# Looking Backward, 1984–1959: Twenty-five Years of Library Automation—A Personal View*

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ABSTRACT

A brief profile of Janet Doe is given. Twenty-five years of library automation are reviewed from the author's point of view. Major projects such as the SUNY Biomedical Communication Network and the Regional Online Union Catalog of the Greater Midwest Regional Medical Library Network are discussed. Important figures in medical library automation are considered, as is the major role played by the National Library of Medicine.

THE PRIVILEGE of presenting the Janet Doe Lecture is a great one which the recipients of the honor have always cherished. 1983/84 marks the 60th year of Ms. Doe's association with the medical library profession. I am pleased to report that as she approaches her 90th birthday, she retains her lively interest in life. She enjoys music and painting. She is an avid solver of crossword puzzles and double crostics, and for light reading she enjoys detective stories. She appreciates fine cooking and enjoys trying new recipes. For some time, she and a group of friends have exchanged recipes and experimented with them. Estelle Brodman tells me that she remembers visiting Janet and sometimes eating wonderful new things, and sometimes dealing with a culinary delight gone wrong. Janet Doe is truly one of the great leaders of the medical library profession. She is one of those rare people who inspire love and devotion in the people who work with her, who would do anything that she asked them to do. This may be because she is always able to find the good in people and refuses to believe that sometimes people don't want to work, or have other human foibles. It is a trait that sometimes makes for administrative problems, but in the end she accomplishes what she wants. Her contributions have been many: as the first editor of the *Handbook of Medical Library Practice,* she impressed her high standards on two editions of that work and set the tone for the subsequent editions. Her consulting services were also important, and her reports on the, then, Army Medical Library, and Harvard Medical Library, were forward looking, farseeing and broad in scope—a fact that was realized some time after the reports were completed. She has recently evinced an active interest in knowing about computers and how they work, and so it seems especially appropriate in this paper to review the past twenty-five years of librarianship in which such dramatic changes have taken place in what we do and how we do it, all largely because of computers.

These lectures provide the authors a unique opportunity to look at librarianship from a variety of viewpoints, and more important, to give the speakers the impetus to focus on a particular aspect or interest, which, given the hurly-burly of daily existence, is not always otherwise practical or possible.

In choosing to look back at library automation over the past twenty-five years I have taken a very personal approach. This is not an attempt at an exhaustive, scholarly, historical survey, but is rather more like a memoir. Not every major figure in the field will be mentioned or even considered, and the topics I have chosen to discuss may seem to some to be of minor importance in the overall picture. Having thus proclaimed my bias for this presentation, you, dear reader, can avoid the necessity of checking to see whether your list of most important, or most famous, or infamous projects is discussed. You will not, I hope, be like the small boy who wrote a book report on a treatise on

*The Janet Doe Lecture on the History or Philosophy of Medical Librarianship, presented May 29, 1984 at the Eighty-fourth Annual Meeting of the Medical Library Association, Denver, Colorado.

FIG. 1.—Portrait of Janet Doe, ca. 1948, when she was librarian of the New York Academy of Medicine.

penguins and concluded that the book taught him more about penguins than he wanted to know.

Every age has its giants, and in the last twenty-five years there have been many—Rogers, Taine, Lazerow, Brodman, Garfield, Adams, Avram, Leiter, Kilgore, Esterquest, Cummings, Darling—to name but a few. I have not listed them in any particular order of importance because that would be not only very difficult, but also somewhat presumptuous. You will also note from the few names mentioned that I have concentrated on the activity which has taken place in medical libraries, although there are inescapable connections to the wider field of library automation. For instance, there are probably few readers who recall that the genesis of the Ohio College Library Center, now OCLC, programs, and their profound impact on all types of libraries, can be traced directly to the work done by Kilgore, Fleming, and Esterquest in the early 1960s. Their pioneering effort was the Columbia-Harvard-Yale Project to Computerize Book Catalogs. It was called by slightly variant names depending on which institution you were addressing; for example, at Columbia it was called CoHaYaMed, and at Harvard it was called HYCCUP (Harvard, Yale Columbia Catalog Utilization Project). It was facetiously suggested that at Yale it could be called YCH (pronounced "yechhhh"). It was an important step in the automation of libraries, and the fact that it failed does not lessen its impact. Kilgore was the librarian of the Yale Medical Library at the time, and the belief that the principles embodied in this project were correct led him to the founding of the Ohio College Library Center. It failed, in large part because of the considerable problems of getting three very independent institutions to compromise and cede part of their autonomy, a problem which plagued many early automation projects, and one which is not unknown today.

Failure in the field of library automation, although not often discussed, has helped to move us forward just as much as success. The only difficulty with knowing about failure and the real reasons programs fail is that it is so little reported. After a number of years one often finds the same project being attempted at a different location. This is, however, not necessarily bad or foolish because the technological advances which have occurred, and which continue to occur so rapidly in this field, and which have such astounding impact, quite frequently make possible now what was not possible ten, five, or even two years ago. So although "those who forget history are condemned to repeat it" may be a truism, in this area of knowledge it does not always apply. But there are also occasions in which one can reapply existing technology to provide new solutions to old problems. As a current advertising campaign notes: "New technology isn't always better, and better technology isn't always new."

Automation and medical libraries have been linked for more than a century. John Shaw Billings, who was the Director of the Library of the Surgeon-General's Office, U.S. Army, was a consultant to the Census Bureau, and he suggested to Herman Hollerith that a machine ought to be able to be developed which could perform the mechanical aspects of tabulation of the census data (Figure 2). The early relationship between Billings and Hollerith has become almost apocryphal, with the story that Hollerith determined the size of the standard 80-column punched card by asking Billings how big to make it, and Billings responded by pulling out the, then, large-size dollar bill and suggesting it as the size; and that is the size it is. Hollerith's early efforts resulted in the mechanization of the 1890 census which was thus able to be tabulated, verified, and reported in record time. In 1911 Hollerith went on to found a firm named the Computing-Tabulating-Recording Company which eventually changed its name to IBM, and his name is immortalized in the name of the standard coding pattern for letters and numbers on a punched card (Figure 3).

