held by AHSC libraries increased by only one percent, yet the average serials budget increased by 15 percent and is now close to consuming a quarter of the library's total budget. Every two years since 1976 the average medical school library budget has increased by 22 percent, barely keeping pace with inflation. The overall view is less favorable. Total support for medical school libraries in 1976 was 3.11 percent of total medical school operating expenses. Since then this support has steadily declined while medical school operating budgets have increased (Table 3).

If budgets for purchase of materials are not to increase to take up the shortfall that is developing, money must be allocated to develop strategies that optimize the organized purchase and sharing of resources between institutions. An AAHSLD survey in 1981 found AHSC library directors giving top priority in the next two to four

years to automation and collection development, in that order. The curatorial responsibilities of the AHSC libraries are still in need of attention.

#### EDUCATION

Over the past 10 years the National Library of Medicine through the MLAA programs sponsored many efforts to adapt new technologies to health sciences education and to foster interinstitutional sharing of instructional resources through such network systems as the Health Education Network for computer-aided instructional materials. The emphasis has been on developing learning resources centers for the use of audiovisual materials, models, and patient simulation programs.

A creditable record has also been achieved in library educational programs. Of the 97 health sciences libraries responding to the 1981 AAHSLD survey, 22.9 percent had established written educational program goals, and 26.3 percent had written educational objectives to guide their programs; 10 (10.3 percent) schools offered formal courses for credit, while 24 (24.7 percent) offered elective courses in the medical school. The courses emphasize library research skills and knowledge of standard reference works, indexing and abstracting tools, and data bases. More than one-third of these courses were being

#### Challenge for Libra

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TABLE 3  
Total Support for Health Sciences Libraries in United States

Fiscal Year	Medical Schools' Operating Budgets* (In millions)	Percent Change	Health Sciences Libraries' Expenditures† (In millions)	Percent Change	Percent Library Support‡
1975	1,519		47		
1976	1,800	18.5	56	19.2	3.11
1977	2,197	22.1	66	17.9	3.00
1978	2,451	11.6	68	3.0	2.77
1979	2,828	15.4	77	13.2	2.72
1980	3,316	17.3	75	-2.6	2.26

\* Data from the AAMC Institutional Profile System.

† Data compiled by the University of Texas Health Science Center at Dallas, 1975-1977 (15-17), and the Association of Academic Health Sciences Library Directors, 1978-1981 (12-14).

‡ *J.A.M.A.* education issues from 1979 to 1981 (Table 26) gave figures nearly a percentage point lower: 1978 = 1.89, 1979 = 1.76, 1980 = 1.71. Those data were from 112 medical schools in 1978 and 1979 and 119 medical schools in 1980.

and collection developer. The curatorial role of AHSC libraries are in transition.

Over the years the National Library of Medicine through the MLAAP program has made many efforts to adapt to the needs of health sciences education. Interinstitutional sharing of resources through such programs as the Health Education Resource Project has aided instructional development on a national basis. There has been an emphasis on developing resources centers for the materials, models, and programs.

Record has also been made of educational programs. In a recent survey, 22.9 percent of libraries responded to the AHSLS survey, 22.9 percent had published written educational objectives to guide instruction, and 26.3 percent had objectives to guide instruction for credit, while 24 percent had elective courses in health sciences. The courses emphasize practical skills and knowledge of health sciences, works, indexing and abstracting, and data bases. More health sciences courses were being

conducted at the request of medical faculty members, and one-fourth were being jointly taught. Courses were also offered in the schools of pharmacy, dentistry, nursing, allied health, biomedical communications, and health care administration. In the 46 libraries where library staff members held faculty appointments, 35 percent were eligible for tenure. Of the 84 library faculty members teaching in the AHSC, 73.8 percent received formal training in educational methods, a remarkable figure considering that such training is rarely, if ever, offered as a part of library science training.

Professional library staff members were engaged in a variety of roles in relation to their work with AHSC teaching faculty members. Of the responding libraries, 36 percent had professional staff members participating in classroom teaching; from 43 to 64 percent had staff members who suggest materials for new courses, select materials for reserve reading lists, and tailor collections to fit new courses; 20 to 23 percent had staff members who conduct or participate in tutorials and assist students in remedial study programs; 4 percent had staff members who work with the faculty on lesson plan development; and nearly 18 percent had staff members who work with the faculty to develop new teaching materials.

