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## ABSTRACT

The Conference Proceedings are divided into three broad topics: systems planning, audiovisuals in biomedical communication, and automation and networking. Speakers from within the Veterans Administration (VA), from the National Medical Audiovisual Center, and the Lister Hill National Center for Biomedical Communications, National Library of Medicine, presented the following papers: (1) VA Library Service by Henry J. Gartland, (2) VA Library Systems by Allen J. Sprow, (3) VA Library Book Cataloging Project by I. F. Rosen, (4) The Union List of Periodicals in the Medical Libraries of the VA by Joseph Bodo, (5) Audiovisual Systems in Biomedical Communications by Robert S. Craig, (6) Application of Audiovisual Technology in Medical Education by Clement Benjamin, (7) Audiovisual Services: The Librarian's Role by Margaret L. Brooks, (8) The Lister Hill National Center for Biomedical Communications and Its Library Networking Projects by Ruth M. Davis, and (9) MEDLARS II: A Status Report. (MF)

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# PROCEEDINGS

## VETERANS ADMINISTRATION CONFERENCE OF SELECTED CHIEF LIBRARIANS

NOVEMBER 20-21, 1969

WASHINGTON, D.C.

VA LIBRARY SERVICE--TODAY'S LOOK  
AT TOMORROW'S LIBRARY



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Assistant Chief Medical Director for Professional Services  
Veterans Administration  
Washington, D.C. 20420

LI 002138

THEME: VA LIBRARY SERVICE--TODAY'S LOOK AT TOMORROW'S LIBRARY

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## INTRODUCTION

These Proceedings of the Conference of Chief Librarians held in the VA Central Office on November 20-21, 1969, with the theme of Today's Look at Tomorrow's Library include papers on VA library systems, audiovisual systems in biomedical communication, the Lister Hill Center for Biomedical Communications, and MEDLARS II.

The agenda topics reflect current areas of development and direction of change in concepts of library-learning resources services within and outside the VA affecting library service in the local hospital.

The amalgamation of the printed word and the audiovisual media leads to a natural extension of library service beyond the printed word. Papers on these topics explore the role of audiovisuals in biomedical communications, the implications of these media in planning for library-learning resources services, and the librarian as audiovisual coordinator.

Status reports on the planning activities of both the Lister Hill National Center for Biomedical Communications and the Medical Literature Analysis and Retrieval System (MEDLARS) II indicate the anticipated nature of the relationships of these planned networks of services to the VA library system.

The purpose of the explication of projections of VA Library Service is to assist VA hospitals to insure the continued responsiveness of Library Service to the programs of the hospitals through articulation of relationships within and outside the VA.

PROCEEDINGS--LIBRARY CONFERENCE, NOVEMBER 20 AND 21, 1969

THEME: VA LIBRARY SERVICE--TODAY'S LOOK AT TOMORROW'S LIBRARY

Welcome

John D. Chase, M.D., ACMD for Professional Services

In Dr. Chase's welcoming remarks, he emphasized the following:

In the delivery of medical care services, it is incumbent upon the VA Department of Medicine and Surgery to coordinate our efforts to meet our objectives.

The learning resource center should evolve as a common facility functionally to include the acquisition of resource materials with their distribution and utilization.

We can look to the agenda of this meeting for guidance in relating the medical library to other elements in the hospital and in defining the role of the librarian therein.

VA Library Service

Henry J. Gartland, Director, Library Service

VA Library Service is carried out in the largest hospital system in the world with academically qualified librarians directing the program in each of the 166 hospitals in the system.

While these Chief Librarians and their staffs are providing library service in support of research, education, and clinical (veteran care) programs in every hospital in the VA system, it behooves us to take a look today at tomorrow's library program.

To this end, the agenda has been divided into three broad topics: systems planning, audiovisuals in biomedical communication, and automation and networking. Speakers from within the VA, from the National Library of Medicine and its components, namely, the Walter Hill National Center for Biomedical Communications and the National Medical Audiovisual Center, will speak to these topics.

We are constantly experimenting with and introducing, wherever applicable, procedures based on ADP techniques. Speakers from both DM&S and DDH will report on some of our recent experience, with varying degrees of success, in this area. We are currently revising our approach to encompass a systems design for library-learning resource center ADP requirements. In the meantime,

we have found that computer-produced catalog cards may be feasible but not practical as an interim module. On the other hand, we have just produced an up-to-date "Union List of Periodicals in the Medical Libraries of the Veterans Administration" and are developing simplified procedures for its periodic updates.

Three staff members from the National Medical Audiovisual Center (NMAC) which is now a component of the National Library of Medicine will talk to us about various aspects of audiovisual systems in the library-learning resources center. The Special Educational Programs Officer will demonstrate some of the strengths and weaknesses of various audiovisual media which are now available for use. The Planning Officer for Audiovisual Systems will explicate the application of audiovisual technology in the hospital library-learning resources center setting with reference to planning implications for development of such centers to incorporate non-print materials with the printed resources. Finally, tomorrow afternoon, the Chief of Reference will address herself to the role of the librarian as the audiovisual coordinator dealing with the special problems which audiovisuals present and with the special considerations which they require.

Tomorrow morning we have scheduled status reports on two activities which will have impact on the VA library system. I refer to the Lister Hill National Center for Biomedical Communications and MEDLARS II. The Director of the Lister Hill Center will tell us about its establishment and describe the library network planning which it is pursuing actively. In this area, the Center has devoted most of its attention so far to bibliographic access and document delivery. Experimentation in the former will assist in defining services to be expected from MEDLARS II when it provides on-line access in the future. MEDLARS II is a replacement system for the original MEDLARS (Medical Literature Analysis and Retrieval System) designed to take advantage of third generation computer technology and to increase the capability of NLM's service programs. The second speaker tomorrow morning will explain where we stand in relation to this activity.

There will be an opportunity for your questions concerning all the topics on the agenda. We hope that the ramifications of these developing areas will assist you in planning with hospital management for library service projections.

### VA Library Systems

Allen J. Sprow, Administrative Librarian (Machine Applications)

In preparing to tell you about library systems at this year's conference, I reviewed what I had said last year about library service requirements and the characteristics of operational components for providing these services. I noted that I had referred to the three general approaches to the development of a library automation program which de Cannaro of Harvard described in the Journal of Library Automation, namely:

1. Wait for developments (VA could wait to see what the three national libraries are going to do);

2. Develop a total or integrated system from the start (this raises the question of our readiness to go from primitive, little-understood manual systems to sophisticated total systems using both on-line and batch processing techniques);

3. Adopt an evolutionary approach leading to an integrated system (this latter approach is being taken by VA).

The next two speakers will describe two interim modules which are being developed as we work toward an integrated library system comprising manual, semi-mechanized, and computer components within and outside the VA.

To make best use of the computer technology available, we must first analyze the library system both by component and by function so that we can determine the alternative man-machine subsystems that must be developed and combined to meet the VA hospital requirements for information. The challenge is to make this analysis iteratively and reiteratively, adjusting the limits of the system as more is learned about the requirements for information and efficient, effective means of meeting them. It is expected that there will be a steady evolution from gross interim modules to more highly refined systems.

As we reiterate our analysis, we will hopefully build more and more interim modules, linking those which have common elements and utilizing data bases in as many components/or functions as they are pertinent. For example, we are exploring the linkage of our periodical procurement and union list of periodicals modules in an effort to reduce keyboarding, simplify identification of titles, and minimize clerical tasks both at the stations and centrally.