If you have wondered how the punches on a card represent letters and numbers, the code is ingenuously simple. A punched card is divided into horizontal rows and 80 vertical columns. Numbers are coded by a single punch in a column in the appropriate numbered row, 0–9. Letters are coded by two punches per column, a control punch in either the 12, 11, or 10 (zero) row followed by a digit punch,

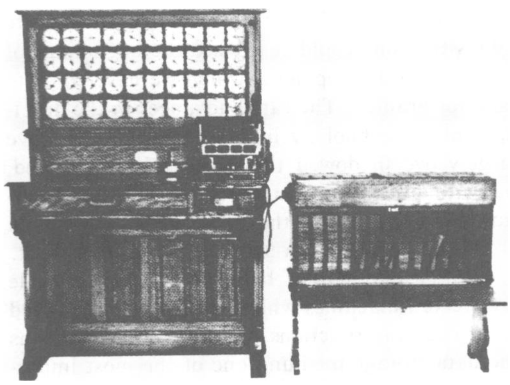


FIG. 2.—Hollerith Tabulating Machine, 1890.

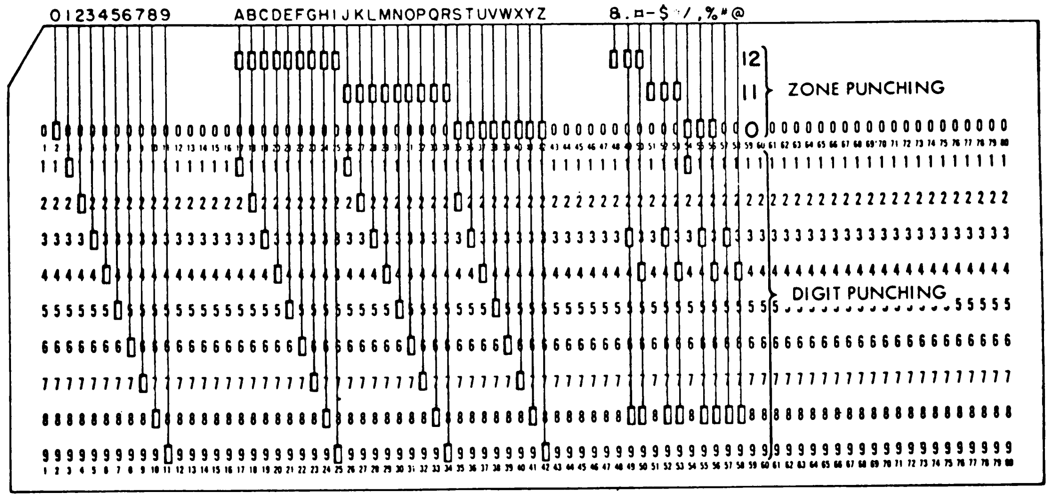



FIG. 3.—Hollerith 80-column card.

as shown in Figure 3. As you can see, the letters A through I have a 12 punch; the letters J through R have an 11 punch; and the letters S through Z have a 0 punch.

This was not, of course, the beginning of automation efforts (which can be traced to a number of sources such as Pascal's calculating machine which was invented in 1642 and which was the first true mechanical adding machine, or Babbage's Analytical Engine of 1822 which performed intricate mathematical calculations and which worked with punched cards, and the Jacquard looms which were operated by punched cards which traveled overhead and controlled the weave design. The descendents of this technology can still be seen on the streets and in the parks of Holland where the punched cards are used to operate gasoline engine powered calliopes), but it is probably the first time that libraries, statistical information, and automation came together. They have never since been very far apart, although it was not until the late 1950s that one could really see the beginnings of the modern developments which we have come to take for granted. The rapid advances in the development of technology in the last ten years have largely overshadowed the entire previous period, but without the solid foundation of library automation which was laid in the '50s and '60s, we should not have reached our present state of achievement.

Library automation began with the available unit record machines which were largely designed for accounting functions. Using punched cards as the data storage medium, one of the most important pieces of equipment was the card sorter (Figure 4). This machine enabled cards to be resorted into a variety of sequences and was virtually hypnotizing in operation. The next step up toward computers was the use of the Document Writer System which used cards to drive a typewriter. As processing moved to computers, cards still formed the data storage mechanism and jobs were performed in "batches."

In 1960, as a new graduate from Columbia's School of Library Service, it was with great excitement that I moved to Washington for a one-year internship at the National Library of Medicine. NLM was singularly fortunate at that time to have five major figures leading it into the modern period. Frank B. Rogers, Seymour Taine, Samuel Lazerow, Scott Adams, and Estelle Brodman were innovative, imaginative, and resourceful achievers. The atmosphere which they generated was electric. The mechanization of the *Index Medicus* was in full swing, and two of the newest marvels of the period, the Xerox 914 office copier and Copyflo machines were revolutionizing both interlibrary document delivery capability, quality, and speed, as well as the way people worked in offices. Carbon copies, although still commemorated today in the familiar "cc" at the bottom of a letter, were shortly to become virtually extinct. These technological marvels were coupled with other unique developments as the planning went forward for the new facilities of the National Library of Medicine which was rising on the outskirts of the National Institutes of Health campus in Bethesda, an area which still had the appearance of a rural suburb. Rapid technological change was also having its