As encouraging as these data are, there is considerable room for improvement. A teaching library concept needs to be articulated (123). Today's educational programs are fragmented and uncoordinated. They teach the use of information resources for research but not for clinical decision-making or lifelong learning. According to the AAHSLD survey, nearly 70 percent of the offerings were limited to a single session. Only 17.6 percent of AHSC libraries had an identified position on the staff for an educational program specialist, although 48.3 percent showed educational

specialist roles. These educational roles should be more systematically planned and integrated. Only 20 of 97 respondents reported any involvement in medical school curriculum deliberations. Much greater involvement of the library faculty in curriculum planning can lead to a more rapid realization of individual knowledge base development.

The barriers to improving the effectiveness of the library's educational roles are perhaps common to most efforts aimed at adding to the traditional curriculum. Library directors believe lack of faculty and lack of student interest are significant barriers and lack of a library staff and lack of financial resources to develop effective instructional materials are inhibiting factors, but most (81.7 percent) of the responding directors agreed that the overcrowded curriculum is the largest problem.

The AHSC faculties have directed so little attention to the nature of information management in health sciences education, especially in medical schools, that questions more than answers abound. What are the AHSC's goals for providing students, faculty members, and practitioners with informational and computational literacy and skills? What does knowledge-base management mean, and how should it be taught? What is the proper environment for teaching and learning these skills? Who should be responsible for such programs? What roles should the library play?

The issue is information management education, not "library education." Professionals involved in artificial intelligence research, medical education, medical computing, and information science, as well as library science, need to explore the parameters, the process, and the content of information and computational literacy in health sciences education. To focus on this increasingly critical problem area, the AHSC, working in conjunction with professional associations and societies,

Notes

Percent Change	Percent Library Support
19.2	3.11
17.9	3.00
3.0	2.77
13.2	2.72
-2.6	2.26

1975-1977 (15-17), and the

a percentage point lower in 1978 and 1979 and 119

should find the means to grapple with the substantive issues involved.

This is a period of turbulence and innovation that calls for new skills and a broadened talent pool in AHSC libraries (124). The library, like other parts of the AHSC, needs systematically to upgrade and refresh the knowledge management skills and concepts of its staff. The automated Stage 1 library will enable staff members to concentrate their efforts on previously neglected service, education, and research roles rather than on curatorial responsibilities. As a result, two types of retraining programs for existing staff will be needed, one to maximize computational and information management skills and the other to enhance research and educational techniques and skills. Academic centers also need to attract the best graduates from library and information science schools to form a solid talent base in academic information resources management. The chemical and pharmaceutical industries among others are absorbing the best, the brightest, and the energetic and entrepreneurial librarians. The average AHSC library entry level salary in 1981 was \$14,000, hardly an attractive level for a bright master's degree graduate.

More opportunities to employ information-management individuals in areas of the AHSC outside of traditional library roles are needed as well. Librarians are able to cross disciplinary boundaries by virtue of their roles as information providers (125). They can introduce more effective use of information into a variety of academic settings rapidly. Opportunities for expanding traditional library roles are rare, but successful cross-fertilizations have occurred, as at the University of Missouri-Kansas City School of Medicine, where the absorption of a librarian into the education evaluation services unit served to strengthen both that unit and the library's roles in the education programs.

### *Information in Academic Health Centers*

#### SERVICE

Most library services today support the library's curatorial responsibilities. Photocopy services and interlibrary loans are mechanical document location and transfer services. Data-base searching, while a highly skilled and complex task, currently is primarily a location service. Only relatively recently has the librarian in the reference role begun to resume aspects of the earlier role of scholar-librarian, whose bibliographical knowledge extended to include knowledge of the content of materials.