Available technology is feasible for assisting us in all of the tasks which together make up the services of the library-learning resources center in the hospital. However, the limiting factors in applying this technology are in developing the necessary software for accurate, efficient, and economical use of hardware now available either already in the VA or on the market, in establishing priorities for development and installation of systems for the library-learning resource center, and in operating within economic constraints of budget.

Our goal is an integrated system which will provide for timely access to information regardless of its format--print or non-print--regardless of its location--within or outside the VA system.

### VA Library Book Cataloging Project

I. F. Rosen, Computer Systems Analyst, Research Service, DDM

The Research Service, Department of Data Management together with the Department of Medicine and Surgery Library & Supply Services, is conducting a study of the application of computer capabilities to the problems of information storage and retrieval in VA libraries. The effort is a reflection of the agency-wide interest in using the considerable ADP powers to meet the challenges of expanding and changing demands for information.

Phase I of the current project consisted of an analysis of library resource control and service functions, with emphasis on acquisitions, cataloging, storage and distribution demands against the library, code standardization and reports for library management.

The current segment, Phase II, is an experimental effort dealing with the storage and retrieval of information from an automated data base. The specific library functions involved are the indexing and cataloging of titles, and the production of library book sets.

The computer accessible data base is being developed from the most active portion of the master catalog file resident at the Book and Periodical Division, Somerville Supply Depot. A system for entry of new catalog records and file maintenance by the Book and Periodical Division, as well as for field station entry of catalog service requests is under development and testing. The requirements of the experimental system are fully coordinated with those of the current manual system and will allow for smooth transition.

I wish to stress that this effort is experimental. Based on results of the field tests and other factors, decisions will be made regarding the next steps in automating library information system.

The most likely effort to follow this one would be to provide the hospital libraries direct access by teletype to the computer file for catalog service request processing. This capability would eliminate much of the clerical processing now done at the Book & Periodical Division, and provide faster service, even in peak periods. More than likely, book identification under a direct file access system would be based on author, title and edition information instead of the six digit record number now assigned and used by the Book & Periodical Division.

You realize now that I'm talking about you "speaking" to the computer directly and not through Books and Periodicals Division. What I want to stress is that this kind of participation in ADP systems will make demands on you--demands which are more exacting, or exacting in a different way. For example, a computer file search based on author/title matching will require strict adherence to an especially established convention regarding punctuation, spelling, and abbreviation when preparing teletype requests for computer input.

I don't mean to frighten or discourage you with the prospect of these new demands. I don't think that I could do so. You have successfully met the challenges of new and different responsibilities before, or you would not



be occupying the positions you hold. I'm confident that when the time comes you will share with us the experience of testing and refining, of bringing into being a better way of doing things.

In closing, it is certainly appropriate to give recognition to Mr. Gartland, the Director of your Service, for his persistent and patient efforts and his unflagging zeal during the past few years of our joint activity. We have learned a lot from him and his staff during the experience. If we hadn't been aware before of the importance of the information storage and retrieval service you provide we certainly are now, and we are pleased to be a part of it.

### The Union List of Periodicals in the Medical Libraries of the Veterans Administration

Joseph Bodo, Computer Systems Analyst  
Administrative Support ADP Systems Service, DDM

Prior to the request from the Chief Medical Director to the Chief Data Management Director, to reactivate the Union List of Periodicals in the Medical Libraries of the Veterans Administration, the last Union List published was in 1965. While in this state of inactivity, numerous changes have taken place, both from a standpoint of obsolescence of certain statistical data contained in the master tape file maintained by the DPC and in the method of processing by the DPC.

First of all, we had to determine what changes to the Union List were desired and what and how we will go about making these changes. It was estimated that there were about 400 changes that had to be made to the existing file before we could even consider any type of conversion to the tape file and/or programs. After careful screening and necessary recoding by Library Service, the changes to update the file had to be keypunched as represented by VA Form 10-1145 (Medical Library Periodical Holdings Report). This was accomplished at the Washington DPC, so that we could closely supervise the accuracy of punching and immediately resolve any problems. The punched cards were then forwarded to the Philadelphia DPC, along with a project assignment for updating of the file. It was then realized that the existing program for updating the Union List Tape file was not adequate to accomplish all the desired changes. Therefore, two more project assignments were prepared and forwarded to the Philadelphia DPC as follows:

1. To develop and test a program that would separate the Master Tape File onto two (2) separate tapes: (A) One to contain the periodical number and titles only; and (B) one to contain the detail of station holdings and other related statistical data.
2. To develop and test a program to prepare a special one time listing of station holdings of periodicals from the Master File, utilizing tapes A & B. (By Station)

Upon completion of the Special One Time Listing, it was forwarded to Central Office Library Service for subsequent distribution to the field stations, accompanied by DM&S Circular 10-69-70.

As the flow of these turnaround listings was received, Library Service reviewed and applied the current uniform three digit station number and the appropriate Regional District Code on the first sheet of each station listing. Since the new single digit holding code had to be keypunched in order to get it into the Master Tape File, it was determined more economical to also keypunch the new 3 digit station code and the new Regional District Code into the same cards, in lieu of converting these mechanically. With this completed, the cards were forwarded to the Philadelphia DPC for processing. Here, the cards were taped and this new tape replaced tape "B" mentioned earlier, as this tape now contained an up-to-date record of station holdings. This new tape along with Tape "A," the one containing the periodical numbers and titles was sorted into the desired sequence and the so-called Edit Copy of the revised Union List was run and forwarded to Central Office.

This edit listing was thoroughly screened and edited and approximately 400 discrepancies were found. These discrepancies were the result of incorrect keypunching, misspelled words in the title that existed in the original file, out-of-sequence conditions, duplicates, etc.

With these 400 corrections made without exception, we were now ready to run the final Union List of Periodicals in the Medical Libraries of the Veterans Administration.

During all this time, our main objective of course was to update, convert and printout a revised Union List at the earliest possible time.

Now we must undertake the task of establishing the necessary procedures for updating this file periodically. If at all possible, we are tentatively planning on an annual update and publication of the Union List. We are further exploring the possibility of linking the update in some way with the Books and Periodicals operation in Somerville, New Jersey. DM&S Manual M-2, Part XIII, Paragraph 8.05, Medical Library Periodical Holdings Report (VAF 1145), is being revised and will be published along with whatever additional instructions are deemed necessary to assist in accomplishing all future updates. Whatever the outcome insofar as the update procedures are concerned, we cannot emphasize enough the importance of accuracy. Remember, the Union List of Periodicals in the Medical Libraries of the Veterans Administration can only be as complete and accurate as your input of changes, additions, and/or deletions make it.

## Audiovisual Systems in Biomedical Communications

### Audiovisual Systems - Pro and Con

Robert S. Craig, Special Educational Programs Officer,  
Educational Studies and Development Section, Educational Systems and  
Development Branch, National Medical Audiovisual Center

Communication is one of the world's most important activities, and the visual image is finally being recognized as the most effective communication form in all human existence.

There is no doubt that sight is the most domineering and the strongest of all of our senses. In fact, this sense of seeing is so important that the term itself has come to mean the same as understanding in our everyday language. For example, we never hear anyone express understanding of information that they have received by saying, "I hear." Instead, the common terms used to express understanding are, "I see," or "I get the picture." Our minds usually conceive thoughts in terms of pictures or visualizations. This is the natural thing to do; to "see" with our minds is to perceive visually. Since we do think in terms of visualizations, or pictures, it is only reasonable that we can enjoy more accurate and understandable communications through the use of "visualized thought." Therefore, my main purpose in the next few minutes is to deal with some advantages, disadvantages, and innovations in those visual systems that involve projected images.