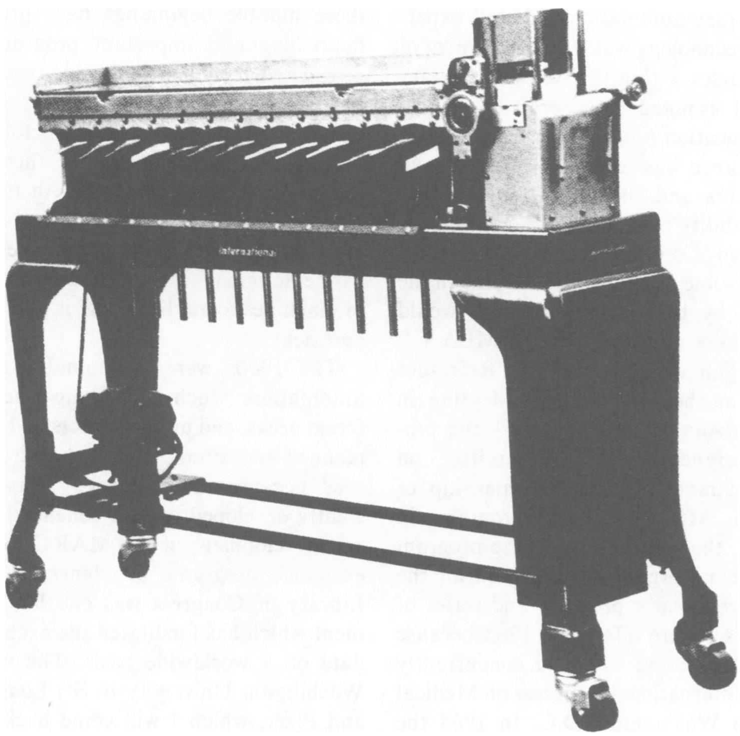


FIG. 4.—IBM card sorter, 1925.

impact on the building, and the library had barely moved in when the computer room facilities were remodeled to accommodate the new generation of equipment.

The design of the building, somewhat unusual, was selected to minimize damage in the event of an atomic bomb attack on Washington. There are no direct windows to the outside and the walls are designed to fall outwards. The roof, in the shape of a hyperbolic paraboloid, was supposed to fall to close the gap over the hall which housed the card catalogs. At least, that was the contemporary explanation. The collections were safely housed below ground.

The two great indexes, the *Index Medicus* and the *Bibliography of Agriculture,* together with the Library of Congress catalogs, were all being mechanized to speed their production using photocomposition and punched card techniques. The new methods made the process of cumulation more accurate and much quicker, but the links with the past were still strong at NLM, and the last volumes of the *Index Catalogue of the Library of the Surgeon General's Office* were just being published. The massive files which contained the material for the never-to-be-published sixth series lined both sides of what seemed like a block-long corridor in the basement of the library. Outside of the government's three national libraries, automation of information activities, or information storage and retrieval, was proceeding at various locations, mostly in special libraries of large corporations such as General Motors or in other government agencies or units such as the Army. Not much had yet begun to take place in medical libraries. NLM enabled its staff, and the interns it selected, to participate in the extensive education programs offered by IBM to its customers. Here one learned how to program unit record machines by wiring control panels, and a short time later, how to program an IBM 1401 computer. It seems even more remarkable to those of us who experienced this time of early computer work to look at today's personal computers which contain more memory in a 256K unit which takes up four square feet of desk space than the most powerful generally available computers of that time with perhaps 64K of core storage, which filled rooms of some 600 to 900 square feet, and required massive electrical support systems for air conditioning as well as for their operation.

One of the key elements in developing both acceptance of library automation and staff expertise in the use of technology was the development of a program of courses within the Medical Library Association. IBM, as noted, had operated an extensive customer education program for a number of years, but attendance was restricted to actual and potential customers and their staff. In order to extend the availability of courses, the MLA Continuing Education Committee had projected a series of courses, some of which would build on the foundations laid by basic courses, which would provide this training opportunity. The MLA CE program had begun with a series of "Refresher Courses" given at the 57th Annual Meeting in Rochester, Minnesota in 1958. In 1961 the program was redesigned by the Committee on Advanced Seminars under the chairmanship of Estelle Brodman. After a series of programs in 1962 in Chicago, the committee and the program underwent a further reorganization, and during the 1963 year prepared a new program and series of courses. No courses were offered in 1963 because the annual MLA meeting was held concurrently with the Second International Congress on Medical Librarianship, in Washington, D.C. In 1964 the first program of courses, still called seminars, was offered in San Francisco. One of the programs was titled "Basic Punched Card Principles for Librarians" and was prepared by this author, and the other was titled "Implications of Machines in Medical Libraries" and was prepared by Estelle Brodman. "Techniques of Systems Analysis and Design" made its debut in 1965, and "Computers and Programming" was produced for the 1968 annual meeting. These courses were landmarks in the field of continuing education for professionals, and the CE Committees, chaired by Erich Meyerhoff in 1964 and Harold Bloomquist in 1965 laid a firm foundation for the current MLA program and charted much of its subsequent development. There were three categories of courses—machine, bibliographic, and historical—but it is the machine courses which concern us here.

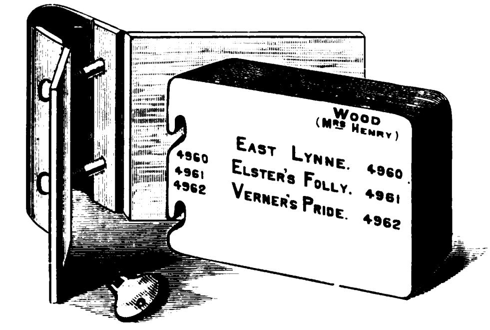
These courses, which were produced with the cooperation of IBM and many other companies, were significant in the impetus which they gave to library automation in medical libraries. The hands-on experience with machines, a part of the program from the very beginning, helped to break down barriers and allay anxieties. Large numbers of the Association's members participated in these programs, and the very success of the totally volunteer effort led to the eventual establishment of the MLA Division of Education. It is hard to believe that these humble beginnings have produced such a flourishing and important program, but it is a program which has had wide-reaching influence far beyond the medical library community and which paved the way which was followed by other library associations. Some of these early efforts look quaint by comparison with today's sophisticated offerings, but they contained some outstanding material, and Brodman's paper on "Punched card equipment—history and philosophy of the use of machines to aid libraries" is still interesting and pertinent.