In 1970, the NLM/MLAA program shifted emphasis from strengthening resources in established libraries to improving the management of biomedical information and encouraging efforts to extend library services beyond the library itself. Many projects aimed at improving delivery of information services into laboratories, patient-care wards, and smaller, isolated community agencies and facilities were funded to a total of nearly \$2 million. While in many states, such as Wisconsin, the outreach services are a long-standing tradition, these roles have been greatly strengthened by NLM programs. Today 81 out of 97 AHSC libraries provide consultation services to hospitals and other agencies needing library services development; 36 AHSC libraries offer library services directly through contract arrangements.

Other outreach innovations designed to take literature to the patient-care teams flowered in the 1970s. LATCH (Literature Attached to the Chart), initiated at the Washington (D.C.) Hospital Center in the late 1960s, is designed to assemble two or three articles from the recent literature pertinent to a clinical treatment problem and to attach them to the patient chart for reference by the patient care team. The questions to which LATCH responds are posed by staff members and attending

### *Challenge for Lib*

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physicians. But this innovation has not spread widely; only five programs of this type are reported in AHSC libraries, according to the AAHSLD survey. How widespread the practice is in hospital settings for which it was originally designed is not known.

The clinical medical librarian (CML) program, developed at the University of Missouri-Kansas City School of Medicine, was a natural outgrowth of the docent teaching approach. The CML is a member of the teaching team, attends rounds, and is responsible for bringing into the patient care setting literature that responds to explicit as well as implicit learning needs of students and staff. Twenty-one programs of this kind are known in AHSC libraries. Both LATCH and CML programs are considered extremely expensive and labor-intensive. While evaluations of programs have shown them to be consistently popular, useful, and desirable, lack of funding has been a serious deterrent to widespread adoption of these techniques.

Information research services, once common in scholarly academic libraries, are now rare. The Library of Congress Congressional Research Service (CRS) is probably the best service of this kind in the world. The CRS operates independently of the Library of Congress and has an extensive collection of resources of its own, but it draws heavily on the Library of Congress' collections and curatorial services. The CRS provides members of Congress and their staffs with two kinds of services: (a) fast fact retrieval and (b) long-range, in-depth policy analysis and information studies. The CRS is staffed with librarians and subject specialists who can answer questions ranging from the most mundane to the most arcane, from the name of a best-selling author to the ecological significance of the snail darter.

The use of new information technologies that relieve librarians of tedious tech-

nical record-keeping functions makes feasible as well as desirable the expansion of interpretative information services (126, 127). Libraries and information resources are not self-interpreting. Fast fact retrieval is a standard service; information research services and data base management should become standard services as well. Until there is something like MEMEX, a prototype electronic desk for a scientist, users will continue to need information brokers, for as Bush (128) observed, users do not so much "consult a library as nibble at it." Here, as in the educational arena, individuals are needed who can use information skills, subject knowledge, and synthesizing abilities to bridge different academic disciplines. This combination of talents is uncommon in any profession and, if found in an existing library staff, should be groomed and cultivated. Retention of this kind of staff is important because effective research services, such as those described in earlier scenarios, depend heavily on intimate knowledge of the institution and its key individuals that develops only with time.

Such services supported in the AHSC library, although initially costly and difficult to nourish, can only lead to improved time effectiveness of the AHSC senior staff. Senior staff members wear many hats, and each imposes different information demands and support services. During the course of a day, a senior faculty member may be alternately an administrator, a researcher, a practitioner, a student. In each manifestation, the individual needs the best information available for decision-making. These information-support roles are frequently carried out with varying degrees of effectiveness by secretaries and special assistants. Information research services and data-base management can be more effective solutions to a common and time-consuming information access problem.

## RESEARCH

Of the few library-based research efforts carried out in the past two decades, most have been disappointing. Although librarians recognize the importance of research to a vigorous and innovative organization, for a variety of reasons few resources are committed to this work. Ninety percent of AAHSLD library directors ranked research as 3 to 5 on a scale of 5 in importance, yet in 58.8 percent of AAHSLD libraries no staff members were involved in any research projects; in five libraries a staff member was identified as a researcher, usually combining research and planning functions. The 38 libraries reporting some research efforts showed their main emphasis to be on questions relating to curatorial responsibilities, such as collection overlap, citation analysis as a collection development tool, serials usage, and regional cooperation. Problems of information management for the user are approached in terms of user satisfaction and the use of self-directed learning tools. This glaring deficiency is informally and anecdotally attributed to many factors: lack of research training for librarians, lack of time by staff members bogged down in operational tasks, and lack of interest in the problems of information use.