There are two basic categories which encompass all projected visual systems--the motion and the still. The motion category includes motion pictures and television. The audiovisual systems in this category are the most dynamic for three reasons:

1. The moving image presents a very strong illusion of life. The apparent rhythm of reality sets up rapport with our own mental concepts of the rhythm and reality of life.
2. The revelation of something new continually taking place within a restricted aperture tantalizes our mental anticipation and demands our attention.
3. The primary advantage that both motion picture and television hold in common is the ability to combine sight and synchronized sound, thus providing a definite continuity of action.

### Television

The first visual system I want to discuss is television. Television is primarily a delivery system. For the first time in the history of education we have a standardized uni-medium delivery system which can effectively communicate all visual forms--slides, motion pictures, etc. It is a system

which makes it possible for many students to view the details of procedures or demonstrations directly from the professor's point of view, and at the same time he is performing the function at his own laboratory table. It is a system that makes possible many unique and fully integrated learning situations. For instance, the TV camera can be attached to a microscope providing students with a magnified image of living organisms which is most impressive. It is a system by which images can be recorded on videotape for instant playback, or for storage and utilization in the future. Thus, the learner could be free to review and study videotapes on his own TV monitor and at his own leisure. We must remember, however, that if teachers continue to use the straight lecture technique on TV, they are not taking advantage of the dynamic aspects of sound and motion. Lectures should be supported by good, clear artwork. If diagrams and charts are used they should be easy to read and uncomplicated. Many carefully selected visuals that illustrate the subject accurately should be used. The TV film chain makes it possible to incorporate all these visual materials (motion pictures, slides, etc.) into any lecture. While videotape is relatively inexpensive to produce, providing you own the equipment, it cannot be utilized without videotape playback equipment which is still quite expensive. However, by the use of the tape-to-film transfer machine, the best material now being produced can be placed on motion picture film for nationwide distribution even though produced inexpensively on videotape. This way, any of the convenient film or 8mm cartridge systems can be used for delivery of the material. Now, all of these facts make television, in its present state, the most economical mass communication medium we have available to us today. Also, I would be remiss if I didn't mention that the technological improvements taking place now in the electronic industry are indeed promising.

CBS's new Electronic Video Recording, referred to as EVR, offers many possibilities in regard to a uni-medium delivery system. With this system any type of sound visual can be converted to an EVR master recording by means of an Electron Beam Recorder. Either color or black and white images can be recorded on the same material. The EVR master is then used to make any number of prints by means of a special duplicator. These prints are then placed in plastic cartridges and will be available for sale at a very reasonable cost, as little as \$12.23 for a 20 minute program.

As these and other developments are perfected, as color video tape and camera equipment costs are reduced making color television a practical reality, we may find that the ultimate delivery method for all audiovisual forms will be the television screen. A truly standardized uni-medium delivery system.

### Motion Pictures

Now, let us consider briefly some aspects of the motion picture medium. The motion picture has not been able to accomplish adequately the overall needs in education because of some inherent difficulties. First, quality production is usually quite expensive. Secondly, it does not have the immediacy of television. But there are some things that nothing can accomplish as well as a motion picture.

The first advantage, Animation -- is the process of adding life to inanimate objects. Although animation is expensive and time consuming to produce, it does make it possible to explain some difficult subject matter clearly and quickly.

The second advantage of the MP medium is Time-Lapse Photography -- this is a process by which the action of an object moving very slowly can be accelerated visually. For instance, (by use of time-lapse photography) a flower that may require two or three days to bloom can be shown blooming in less than a minute.

The third advantage of the motion picture medium is Slow Motion Photography -- a process by which motion of an object moving extremely fast can be slowed so that the motion can be analyzed. Slow motion photography is usually considered as any MP photography at a speed of approximately 64 frames to 5,000 frames per second.

Research is presently underway to adapt all of these techniques to the television media; however, the present methods are strictly experimental and are not practical at the present time. Today, the color sound motion picture offers us the most dynamic means of visual education presently available. By dynamic, I mean it can leave the deepest impressions which result in maximum retention and recall. Let me show you some fantastic footage that I think illustrates the dynamic aspects of the motion category.

It is important to point out here that one of the greatest innovations in motion pictures has been the 8mm single-concept cartridge film. As we use the term "single-concept film," we mean a short reel of film which presents only a single item, a single practice, a single technique. It generally takes the shape of an 8mm motion picture continuous loop placed in a plastic cartridge. A cartridge can be inserted into the projector in only one way, and when the ON lever is depressed, both picture and sound begin simultaneously. Cartridges can be individually packaged in cardboard boxes to facilitate placement on library shelves. They can also be accompanied by both instructor and student guides.

Some of the 8mm automatic cartridge loaded projectors are the Fairchild Mark IV magnetic sound unit, the Technicolor 1000 optical sound projector, the attache case Bohm Benton magnetic sound unit, the MPO Videotronic Super 8 projector, and the cartridge loaded Panacolor equipment using a rather large cartridge which holds a roll of 70mm film containing up to 2 hours of material. An even newer system being developed by AB Dick is no larger than a shoe box and offers tremendous possibilities in self directed study especially since it will sell for around \$150.

However, since the continuous loop system does not permit instant replay of important material and there is no standardization of the cartridge design, the Automatic reel to reel cartridge has been produced by Kodak which offers some additional possibilities for those who have Super 8mm movie cameras and wish to produce their own single concept film clips. Original color film

provides very good color reproduction when shown on fully automatic front screen projectors such as the new silent Ektagraphic 120. Sound can be added to these original films by using magnetic striped film on such recording projectors as the Kodak M 100A or the new Bolex SM8. After recording, this Super 8 sound film is rewound on the same reel that came from the processing plant. This reel is then snapped into an automatic film cartridge like the one designed by Bolex. These cartridges can then be stack loaded for fully automatic continuous showing in the new Bolex Multimatic Super 8mm sound projector. Other manufacturers are working on automatic reel to reel cartridge loaded equipment such as the Fairchild Kumig 711 which will use the Kodak reel and cartridge.

Thus, the 8mm cartridge loaded projectors are bringing about a revolution in educational techniques in that they make practical the self-paced study or review of material by the student at his own convenience.

### Still Photography

Now, I would like to discuss briefly, still photography. The effective use of still pictures is so simple and inexpensive, that every medical-health institution and in fact every professional should be involved in some phase. Included in the still picture medium are a vast number of systems--chalk boards, flip charts, opaque photographs, printed diagrams, models, etc. However, I am speaking primarily of projectables, slides, and filmstrips.

Although the still category is not as dynamic as the motion category, it does present some distinct advantages that must not be overlooked.

1. The 35mm projected image provides the largest, sharpest, most correct color image possible with relatively inexpensive equipment.
2. Production of still projectables is about 1/10 as expensive as motion picture.
3. Release prints are cheap enough to be given away.
4. Projection systems are considerably cheaper to purchase and maintain.
5. Updating of still projectables necessitated by new technical knowledge is less expensive and easier to do and, therefore, more likely to be done.