The 1960s were a seminal period in library automation. Much was taking place in many different areas, and many projects and programs were planned and attempted which did not wholly succeed because the technology was not yet sufficiently developed or cost-beneficial. The planning and development of the MARC format and data exchange programs by Henriette Avram at the Library of Congress was one landmark achievement which has facilitated the exchange of library data on a worldwide basis. The work, begun at Washington University in St. Louis by Brodman and Pizer, which I will come back to, has led to online systems which are still operational and effective in their subsequent regenerations twenty years later. Seminars on machine methods which were held in St. Louis from 1962 to about 1965 attracted visitors from all over the country and from many foreign nations. There were a number of major national and international symposia held in the '60s which helped to spread knowledge of what was being done, what was hoped to be done, and what might be done in the future. One symposium, held at Brasenose College at Oxford University was especially significant, bringing together major U.S. and British figures. Although the Director of the British Museum, Sir Frank Francis, who hosted the meeting, declared that he could "see the light at the end of the tunnel" and was somewhat optimistic in his assessment, progress was being made although the tunnel mouth is still elusively ahead of us. We have since perceived that we are not on a single track, but rather that library automation is an area where there may be several correct solutions to a problem given the differing variables of different locations and different times.

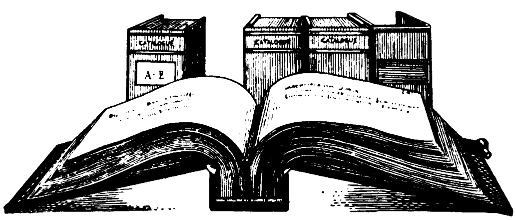
Some technological advances such as machine translation have still not come into common use. The classic tale of the 60s had a computer translating the phrase "The spirit is willing, but the flesh is weak" from English into Russian and then back into English. The outcome of this process generated the phrase: "The wine is good, but the meat is bad." There were also endless discussions of the problems of syntax and inverted headings. How did the computer solve the problem of distinguishing between "Blind Venetian" and "Venetian Blind"?

In the 1960s, computer technology had enabled libraries to come full circle—from the early library book catalogs like the page from *A Catalogue of Books in the Library of the Surgeon General's Office* (Figure 5), to the card catalog, to the sheaf catalog (Figure 6), which tried to bridge the gap between book and card catalogs and provide the benefits of both, to the computer-produced book catalog.

New medical schools which were developing in a number of institutions in the '60s looked toward automation as a major tool to help them achieve parity with older libraries and shorten the time span in which they could provide necessary services. One of the most advanced of these schools was the University of New Mexico where the Health Sciences Library, under the leadership of Robert T. Divett, used automation for circulation services, and published one of the first automated book catalogs for a medical school library. This catalog took advantage of the computer to produce

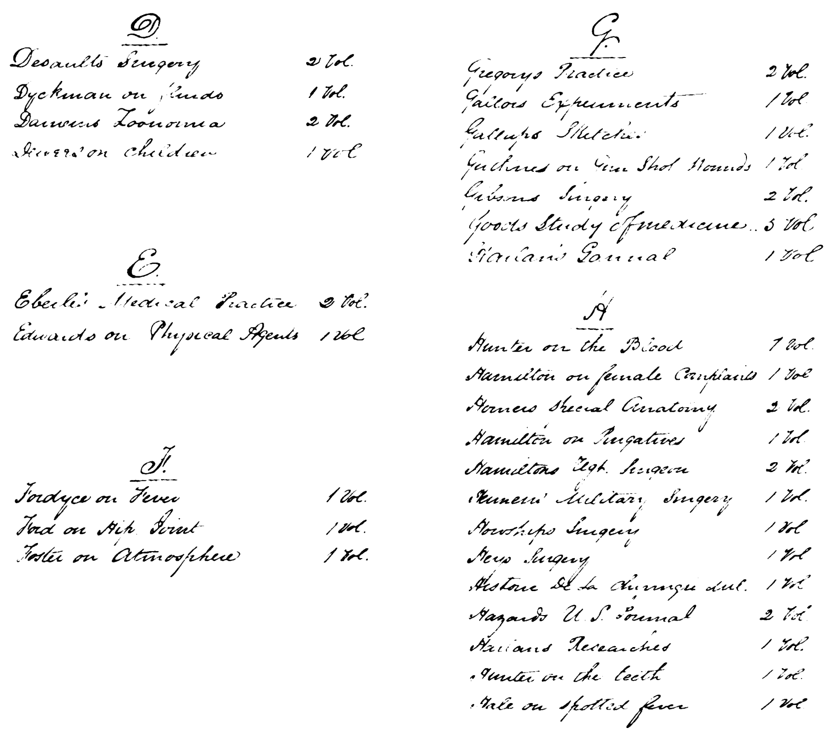



Brown's "Adjustable Catalogue-Holder."




Adjustable Sheaf Catalogue. Locked.

FIG. 6.—Sheaf catalog.



D
Desaults Surgery 2 Vol.
Dyckman on Fluids 1 Vol.
Darwins Zoonomia 2 Vol.
Dewees on Children 1 Vol.

E
Eberle's Medical Practice 2 Vol.
Edwards on Physical Agents 1 Vol.

F
Fordyce on Fever 1 Vol.
Ford on Hip Joint 1 Vol.
Foster on Atmosphere 1 Vol.

G
Gregorys Practice 2 Vol.
Gallois Experiments 1 Vol.
Galluhs Skeleton 1 Vol.
Guthrie on Gun Shot Wounds 1 Vol.
Gibsons Surgery 2 Vol.
Goods Study of Medicine 5 Vol.
Gerlands Journal 1 Vol.

H
Hunter on the Blood 1 Vol.
Hamilton on Female Complaints 1 Vol.
Horners Special Anatomy 2 Vol.
Hamilton on Purgatives 1 Vol.
Hamiltons Eyl. Surgeon 2 Vol.
Hennens Military Surgery 1 Vol.
Howships Surgery 1 Vol.
Heys Surgery 1 Vol.
Histoire de la Chirurgie 1 Vol.
Hazards U.S. Journal 2 Vol.
Harlands Researches 1 Vol.
Hunter on the teeth 1 Vol.
Hale on spotted fever 1 Vol.

FIG. 5.—Page from "A Catalogue of Books . . ."