The library has been seen by others as a natural laboratory for basic as well as applied research in significant questions of information use behavior (61, 66, 129). Many questions are as yet unasked as well as unanswered about the appropriate character and proper design of academic information systems within the AHSC complex (130). Faculty members who work with medical knowledge representation systems must eventually include the library in the design of the knowledge input-output loop. The degree of acceptable or necessary system redundancy needs investigation. Library classification schemes may

*Information in Academic Health Centers*

be dysfunctional, inasmuch as they neither support typical human cognitive approaches nor follow human information-processing patterns (131, 132).

The library's manageable size and its multifunctional information files provide the AHSC with a useful laboratory to examine the effect of possible strategic planning decisions before they are implemented institution-wide. If opportunities are provided for multidisciplinary teams to work on medical information management questions, extraordinary progress in pulling the AHSC into a coordinated network system could be made in a short time.

**Readiness for Change**

Judging by the responses to the 1980 Delphi survey, AHSC library directors are well attuned to the need for change (11). They see the major problem as sufficiently rapid adoption of information-processing technologies to respond to the new service needs and demands that are developing as a result of major technology shifts.

Funding of additional resources is a severe problem. Shrinking institutional resources have restricted opportunities for enterprise. Securing support for projects under the Medical Library Assistance Act is hampered by budget appropriations that have never approached early authorization levels and are inadequate to meet the magnitude of the task at hand.

Responding to new service demands is impeded by the lack of staff members. More than 76.6 percent of the AHSC libraries reported there were program areas insufficiently staffed to achieve the goals already set for the library. The major staffing gap is in meeting educational and service responsibilities, and 84 percent believed it is not possible to reallocate existing library staff members to relieve the shortage. Nine out of every 10 AHSC library directors need improved staffing to

*Challenge for Libr*

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meet current commitments: over half need one to three additional staff members, and another third need four to six new staff members.

In addition to shortages of personnel, there are shortfalls in certain skills and knowledge. A third of the directors see a lack of skills in statistical and systems analysis and basic research methodologies. About a fourth believe more knowledge of artificial intelligence research and medical knowledge systems is needed. Librarians share the same deficiencies as many others in the AHSC, but lack of information management or library management skills is not a primary concern.

#### Integration of the Library

The library needs to be involved in the institution's planning and development in order to make an effective response to program directions. The library is integrated when it is a link in the institution's communication chain and a participant in institutional policy-setting.

The intuitive judgment of many librarians is that the AHSC library is more effective and relates better to its constituents if it is a part of the AHSC structure rather than the university library structure. This belief has been difficult to validate. The AAHSLD data shed some light on the question, but more research is needed. Of the 97 responding AHSC libraries, 20 reported to the university library; 39 to a

university vice president, president, or chancellor; 19 to the medical school dean; and 19 to an assistant or associate dean. Nine had dual reporting channels and reported to both the university librarian and to an individual in the AHSC. Data were collected on the health sciences library directors' regular contact with the AHSC executive staff, participation in institutional planning activities, faculty status, and participation in teaching and educational programs. Directors and librarians in health sciences libraries that are administratively part of the AHSC structure are more likely than their colleagues in libraries that are part of university library systems to (a) meet with AHSC executive staff ( $p = .013$ ), (b) participate in institutional planning ( $p = .060$ ), (c) hold faculty appointments ( $p = .055$ ), and (d) be involved in educational program activities ( $p = .004$ ). No significant differences were found on operational library variables such as total budget, expenditures on staff automation or collection development, library services utilization, number of courses taught, or variables associated with general institutional governance, for example, service committees.

These data do not support the conclusion that the AHSC library is well integrated in academic centers. The fact that a substantial number of AHSC library directors (37.1 percent) reported no regular access to the AHSC executive staff suggests otherwise.