Because of these advantages and the fact that most subject matter can be taught through a still picture medium, a tremendous amount of hardware is being developed by the audiovisual industry to make the use of still photographs simpler and more effective.

The sound on Slide projector, manufactured by 3M. It is unique because the sound for each picture actually accompanies each slide. A magnetic sound disk encircles each of the 2 x 2 slides and provides up to 35 seconds of sound for each frame. Thus slides can be re-arranged without re-recording.



A newer and different approach to the filmstrip media is found in the Audiscan and the Labell Courier 16 equipment. This method is extremely practical. These machines use a continuous loop cartridge which contains both a 1/4" sound tape and a 16mm filmstrip. When this cartridge is inserted into the machine, all mechanisms are engaged automatically. Labell also manufactures a larger machine, the Sentinel 16, which is operated entirely from the front for use in study carrels and exhibits. In addition to this, the very same 16mm sound cartridge can be used in the Labell Tutor 16 unit for front projection to larger audiences. Thus, the age of the synchronized sound still picture cartridge loaded projector is now with us.

Compressed Speech is accomplished by this German-made device called the Eltro Information Rate Changer. You may say, "Just what is Compressed Speech?" Well, listen closely and you shall hear.

There are some innovations taking place in the Still Picture Media that are also quite exciting. Holography is the process of recording and viewing a three-dimensional image by use of laser light. Although its development is in the horse and buggy stage it is undergoing some radical changes. This hologram developed by Bausch & Lomb does not require laser illumination for viewing. By using a small light source in a darkened room, a completely 3-dimensional image can be viewed with white light.

An even newer photographic innovation is now in development by Dr. Korpel at Zenith Corporation. It is called Acoustic Bragg Diffraction and depends on the laser light source for its perfection. The final photographic image is the result of the diffraction of the light waves by a controlled high frequency beam of sound waves. The main implication of this system is the direct viewing or photographing of an enclosed object through seemingly opaque material.

Kodak's Visual Maker Kit using flash cubes as a light source and the Instamatic Camera coupled with two copy stands, one for 8" sq. areas and the other for 3" sq. areas makes the copying of illustrations and photographs from all types of printed matter an extremely simple and rapid procedure. The Lester Dine Instateck Clinical Camera also using the flash cube as the light source makes the photography of interesting clinical cases an easy and routine procedure.

Aeroflex Laboratories have developed a system called Multiplex Recording Photography which makes it possible to record up to 400 full frame images on one piece of film. This means that a complete color slide series could be mailed in an envelope. The projector is quite simple in design and could easily be adapted for random access selection.

Presently, the simplest and lowest cost random access projector available is the Kodak Carousel RA-950. With this unit, the slides can be shown in sequence and then any one of them selected at random to appear on the screen within 4 seconds for questions and discussions.

A number of different companies have developed a lightweight tape playback machine. A Kodak Carousel fits into the upper portion of the sound device. Narration recorded on another 1/4" half track tape recorder is loaded in a continuous-loop cartridge which is plugged into the machine. Then using a pulse control device, the inaudible slide changing beeps are recorded on the other half track of the tape. From then on the operation is entirely automatic. Using this same basic approach, Shepard Systems, Inc. have developed the Sonoshow Master using the Sawyers projector, which utilized a 100 slide tray and the RCS 1/4" reel-to-reel tape cassette. They also manufacture the Sonoshow Junior, a lighter and smaller machine which uses a continuous loop tape cartridge coupled automatically for sync sound slide operation.

The advent of the Phillip's 1/8" magnetic tape cassettes and simple equipment for mass duplication is forcing manufacturers to produce a whole line of sound equipment like the Wollensak 2550 and the Elco Sound-O-Matic which will program automatic slide and filmstrip projectors. In fact, Viewiex has designed a completely portable AV kit for either slide or filmstrip viewing with a cassette sound recorder.

Slides may be projected by two carousel projectors using a dissolve control device which fades out the slide on one projector while it fades in the slide on the second projector. Using only one carousel at \$150, a sound synchronizer at \$40, and a stereo tape recorder at \$180 you are ready for a sync sound slide show.

#### Conclusion

Visual Imagery: as old as man himself. Projected Images: relatively new. You know, a new invention, a new system, a new methodology is like a new continent. It is a vacuum begging to be filled, a ship seeking a captain, an opportunity searching for a chief. The use of audiovisuals in communication and education is such a system, a methodology, an invention, if you please, but where are the captains, where are the chiefs? We don't need any new means of communication, we merely need to use our present systems effectively. Knowledge and Technology are leading the race and communication, poor, weak, frail communication is limping along about four laps behind. Great amounts of information are available, but because we have not used audiovisuals effectively, this information is not being properly disseminated and used. But with the increasing simplification of audiovisual systems, the dissemination and utilization of knowledge can be far more effective. The projected visual image should be welcomed as a tool for successful communication. Is your tool chest partly empty?



## Application of Audiovisual Technology in Medical Education

Clement Benjamin, Planning Officer, Audiovisual Systems Planning Section, Educational Systems and Development Branch, National Medical Audiovisual Center

You have just seen reviewed a variety of audiovisual media, and heard a description of the strengths and limitations of each. Mr. Craig has painted a glowing picture of what can be done with technology that is available to all of us today.

Unfortunately, as one of your colleagues recently commented, it is difficult to find the bridge between the audiovisual ghetto in which he lives and teaches and the blue sky of audiovisuals which Mr. Craig so adroitly paints.

The problems in bridging this gap are many, but the chasm is not unbridgeable. In my presentation today, I will attempt to identify some of the problems, show some of the solutions, and suggest, if not action itself, those areas wherein action is required, with the assumption that the specific type of action is to be identified and recommended by you. I would like to emphasize from the start, however, that audiovisuals are not a panacea. As one of my colleagues observed, a whole truckload of audiovisuals wouldn't necessarily solve the communications problems of some organizations. For, even with carefully prepared audiovisuals, we are faced with what might be called the "leading the horse to water" syndrome. Yet, in some instances, even simple means have been quite effective.

Audiovisuals can be a working tool--a valuable ones. But like any tool, audiovisuals must be designed specifically for the job at hand, and they must be used with skill if optimal results are to be achieved.

A working tool . . . the implication: There is a job to be done. What job? This must be defined in all of its ramifications before a solution can be sought. Specific pieces of audiovisual hardware should not be bought until the job has been defined--yet how often have we heard of instances where sizable funds have been spent for equipment that lies idle because either it was unsuited to the task or there was no software available for use thereon.

Thus, whether one is considering the use of audiovisual technology in the basic sciences, for clinical instruction, within the hospital setting, or as a medium of continuing education, one must define carefully the parameters of the individual situation--the task that the tool must be designed to accomplish and the conditions under which it will be used.

The problems are varied. Hopefully, the following slides, prepared with tongue in cheek, will serve as examples:

From the harried research specialist: "By the time the students know enough about anatomy to understand what the school hired me to teach, they have graduated."

"I spend all my time answering questions like 'What's a tibia?'"

From a representative of a national organization: "For continuing education to reach our members, we must reach them where they are. Perhaps putting TV on golf carts would be the answer."

From an instructor: "I believe in lectures and note-taking. If my students didn't take notes, there'd be no reason for their coming to class."

From the administrator: "Why waste money on 8mm projectors now, when next year there'll be other machines at half the price?"

And from miscellaneous faculty members: "I would enjoy teaching if it weren't for the students."

"I'm against audiovisuals because they're canned, and anything that is canned loses the living experience."