FIG. 7.—Panel on computers in medical libraries at 1968 conference at the University of Oklahoma Medical Center. Shown from left to right are: Irwin Pizer, Martin Cummings, Robert Divett, and Leonard Eddy.

the copy, but cast it in a format which would be familiar to most users of a card catalog. The subsequent problems with automation programs in that library read like a catalog of disasters caused by the shortsightedness of the school's administration through a basic misunderstanding of the importance of the work being done, the role which machines were coming to play in a library, and an unwillingness to commit the necessary financial resources to enable the programs to continue. The costs of these early efforts were not small, just as they are not small today, but in the '60s it was still arguable whether automation in the library was the best road to follow.

The arguments were, in many ways, like the arguments one hears today on the international scene where less developed countries see automation as a tool which they will not use because of cost, or lack of skilled people, or lack of technology and support systems. But the fact is that small libraries in Western countries which also thought along these lines in the '60s are now using mini- and micro-computer systems routinely, and they tap into national networks of information and bibliographic utilities through telephones and terminals. The entire developmental stage has been skipped by these libraries, and the results of the years of experimentation have been applied. It is highly probable that the same phenomenon will occur on the international scene, and probably in a span of time shorter than twenty-five years. In fact, it may no longer be possible for these countries to follow the evolutionary development of Western libraries in the 20th century, even if they wished to do so.

The reorganization of the Washington University School of Medicine Library under Estelle Brodman offered an outstanding opportunity to begin the application of machine methods on a wide scale in a medium-sized library. Much pioneering work with the use of unit record machines had already been done by Ralph Parker at the University of Missouri in Columbia, and we were fortunate in having that successful example as a model as we began our efforts in St. Louis. The most pressing need centered on the circulation system, and because there was an extensive investment in equipment and supplies to produce embossed plastic cards, the system that was designed used these elements and combined them with punched cards. Then attention turned to the problems of serials control, and collaboration with the university's computer center. As happens often in library automation, the possibilities of success often center on the mix of personnel available, as well as the resources which the institution is willing to commit to the program; and in this case there was an extremely felicitous combination. Working closely with computer programmer Don Franz, we were able to design a system for serials control which had several interesting features. But the most elegant piece of the system, which we jointly developed, was a four-character code for predicting the arrival of periodical issues. This code was devised by reviewing the past receipt history of the title and converting that information to the coded format. The system then produced punched cards for each issue expected, and these were kept as a file from which the cards were pulled as the appropriate issue arrived. The receipt cards were used to produce daily lists of arrivals, then weekly cumulations of titles, and finally were incorporated into the computer records on a monthly basis. The climate created by Dr. Brodman for this work was a major factor in its success, as was her expert advice on technical matters. The team of people assembled by Dr. Brodman in St. Louis for the enormous task of bringing that library into the 20th century was also a major factor in the success of programs. The other two major contributors to the reorganization were Robert B. Austin and Isabelle T. Anderson.

I left Washington University in 1964, and the work on machine methods continued there under a number of able successors, among them Glyn Evans, who went on to become the coordinator for library systems for the State University of New York, and Millard Johnson, who continues to plan and coordinate the PHILSOM Network. The work of the years at Washington University is well documented in a series of papers which describe the trials, errors, and successes of the program.

By the mid-1960s, a unique set of circumstances at the State University of New York created an environment in which a major network was projected which would propel libraries into the online era. A Task Force on Automation was created with librarians and health professionals. The librarians were Irwin Pizer, Miriam Libbey, and Helen Kovacs; and they drafted a plan for an online, real time, user friendly system which would integrate the functions of the library from the user's point of view. That is, a user could search at a single terminal for both book and journal materials, and select those citations of interest; the system would determine which of the participating libraries owned the item and was closest to the user, and, if the item was not in the user's library, would generate an interlibrary loan request for the material. This ambitious system was made possible only through the close cooperation of the National Library of Medicine. NLM was also preparing its online version of MEDLARS, and it agreed to make available its MEDLARS tapes for use in the SUNY system. This major effort was also only achieved because of the intense interest of IBM in marketing a computer system for libraries which would have potential for replication and transferability on a broad basis. IBM agreed to provide major personnel support and technical assistance. The report was accepted by the university, and in 1965, a three-year developmental period began which culminated in the SUNY Biomedical Communication Network going online in October of 1968. In addition to being the world's first online bibliographic information retrieval system (an accolade bestowed by the English association ASLIB), it was also the first network which operated on a wide regional basis. The network points were as dispersed as Boston, New York City, and Bethesda on the eastern seaboard, and across upstate New York in Albany, Syracuse, and Buffalo, with the westernmost point being Toledo, Ohio.

The SUNY Network pioneered in the task of depth indexing monographic literature on a chapter-by-chapter basis, and in mapping MeSH terms to the language used in the journal literature. The former task was performed by Jan Egeland, and the latter was undertaken by Dr. Alexander M. Cain, now of the National Library of Scotland. It was, in a real sense, the first bibliographic utility accessible online, although the terminals were dedicated to the system. Thus, it was only accessible to those institutions hooked into it, but it worked, and it grew. The reasons that it does not exist today are again the interesting ones of institutional priority, and the lack of realization of the importance of the program by administrators. The SUNY Network survived a transfer of the system to new university computers in Albany, New York in the early 70s, but the network then had to compete with other users for time in a shared online environment in which it was given lower priorities than university needs.

As response time degenerated, dissatisfaction grew, and in 1976, to the amusement of the university's administration, the Network's User Advisory Board began to seek a commercial vendor who would provide the services that they required. The result of this search was the founding of BRS, Bibliographic Retrieval Services, Inc. by Jan Egeland, Ron Quake, and Lloyd Palmer. Together they created a search system *de novo* which replicated the SUNY system and improved it, and in 1976 BRS began providing commercial online services. SUNY ceased to operate its network in 1977 as all of its non-university subscribers had transferred to BRS, and arranged with BRS to provide service to the remaining SUNY participants. SUNY continued, however, to provide additional ports for

NLM's MEDLINE system until the early 1980s. The entry of BRS into the online services field revolutionized the pricing structure which then existed, as the other firms offering online search services of various databases quickly lowered prices to become competitive. The subsequent development and growth of BRS has shown that the real forces of the marketplace and the wishes of the consumer do, indeed, play a major role in the marketability of a product or service that cannot be ignored.

One reason for the interest of NLM in the SUNY Network's development was that it held great potential for provision of information for NLM's MEDLARS Online system. How would end-users react to the ability to search online databases themselves? What were the problems of operating a network over a large geographic area? What volume of use could be expected? These and many other developmental and operational questions were asked. As NLM began its AIM-TWX experiment with end-users, it too found similar answers to many of the questions on which SUNY had provided data. Users had a very low tolerance for a system which required them to proceed through a lengthy series of questions and answers in order to formulate their search. They were impatient with response times which, although rapid in comparision with manual searching, seemed endless when sitting waiting for a keyboard response. Users preferred to have a trained intermediary perform their searches, especially as few users searched the system with enough frequency to become highly proficient, and most were not able to keep up with system changes which altered searching formulations.

An interesting attitudinal change has taken place in the '80s as end-users with their own personal computers at home, and frequently in their offices, have now become very interested in performing their own searches. Libraries are responding to this demand by developing and offering end-user training programs.

One of the great advantages of the SUNY Network was that it was entirely under the control of the library. This greatly simplified the interactions between librarians, programmers, and computer technical staff. The computer facilities were located in the library, and the proximity of library and computer helped the staffs of both units better understand the complexities of each operation. One benefit was that there was no competition for priorities regarding computer time and projects. This enabled the SUNY Network to undertake a number of important projects for other library groups, which developed as by-products of the SUNY Network operation. Among these were a series of union lists which were generated for the Central New York Reference and Research Resources Council (one of New York's series of 3Rs Councils), the Rochester Council, the SUNY at Buffalo Library System, and most significantly, the New York State Library. The contract with the State Library resulted in the first state-wide union list of serials which was produced for New York, and contained holdings for a wide variety of key subject libraries throughout the state.

At the same time that the SUNY Network was emerging, Hugh Atkinson, the Head of Technical Services at SUNY Buffalo, was developing the concept of an online catalog and circulation system based on short title entries for books. The work on this system was begun at Buffalo, but was only in its early data input stages when he left to become Director of Libraries at Ohio State University. There, the system was further refined and emerged as LCS, the Library Computer System, which still continues successfully, with subject searching now an added feature. When Mr. Atkinson moved to Illinois to become University Librarian of the University of Illinois' campus at Urbana/Champaign, the system was purchased from OSU and replicated as a university-wide system. The LCS system has since been adopted by the Illinois Board of Higher Education as the preferred circulation system for the state, and LCS now serves some twenty public and private universities, colleges, and community colleges in Illinois, as well as all of the Illinois Public Library System Headquarters. LCS handles more than 2.5 million bibliographic and circulation transactions as well as more than 30,500 interlibrary loan requests each month. The database contains over 7.8 million titles of serials and monographs. The system was further augmented by the establishment of the Illinois Library Delivery System which links all of the public library system headquarters as well as the major university centers by truck route, and assures that materials requested and charged via LCS are delivered to the requesting location within the state in a period which usually does not exceed forty-eight hours.

The next developmental stage of this system calls for the linkage of the LCS records to full bibliographic records which are able to be searched by subject. This system is based on the programs developed by the Washington Library Network which have been adapted for local use in Illinois, and which are now moving from the demonstration to the operational stage.

Planning is also underway for the third generation of LCS as a system in order to assure that it can continue to function efficiently and cope with increased use and user demands and an expanded number of member institutions.

One of the greatest needs in dealing with library automation is having a clear picture of what is to be accomplished. The lack of such a clear picture, or mission, has caused many well intentioned efforts to fail. One of the most recent examples of this is the decline and approaching demise of MIDLNET, the Midwest Library Network. MIDLNET was seen as the counterpart of a series of regional networks—NELINET, SOLINET, AMIGOS—which were to provide a wide range of services to their subscribers and form the basis of a truly national distributed network. Unfortunately, the era of MIDLNET came too late in the developmental history of the region; and although it was supported by the Big Ten Universities and a number of other prestigious institutions, their own priorities made collaboration difficult or impossible because of internal commitments to their own systems. MIDLNET's primary goal was to provide a regional catalog of monographs and serials and the MIDLNET Board struggled for a number of years to achieve this goal. Problems arose because many of the member institutions such as the University of Chicago, Northwestern University, the University of Illinois, and University of Minnesota, to name a few of the strongest, already had systems that were operational or close to being operational. In addition, there were strong state organizations in Minnesota, Illinois, Indiana, and Wisconsin which provided a variety of services and served major leadership roles in their communities which could not be brought together. Although it was suggested by the author that records could be used at the output stage for a regional catalog, the Board insisted that the only viable approach was to have all participants in a single system which began with the generation of the record in the acquisition process. As this would have meant scrapping expensively developed systems in most of the participating institutions, nothing came of this effort, and although MIDLNET had some success serving as an information and services broker for its members by offering access to BRS and OCLC, this was not enough to sustain its existence, nor was it central to its *raison d'etre*.

Although MIDLNET and its Board tried very hard to discover a major functional purpose for the organization, they were not able to identify any pressing problem to which all of the institutions could agree to bring their considerable resources to resolve. Consequently the organization, although technically still in existence, is not active, but is prevented from dissolving because its by-laws do not provide for the distribution of assets. Presumably, this problem will be able to be solved.

At the time that MIDLNET was rejecting the idea of an online union catalog based on the machine-readable record output from a variety of systems, a number of events were taking place which gave new life to this idea. The Midwest Regional Medical Library Network had taken on the old Midwest Medical Union Catalog (MMUC) which was based at the John Crerar Library, and had performed a study which recommended that the catalog be replaced by a machine system as soon as practicable. BRS had also announced the availability of a private database service which allowed institutions to mount their own materials and control access to their data. The MMUC had come to a halt for several reasons. It was unable to cope with the problems of filing catalog cards submitted by participants; users were uncertain that a search of a catalog of selective submissions really told what was regionally available; most usage was confined to the local telephone calling area; libraries were shifting their technical services away from systems that generated cards; and the costs were escalating unrealistically.