"If a student really wants to learn, he can learn from a lecture."

"What we need is television and a computer, and we'll be O.K."

"The trouble with putting my presentation on videotape is that I have to plan it out in advance."

"The trouble with being on videotape is that my colleagues pick my presentation apart."

"Audiovisuals are just a crutch used by weak teachers to support themselves."

"We've never done it that way before."

"I'm against core curriculum."

"I don't want to be replaced by an audiovisual."

"Our problems are different."

The quotations you have just heard are interesting because they give insight into very real problems and concerns. And I am not surprised at resistance toward using audiovisuals, for in attempting to use those we have today, many instructors meet with justifiable frustration.

Four major factors contribute to the use or nonuse of audiovisuals.

First, audiovisuals will not be used unless they are easy to use. The instructor neither has the time and inclination to set up complicated audiovisual machinery, nor wants the embarrassment of mechanical failure.

Let me illustrate a situation I encountered personally, one which I hope does not reflect yours. The place: one of the leading professional schools in the country. The occasion: a presentation to faculty and graduate students on the value of using audiovisual media. Prior to my arrival, I had been assured that both a projectionist and an excellent sound motion picture projector would be provided. Upon arrival, I found the following examples accompanied by slides:

The person who made the commitment had left the country.

The projectionist was a graduate student who had threaded the projector only twice before and had never threaded it for sound.

I asked to borrow an overhead projector and was brought an opaque projector.

I asked if the room had a public address system and was told "no." However, observing a microphone on the speaker's stand, I followed the cord (which had been painted when the wall was painted years previously) to an amplifier, which I turned on.

I asked to borrow a projection stand. When one arrived, on it was a dusty but new overhead projector with the operating instructions still sealed in an envelope.

The light on the lectern wouldn't light. A quick check showed that the cord was unplugged. As I inserted the plug into an outlet, I received a 115-volt shock.

The exciter lamp on the 16mm projector wouldn't light. We waited while another projector was located and brought from an adjacent building.

The pull cords on the spring-loaded, black window shades had to be lashed to the radiators to keep the shades down.

And finally, light out, the motion picture projector was turned on, ran two minutes, then overloaded the circuit--and blew a fuse. Before we had this problem solved, we had blown three fuses, and secretaries from half the building were out in the corridors looking disapprovingly in my direction, their electric typewriters having stopped.

Fortunately, it was a lovely day, and a good time was had by all. A slide projector which I had brought with me behaved admirably.

Was this a typical situation? Let us hope not. Yet many of you have had similar experiences.

Any organization which wants its personnel to use audiovisuals should plan to provide a person--other than the instructor--who is responsible for the maintenance and handling of audiovisual equipment. If audiovisuals are to be used, they must be convenient to use; otherwise they will gather dust.

Second, the learning environment is important to whether audiovisuals are used. Learning spaces should be designed for learning, yet how often this is not the case. [Slides accompanied the following examples.]

At one school we visited recently, there was no air conditioning. During warm weather, which was most of the year, one had the choice--when projecting audiovisuals--of a hot classroom with open windows or an unbearably hot classroom with blinds drawn.

At another school, where a similar situation exists, there is the added nuisance of noise from both an expressway and huge exhaust fans in several of the classroom windows. One class meets before 7:00 a.m. by popular demands.

Additionally, a liberal assortment of pillars in the classroom, though guaranteeing the stability of the roof, obstructs the view.

In another school, a lecture room is 25 feet wide by 125 feet long, with the floor tiered at an angle of approximately 45 degrees. I was advised, "Don't look at students beyond the first five rows or you'll get a stiff neck." This room is affectionately called "The Pit," and the local story is that students in the last ten rows get nosebleed.

Unique? Not at all. In at least two other schools, there are similarly long, narrow classrooms--but with level floors, giving a tunnel effect. In one, the students rely solely on TV monitors to see the instructor.

In the other, the instructor stands near one of the side walls, with students seated in semi-elliptical fashion facing him. Those in the end seats can neither read the blackboard nor see projected material.

And in one hospital, we found the student carrels in an open corridor directly opposite a bank of elevators.

To some degree, many schools and hospitals--even the most modern--have similar problems. Too often, and ridiculously, people must adapt to the physical environment rather than adapt the brick and mortar to their needs. If audiovisuals are to be used, one must design the learning environment of which they are a part.

Third, if audiovisuals are to be used, they must be available when and where they are needed. This means easy accessibility. Any plan for action, therefore, should take into account the problem of locating what has already been done, both locally and nationally, and selecting those delivery systems which will make this material available to the user with the least effort, perhaps through the school or hospital library.

Catalogs are one means of making accessible information about audiovisual materials that are available. At the simplest level, there is a need for catalogs which describe what is available within the facility. Learning of such materials is not an easy task. Instructors have slides tucked away in many desks. These slides are often excellent but unidentified. Many are

worth cataloging, duplicating, and being made available to many users from a central point.

There is also a need for cataloging the wealth of material available nationally and internationally. For example, in both the areas of cancer and neurological and sensory disease, the National Medical Audiovisual Center's international index contains over 1200 listings. And a recent computer printout in the area of surgery took 900 pages. Available listings of this type need to be assembled and organized so that they are easy to use.

Finally, if audiovisuals are to be used, they must be suited to one's need. Therefore, at the highest level, comprehensive specialty catalogs should be prepared listing only those audiovisual materials which have been reviewed and evaluated at least subjectively. The instructor planning a series of presentations, the researcher seeking visual documentation, the practitioner with a particular problem, and the student seeking information; all could use such a catalog. It should provide information that will allow the user to judge the audiovisual item's instructional potential for his particular audience.

Who should undertake the task of locating and evaluating audiovisual material? In my opinion, the job is too big for any one instructor or perhaps any one school to handle. If schools can't do the job, who can? Though the instructor is in the position to analyze the curriculum, the audience, and possible uses of audiovisual materials by his students more validly than is a committee representing a group of schools or a national organization--a national group is in a better position to provide personnel, equipment, and time: resources critical to the development of effective communication materials. A broadly based and organized program is the only reasonable approach toward solving the problem.

In reviewing audiovisuals for the purpose of cataloging only those which are of value to a particular curriculum, one discovers areas for which little or no material is available--thus suggesting the need for production. Moreover, until such a survey has been made, one cannot know that time and money spent on new productions will not be wasted through duplication.

It is both possible and practical to produce audiovisual material at the local level with a minimum of means. A plan for action at the local level should, therefore, include a study of the feasibility of producing materials that cannot otherwise be procured, for use with one of the more common delivery systems. The simplest system may be slides or slides plus audiotapes.

The instructor cannot be expected to produce audiovisual material unless it is easy to produce. Therefore, the approach in a number of schools of medicine has been to establish a department of biomedical communication, or a communications arm within the department of medical education. Such a department has as its purpose the provision of those skills and talents required to work with faculty members, analyzing curriculum content and specific communications problems and coming up with means or products for their solutions. Such a department can also serve as the focal point for

purchasing and maintaining audiovisual equipment, so as to insure ease of operation and compatibility throughout the school, hospital, or medical complex. The department may also be the focus for the acquisition and distribution of audiovisual software--and for designing the learning environment.

Let us now review ways in which some schools and hospitals are using audiovisuals to assist in solving the communications problem. (Slides accompanied the following examples.)