In 1979, therefore, I proposed the establishment of an online regional union catalog of monographs and audiovisual materials which would link all of the resource libraries in the old NLM RML Region VII. This proposal, first submitted to NLM as a grant, and then as a contract, was approved and funded in 1981, and work began on creation of the database. One element of this proposal was the automatic routing of interlibrary loan requests, a feature which had been a part of the original SUNY Biomedical Communication Network. There the programming and database linkages had all been completed and tested but not put into operation because the participating institutions were fearful that the ILL traffic load would be so great that they would be swamped. When the system was moved to Albany, the ILL element of the system was lost, as was the dictionary of MeSH terms matched to vernacular terminology. However, given a lapse of ten years and changes in the perceptions of librarians about ILL services, together with the improvements in technology, it seemed again possible that this could be achieved.

One element of the program was the automatic routing of requests to the smallest nearest library which owned an item, rather than to a major library, if there was a choice. It was hoped that this reverse routing would help to spread the ILL traffic burden and make smaller libraries an integral part of the RML network. By 1982 this programming had been completed, and the initial test running of the ILL module of the system was begun. It then became apparent that individual libraries preferred to have the option of choosing the lending library because of the difference in costs for filing an interlibrary loan request at different institutions in the region, even though the costs were often no more than 50 cents per transaction, and the cost of identifying an institution with lower costs consumed more resources in terms of staff time than the actual cash saving provided. The system has now been modified to allow for such intervention, although attempts were made to eliminate the basis of the problem by trying to achieve regional consensus on a standard minimum rate for interlibrary loans. It has not been possible to achieve a standard rate for a number of reasons, although this goal has been greatly encouraged by the National Library of Medicine.

Part of the success of the online union catalog, and of the SUNY Biomedical Communication Network was due to the far-sighted leadership of Dr. Joseph Leiter, then Deputy Director of the National Library of Medicine for Library Operations. His faith in the development of systems outside the NLM, and the uses that such systems could be to NLM in the provision of data for planning and modification of the developing MEDLARS II and III systems, opened the way for a period of fruitful and jointly useful collaboration.

The regional online catalog is unique in a number of ways and represents an important step forward in the processing of machine records. The records from a number of systems, among them OCLC, MARC, RLN, Marcive, LCS, Northwestern University's NOTIS, the University of Minnesota system, have all been loaded into a single database, searchable using BRS's standard search system. The ILL module precludes the necessity of inputting the bibliographic information for a request after the item has been identified in the search of the database, and the routing of the request can be done automatically. All records of the ILL process are automatically maintained by the system. The online catalog will allow for the analysis of collections in the region and help with the problem of identifying resource deficiencies as well as strengths. The true test of the system will come as the period of NLM developmental support ends, and the institutions are called upon to pay the costs of maintaining the system without subsidy. The catalog is already the third largest biomedical monographic database after CATLINE and the online catalog of the Medical Library Center of New York, with more than 100,000 titles represented, covering the period from 1965 to date. Plans are in the developmental stage for making the database publicly available to help defray the operational costs.

The catalog project has not been without problems, the most difficult to resolve resulting from a computer operator error in which records from four Illinois libraries were loaded as if they all belonged to one institution. This error necessitated the reconstruction of the entire database, and has taken more than a year to resolve. Although the problem may seem minor, it is complicated in this system by the complex merge/purge process to which records are subjected in order to provide one unique record for a title with all of the location and call number information for the holding institutions.

Systems have difficulty and often fail for a variety of reasons, not the least of which is illustrated by the online catalog example just mentioned. One of the reasons that systems fail is that the vision of the designers exceeds the capabilities of the technology that is available. This problem will probably always exist, as, indeed, it has always existed. In the SUNY Biomedical Communication Network development, one of the problems was the storage of large quantities of data online. In the 1960s IBM was still trying to develop large-scale storage devices which could solve this problem, and the SUNY system was designed using an IBM Data Cell. This was a machine somewhat larger than a 20 cubic foot refrigerator which contained cylinders of magnetic film in strips, with the cylinders being mounted on a drum. The location of data on a strip was recorded in a machine index, and when accessed the appropriate strip would lift from its storage cylinder, wrap around a read head, and then return to the cylinder after use. The machine was filled with an inert gas to maintain its pressure and internal atmosphere, and was a mechanical marvel. Unfortunately, IBM was never able to solve the many mechanical problems which such a machine was subject to, and the device has passed into history as a curious, but unsuccessful mass storage device. Fortunately, the cost of online stor-

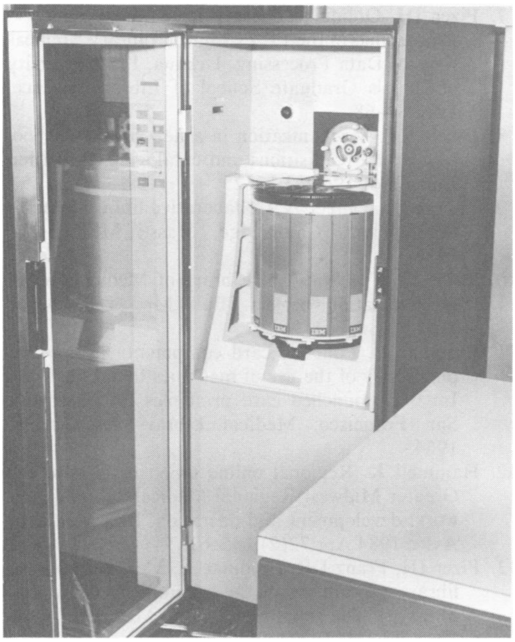


FIG. 8.—IBM data cell.

age has dropped as technological advances of other types have come along, although the future of bubble memory storage devices is still not clear.

Another of the reasons that systems have failed is due to the problems of communication between librarians and computer programmers and system designers. This problem has plagued many systems and is not one that is capable of easy solution. Even librarians trained as programmers, or programmers trained as librarians have not been entirely successful answers to the problem. A more difficult problem is that posed by changing institutional priorities. Many systems have run afoul of this problem, including two mentioned here: the University of New Mexico system, and the SUNY Biomedical Communication Network. This problem may result from the limited vision of senior administrators, the inability to understand the emerging role of the library as the keystone of the institutional information network, or changes in priority caused by budgetary expansions and contractions. Whatever the reason, this lack of communication may signal the end of years of work and make useless the investment of enormous sums of money. Another side of this problem is the institutional commitment to a poor system which is supported for years and years in the hope that the difficulties will be overcome, and the desire not to lose the already substantial institutional investment, plus the factor of embarrassment over failure.

There were many other landmark projects which space has not permitted me to discuss. These include the UCLA Biomedical Serials Control System, the development of RLIN, the Stanford/Chicago/Columbia Catalog Project, the University of Chicago's integrated system, the Minnesota Union List System, the IBM–DOBIS library system, etc. All of these were notable either as successes or as failures, and many of them have been well documented in the library literature.

## CONCLUSION

The enormous changes in technology over the past twenty-five years, coupled with the increase in sophistication of librarians, have made possible the vast changes which have occurred, and which continue to occur with increasing rapidity. The momentum of the past drives the changes of the present, and both fuel the process which will generate the advances of the future. As technology spreads to the underdeveloped nations, the changes in information flow and transfer will be even more rapid than they have been in the past, as third world nations leapfrog much of the developmental aspect of the 20th century to the brink of the 21st. The predictions that machines would reduce the manpower needed to operate libraries have not come to pass, and libraries remain the highly labor-intensive organizations which they have been for centuries. The changes which have occurred have taken place in the tasks we perform, and in our ability to do more things better. Although some have predicted the paperless society, it is not clear whether that goal, if it is a goal, will be achieved, or whether it is desirable. A faculty member at the University of Illinois, charged with helping to forecast the research library of the year 2000, noted that although the generation born in the '50s or before has claimed that no one will want to curl up in bed with a computer terminal, by observing the children of the '60s and '70s it is not so certain that this will be an unacceptable prospect. This generation, growing up with visual display terminals as an ever-increasingly important part of their lives, from study to recreation, is much more tolerant, and has higher expectations of the things that can be done by computers than previous generations. As the new technologies which are available, but which have not yet been applied to libraries on a wide scale, such as holography, optical fibers, laserdiscs, optical discs, ink-jet printing, xerography, etc., become more common and more available for experimentation, it is not at all clear what libraries will look like in another twenty-five years. None of us is so sure that we can claim that we have even begun to exploit the possibilities of television for practical library services, and we are approaching the fiftieth anniversary of the availability of that technology on a commercial basis.

The changes in libraries caused by automation over the span of my career have been exciting and dramatic, and I look forward to the coming changes with great anticipation, a sense of wonder, and enthusiasm. Librarianship has been, and will continue to be, a stimulating profession. I am hopeful that you all join me in viewing the prospect of coming change with pleasure.

It is through our combined efforts and ingenuity that libraries will continue to be viable societal institutions, playing a key role in the "information age."

## Bibliography

1. Brodman E. Personal interview, Tuesday, May 1, 1984.
2. Kramer CE. Description of the Columbia-Harvard-Yale Medical Libraries Computerization Project and the Parkinsonism Information Center Project. Unpublished paper, New York, 1965;Jan.
3. Kilgour FG, Esterquest RT, Fleming TP. Computerization of book catalogues at the Columbia, Harvard, and Yale medical libraries. Proceedings of the American Documentation Institute, 26th Annual Meeting, Chicago, Ill., 1963;Oct:299–330.
4. Rogers FB. Selected papers of John Shaw Billings. Chicago: Medical Library Association, 1965.
5. Adams S. The way of the innovator: notes toward a prehistory of MEDLARS Bull Med Libr Assoc 1972 Oct;60:523–33.
6. Kilgour FG, Long PL, Landgraf AL, Wyckoff JA. The shared cataloging system of the Ohio College Library Center. J Libr Automation 1972 Sep; 5/3:157–183.
7. Pizer IH. Online technology in a library network. Proceedings of the 1972 Clinic on Library Applications of Data Processing. Urbana, Ill.: University of Illinois Graduate School of Library Science, 1972:54–68.
8. Divett RT. Mechanization in a new medical school library: I. Acquisitions and cataloging. Bull Med Libr Assoc 1965;53:15–25.
9. Fasana PJ, Veaner A. Collaborative library systems development. Cambridge, Mass.: MIT Press, 1971.
10. Taine SI. The National Library of Medicine index mechanization project. Bull Med Libr Assoc 1961;49:Supp. 1–96.
11. Brodman E. Punched card equipment: history and philosophy of the use of machines to aid libraries. In: Basic punched card principles for librarians. San Francisco: Medical Library Association, 1964.
12. Hammell K. Regional online union catalog of the Greater Midwest Regional Medical Library Network: development and operation. Bull Med Libr Assoc 1984 Apr;72(2):155–61.
13. Pizer IH, Franz DR, Brodman E. Mechanization of library procedures in the medium-sized medical library: I. The serial record. Bull Med Libr Assoc 1963 July;51(3):313–38.
14. Pizer IH. Book catalogs versus card catalogs. Bull Med Libr Assoc 1965 Apr;53(2):225–38.
15. Cain, AM. Thesaural problems in an on-line system. Bull Med Libr Assoc 1969 July;57(3):250–9.
16. Egeland J. In-depth indexing of monograph literature for an on-line system: A pilot project. Bull Med Libr Assoc 1972 July;60(3):432–8.
17. Hall JL. ASLIB bibliography no 8: On-line information retrieval 1965–1976: A bibliography with a guide to on-line data bases and systems. London: ASLIB, 1977.
18. Proceedings conference on the use of computers in medical education. Co-sponsored by U.S. Department of Health, Education and Welfare Public Health Service Bureau of Health Manpower and The School of Medicine University of Oklahoma Medical Center. April 3, 4, and 5, 1968. Oklahoma City: University of Oklahoma Medical Center, 1968

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