Problem: To get information on the detection and diagnosis of oral cancer to dentists in rural Kentucky. It was assumed that the practitioner in the field would not have access to audiovisual equipment.

Solution: A set of 93 slides and a semi-programmed text, designed by Dr. Sheldon Rovin, University of Kentucky School of Dentistry, and a battery operated slide viewer, were sent to each dentist. The text asks the practitioner to examine a slide. It also provides him with information about the patient. The dentist is then asked a question. Answer choices are presented in a multiple-choice format. He then turns to a subsequent page where his selected response is discussed. If his response is incorrect, he is told why it is incorrect and is asked to select another response. If his response is correct, he is directed to proceed.

Problem: In downtown Atlanta, to provide a system through which professional staff and students throughout the metropolitan area could participate in Grady Memorial Hospital's conferences, CPC's, guest lectures, etc., without the necessity of traveling to the hospital.

Solution: The Community Medical Television System, giving line-of-sight transmission to hospitals and medical organizations within a radius of 25 miles, with direct "hot-line" telephone service for questions. In addition, videotape replays at another hour for those who missed the live broadcast.

In South Carolina, a somewhat similar system reaches physicians throughout the state--by cable to subscribing hospitals and high schools, and through open-circuit TV. In this instance, question-and-answer sessions are handled locally.

Problem: Training student nurses and ancillary personnel in certain rehabilitation nursing procedures.

Solution: At NYU, a series of 36 8mm sound motion pictures, cassette loaded for ease of use by persons with training in operation of audiovisual equipment, with projectors placed at nursing stations for use at odd hours or when needed.

Problem: To provide 24 hours a day, to physicians everywhere, information on the management of emergencies in practice.

Solution: "Dial access" audiotapes at the University of Wisconsin. There is always someone on duty who can receive a telephone request and plug a cassette-loaded audiotaped response into a special audio-playback.

Problem: To provide live audiovisually-supported instruction over distances without special video cable, often to a number of points simultaneously.

Solution: "Telelectures," slides, motion pictures, or videotapes are mailed in advance for local showing on cue in support of a presentation. The speaker makes his presentation by telephone or two-way radio, and answers questions. Wisconsin, Albany, and the Harvard University School of Public Health, to mention but a few, use this system.

Problem: To provide the student, on his own time, instructional experiences which require a variety of media.

Solution: Special learning carrels, in lab or in library, readily accessible to the students' living or work areas. The student receives information or instruction by audiotape, film, videotape, or the printed word; is involved in practical exercises, directed to a variety of media, and told whether or not his responses are correct. Examples: Anatomy course at the School of Medicine, University of California in San Diego; physiology and pathology courses at the Medical College of Virginia; and obstetrics course at the University of Washington.

Problem: Consultation where patient and specialist are separated by miles.

Solution: University of Nebraska, 24-hour-a-day closed circuit, two-way television by cable between the state hospital at Norfolk and Omaha, over which practitioner and patient or ancillary staff talk. Also, courses are conducted and patients and families visit by television.

Another example: Again, CCTV--to connect Massachusetts General Hospital with Logan International Airport. From the airport, a nurse with a patient requiring emergency treatment can benefit from two-way communication with a specialist at the hospital.

Problem: To save practitioner's time in delivering routine information to patients or their families.

Solution: At Piedmont Hospital, Atlanta--sound/slide presentations in a "black box" that can be used in clinic areas or patient rooms. Automatic and repeating, the machine is turned on by a single button and shuts off automatically.

Another solution: From California--cassette-loaded sound motion pictures on prenatal and postnatal care. The hardware starts with the push of a lever, shuts off automatically. Self-contained, with earphones if desired. Available commercially on a rental basis.



**Problem:** To reach practitioners and nurses through the states of Washington and Alaska with information in audio and still-image form. System must be easy to use and capable of being programmed.

**Solution:** Placement of cassette-loaded 16mm sound filmstrip projectors in hospitals throughout the region. Automatic audio stop after questions allows students time to respond while picture remains on screen. Student pushes "go" button to proceed.

**Problem:** Instructor conducts CPC's and nobody can see detail in X-rays on light box.

**Solution:** TV camera zooms in for closeup; contrast adjustment emphasizes detail; all students can see.

Similar solutions in oral surgery, gastroenterology, anatomy, with the added fillip in angiography that videotapes can be replayed, slowed up, stopped for study or to emphasize an individual image.

The uses to which audiovisuals can be put are almost limitless. The limit, in part, is due to our own ingenuity and imagination.

Since our budgets are also limited, however, we are faced with hard practical problems as we select our working tools--problems which vary with the ramifications of each situation. (i) If the equipment is priced within our budget and will meet the requirements of the job, are there good films or other audiovisual materials available in sufficient variety and applicability to justify its purchase? Or must we produce our own materials? (a) And, if we have the machines and the materials have we encouraged their use by making them available when and where needed, by providing suitable environmental conditions, and by making them easy to use?

If our answers to the above questions are yes, then we are well on our way toward a successful, audiovisually supported program.

### Planning Implications for a Library-Learning Resource Center

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### Introduction

It will not come as a surprise to you, I'm certain, that libraries throughout the country are becoming more than repositories of the printed word. I personally believe that the traditional concept of a library containing only books and journals is as outmoded as the horse and buggy and high-buttoned shoes.



In view of the current and predictable need for more rapid access to a wide range of learning resources and the trend toward independent study as a technique of learning, the medical library of the future will take on an appearance unlike that of the majority of libraries today. Of this you can be certain: the library of the future will not only house the traditional printed word, but will also store and make available to students, teachers, researchers, and professionals in the community, alike, learning resources of all types. These resources will include audiotapes; 16mm motion pictures; single-concept, cartridge, 8mm motion pictures; cartridge sound/slide series; filmstrips; videotapes, live television programs, and television film recordings; teaching machines, programmed instruction, and computer-assisted instruction; micro-format materials; EKG's, EEG's, classic cases and records; models and specimens. The library, or learning resource center, as it is sometimes called, will contain all the equipment required to see, hear, and retrieve information.

### Planning for Affiliated and Nonaffiliated Hospitals

In the development of a Library-Learning Resource Center, two major considerations that will require study are the VA hospital that is affiliated with a medical school or center, and the nonaffiliated hospital. Inasmuch as 89 of the approximately 168 VA hospitals are affiliated with medical schools, the educational role of the affiliated hospital, coordinated with that of the school, needs to be defined early. In this way, duplication of effort and facilities may be avoided. In some instances, there may be a need to provide within the hospital's library-learning resource center certain types of educational facilities designed to serve both school and hospital. Implicit in this is the need to analyze the educational resources and needs of the medical school or center, and perhaps even the entire medical community. In the early survey and exploration stage, the dean of the medical school should be requested to provide written agreement outlining in general terms the educational policies of the school and how its program is expected to relate to the use of the hospital's instructional facilities. In the case of the nonaffiliated hospital, only the educational role of the facility, and its relationship to the learning resource center, need be defined.

### Nonbook Materials and Equipment

We at the National Medical Audiovisual Center are often asked to outline the types of materials and equipment that should be included in a library-learning resource center. I am sure you all know this is a loaded question and one that cannot be answered without a thorough knowledge of the hospital's or school's educational philosophy and the way it will be translated by those responsible for instruction. Only when this information has been gathered can one gain an idea of what materials and devices should be obtained for installation in the library-learning resource center. Nevertheless, I can give you some examples, based on our own experience. One medical school decided to tape every lecture given during the four year course. The intention was to place these audiotapes, along with supporting visuals, in the learning resource center. This action was taken for three reasons: (1) in

order that absent students might cover material they missed in the classroom, (2) in order that all students might review points on which they need clarification and to prepare for examinations, and (3) in order that students not taking a course might use the material for reference, independent study, and exploration.

In other instances, faculty have informed me they would include material designed to expand on subjects taught in the classroom. For example, an instructor may explain and portray how a disease entity affects one organ and suggest that interested students might wish to view a set of slides or a film in the learning resource center that portrays how other organs are affected. In another instance, I was informed by a hospital administrator that he would explore the possibility of placing in the library self-instructional materials for custodial, dietary, and administrative personnel.

Whatever the school or hospital's educational philosophy, it must be spelled out in educational objectives before any decisions can be made regarding the procurement of materials and equipment, and before any architectural planning or remodeling can begin.

### Accessibility of Learning Resources

If learning resources are to receive optimum use, they must be made readily available to users as needed. Implied in this concept is the problem of storing and handling materials. Storage and retrieval facilities in the library-learning resource center include the following functions: the collecting, cataloguing, storing, distribution, and retrieval of motion pictures, audiotapes, and other resources. Attempts should be made to collect from within the facility all presently available audiovisual and other nonbook materials deemed essential to the learning situation. Master copies should be duplicated and duplicates placed in the library. When indicated, resources should be obtained from outside sources. Instructional resources that are not catalogued, indexed, cross-referenced, etc., are of little value. In some cases, audiovisuals can be stored in steel cabinets; in others, a temperature-controlled room may be indicated. The distribution process includes both the handing of materials to students and the electronic distribution of materials by television and audio networks from a central point. In the former case, the student will usually check out materials much the same as they would a book or journal, and view the item in a carrel or soundproof room in the library-learning resource center. In the latter case, a student may view a videotape or listen to an audiotape in a closed or open carrel in the library-learning resource center, in a subcenter within the hospital, or perhaps even in a lounge.

### Accessibility and Environment of the Resource Center

The library-learning resource center must be environmentally pleasing in appearance and character, adequately equipped, readily accessible, and an integral and vital part of the total educational program.

The resource center should be located on the ground floor of the hospital, adjacent to major hospital circulation, and accessible to the public. If at all possible, it should be situated in proximity with medical illustration, medical photography, pathology, medical records, and radiology. A close relationship should exist between the resource center and these services, since many of the resources will be generated in these particular units.

Physical and environmental factors can often make or break the effectiveness of a library-learning resource center. To learn, students must be able to see, hear, and react to material presented. Such requires overall illumination of 30 - 40 footcandles, with individual work lights at carrels and study stations; appropriate acoustical isolation in carrels, listening, and viewing rooms; appropriate ventilation and air conditioning; comfortable room furnishings; and an avoidance of room colors so depressingly drab as to discourage enthusiasm.

### Equipment Needs

Equipment used for the display of audiovisual materials must not only be available in sufficient quantity, but must be modern and well maintained. Nothing discourages a potential user more than an outdated, difficult-to-operate, or nonfunctional piece of equipment. Storage space for portable equipment should be planned for in the library-learning resource center. A factor often overlooked in planning for equipment is the need for adequate electronic and electric access. It is extremely important that provisions be made for the needed voltages, outlets, and such devices as raceways to accommodate the necessary channels. With the advent of electronic storage and retrieval systems, computer-based operations such as MEDLARS, the use of the Teletypewriter (TWX) for interlibrary loans and bibliographic printouts, and the possible use of computer-assisted instruction, planners should give special consideration to the types of equipment required and resultant space and electric needs.

### Types of Learning Spaces

It may be helpful, at this point, to review the types of carrels and rooms which should be considered by planners in developing space needs for a library-learning resource center. I am not implying that you should have all the types of carrels and rooms I will discuss, as this depends on such local considerations as the number of potential users and the educational philosophy of the hospital.

Carrels used most often consist of the following: (1) Small, open carrels used for reading only. (2) Closed carrels used for typing, acoustically treated. (3) Closed or open carrels designed for the electronic retrieval of live or videotape programs and audiotapes from a central origin, containing facilities for viewing rear-screen cartridge motion pictures, filmstrips, slide/sound series, etc., and acoustically treated.

Other areas designed for the use of audiovisual resources and requiring special planning include the following: (1) Small, soundproof, reading room for physicians on call, including a paging system and projection facilities. (2) Small, soundproof conference rooms to accommodate four to six persons, including projection facilities. (3) Soundproof room for showing 16mm or perhaps Super 8mm sound motion pictures and sound/slide series, including projection facilities. (4) If needed, a soundproof microfilm or microfiche storage and reading room. (5) If required, a soundproof room for use of computer-assisted instruction, containing one or more terminals. (6) A special room might be required for the storage of motion pictures, filmstrips, slide, and other media. It should be air conditioned and contain necessary temperature controls.

### Summary

Libraries are evolving into learning resource centers which will contain a wide variety of nonbook learning resources, as well as the traditional books and journals. These will include such media as motion pictures, videotapes, and teaching machines. The library-learning resource centers developed in VA hospitals affiliated with medical schools and centers should work closely with their affiliates to insure adherence to educational philosophy and to negate the possibility of duplicate facilities. Requirements for materials and equipment included in a library-learning resource center can only be ascertained after a close review of the teaching objectives of the institution.

To function effectively, the hospital library-learning resource center must insure the accessibility of learning resources to users by carefully collecting, cataloguing, storing, distributing, and retrieving all types of media. It should be located on the ground floor of the hospital, in a heavily used area, close to medical illustration and photography, pathology, medical records, and radiology.

Physical and environmental factors must assure the user adequate visual and auditory reception of information, a comfortable climate, comfortable furnishings, and a cheerful atmosphere. Equipment in the center must be adequate in quantity, modern, well maintained, and properly stored. Provisions must be made for the needed voltages, outlets, and raceways.

Carrels for reading only, for typing, and for electronic information retrieval are needed, as well as rooms for physicians on call, for small conferences, for presenting audiovisuals, for microfiche reading and storage, for computer-assisted instruction, and for the storage of filmic materials.

## Audiovisual Service: The Librarian's Role

Margaret L. Brooks, Chief, Reference Section,  
National Medical Audiovisual Center

Until three years ago, I had spent almost 90% of my life in a classroom - either as a student or as a teacher. And during those 29 years I had struggled - as I'm sure many others have struggled - to find ways to clarify points, reinforce my thinking, supplement my teaching. And invariably, I turned to visual aids. When I had to dissect a frog, I looked for a picture - when I had to learn the anatomy of the nervous system, I looked for a picture. When I was teaching the anatomy and physiology of the brain, I relied on photographs, drawings, slides, motion pictures. And now that I am no longer in a classroom - I find that I still rely very heavily on visualization - in daily conversation - in my work - in everything. In fact - I even use visual aids when I talk to my dog. Maybe that's why I like my job.

You see, I'm in the audiovisual business, and I like my work - because it is a growing, changing, vital sort of business. The people who work with audiovisuals are an enthusiastic group - who see the unlimited potential that audiovisuals have to offer students, educators, laborers, professionals, illiterates, scholars, children, adults - and all the people in between. The audiovisual has become one of the most powerful teaching tools ever devised because the audiovisual brings into play almost all of man's senses. I believe very strongly in the value of audiovisuals in all areas of education and communication. I believe in the use of audiovisuals - And - I believe in the future of audiovisuals. My faith in audiovisuals as teaching aids is shared by people all over the world. In my position as Chief of Reference, I have met and dealt with men and women, doctors, educators, lay people from throughout the world - and without exception, they have the same faith in the value, use, and future of audiovisuals.

Fortunately, audiovisuals as we know them today are a far cry from the audiovisuals which I knew as a student in the public schools of a modest southern city. The current concept of audiovisuals was as remote to education and libraries as man's moon walk must have been to Lindbergh as he struggled to stay aloft over the Atlantic. The use of audiovisuals frequently meant a strong, persistent voice and a chalky finger piercing the air to emphasize a point or create a mental image. But - Education has come a long way in 20 years. The quality and type of education have changed. The quality and type of educators have changed. Educators have opened their minds to new concepts of teaching at all levels. They have begun looking for new ways to teach, new ideas to teach, new resources to enrich that teaching. The real educator doesn't teach merely facts - he teaches ideas. He doesn't rely only on the text book or the printed word - or diagrams hastily sketched on a chalk board. He uses every avenue of entry into the student's mind - sight, sound, touch - to initiate inquiry and stimulate interest.

The library has come a long way in 20 years. It is no longer simply a storage area for little-used books and journals. It is rather, a center

of learning - a key to investigation. The librarian is no longer like the proverbial king - sitting in his counting-house - counting out his gold. The librarian is no longer just another staff member who doesn't count against the state's allotment of educators. He is a vital part of the faculty, the hospital staff, the community. The librarian is the locksmith who holds the combination to the vault of information available.

And - audiovisuals have come to life in the last 20 years. When the term audiovisual is used - it doesn't mean just the 16mm film that has been molding on some shelf - Audiovisuals today are just what the name implies - they are any instructional material that can be seen, heard, or both. The voice of the audiovisual specialist is being heard, attitudes are changing, progress is being made, and the future of audiovisuals in all areas of education is promising.

However, I am not trying to sell you on the idea of using audiovisuals. I'm not selling the value of using audiovisuals at all levels of education. The purpose of my visit is not to tell you how, why, or when to use audiovisuals. Nor am I here to imply that audiovisuals should ever take the place of the printed word. I am here to discuss a problem which is, or should be, of concern to all of us. Improved communication of information, particularly biomedical communication, is a contemporary problem facing our nation and other countries of the world today. We hear a great deal of talk about "the generation gap" - the fact that "people over 30 don't understand the people under 30" - the "establishment doesn't know what's going on" - "there's no communication between people" - "communication breakdown" - It seems that so frequently when problems arise - for example - the disturbances on college campuses - that the basis of the problem is a breakdown in communications or a complete lack of communication - Parents are unable to communicate with children - husbands with wives - teachers with students - government doesn't communicate with the governed - countries don't communicate with countries - and so the problem grows. This problem of communication. This is nothing new by any means. Since the beginning of time, I suppose, there has been a communication problem. Lack of understanding, stemming from lack of communication, has been the basis for everything from family feuds to world wars. But the problem as we face it today is much more serious than it was in biblical times, or even a century ago. When man is able to travel faster than speed of sound, when the population is increasing and death rate decreasing to the extent that before another century comes and goes the earth's surface may not hold all of its masses, then the problem of communication becomes much more significant.

Communication is a social problem, and social problems are very much the concern of all of us. It has been said that the great problems of this decade - on which public funds and public energies are being concentrated are social problems. These are the problems which involve man himself or his environment. The problems of the 60's are peace, poverty, pollution, population, prejudice, and preparedness. The major effort of the 60's is to find means of containment of these problems. There is underway a concerted attempt to find solutions to these problems through technology. It is not accidental



that the technology which figures most frequently in this context is communications technology. Communication - an art that deals with expressing or exchanging ideas effectively in speech, writing, graphic or dramatic arts.

The key to the solution of the problems of society is education. It must both equip society to live with its problems at the same time as it attempts to communicate ways of resolving them. Medical education is of particular importance because medicine and health figure directly in at least three of the six problems of the sixties. And yet education itself is a problem. Time is of such an essence that one must simply insist that education help itself while ameliorating its fellow problems. Education depends upon communication. Without communication there can be no education. Fortunately, medicine, science, history, and experience are communicable knowledge. Education is the formal procedure for their communication. But education is facing a very real problem - one which will not find its solution in being ignored. The problem facing education will not just go away if we close our eyes and wish it so. Nicholas H. Charney, editor-in-chief of Psychology Today, in an article appearing in the March issue of Audiovisual Guide stated the problem in this way: "Sight and sound. The electric circus. The Mantra of the Maharishi. The message of Marshall McLuhan. The Beatles. The beat. This is the turned-on, tuned-in, audiovisual world of today's youth. This is the generation that goes to the movies to find out whether to read the book. This is the generation which must be sold on the excitement of a new thing before trying it out. This is the generation responding to the new. The multiple screen. Stereophonic sound. A changing preception of time. Of realism. Watch a bullet in flight on film. See a flower grow from a seedling in a second. See on satellite - sent TV the death of a man in Viet Nam the day he is shot." Mr. Charney goes on to say that: "We're trying to compete with all this in education by selling the same old textbooks to our students. We're trying to educate this generation as though it were two worlds. One, the swinging 60's. And one the floundering 40's. Because our educational material is woefully lacking, students are not held. They are not talked to in their own language. In their own medium. If our modern technology and know-how are put to good use, if we put the student in the proper educational environment, that student will respond with interest and enthusiasm."

How do we create this proper educational environment? One excellent way is through the use of audiovisual material. Economical, reusable, current, realistic audiovisual material - helping to bridge the communication gap. In 1894 Thomas Edison said, "It is impossible to fascinate young minds with dull textbooks. I believe that the motion picture is destined to revolutionize our entire education picture." This problem of communication in education is not limited to public schools and colleges. For the last several years, there has been developing an organized demand for the continuing education of biomedical practitioners. In the report of the President's Commission on Heart Disease, Cancer and Stroke, it was stated that: "Most of the physicians practicing today received their education in the 1930's. The fact that they are practicing today two or three decades later would have been unimportant in earlier, quieter centuries. Today it poses a critical obstacle to the delivery of up-to-date health care. Therefore, a systematic, nation-wide program of

continuing education for physicians is a categorical imperative of contemporary medicine." The imaginative use of new communications media offers the best hope for necessary breakthroughs in continuing education.

Dr. James Lieberman, Director of the National Medical Audiovisual Center, is aware of some of the problems confronting the practicing physician who wishes to continue his education. In a recent interview for the magazine, Photo Methods for Industry, Dr. Lieberman said: "The thoughtful physician is faced with constant need to retool his mind as the onslaught on new material in his field and related ones develops. He will need the facts and concepts with which to revise opinions and approaches to disease, its diagnosis and cure. However, it is a dilemma of modern clinical practice that time usually spent in the care of patients will not be devoted in its stead to postgraduate education. Demands made on today's physician rob him of one of his most valuable instruments of learning - time." He went on to say that: "With the sobering prospect of information expansion exceeding the capacity of the health scientist to deal with it systematically, the professional person finds himself in the position of having to make heroic attempts to stay in the mainstream of new medical diagnostic and therapeutic thinking. There is strong evidence that the habits and patterns developed by traditional modes of instruction will not serve the modern medical student to best advantage." The traditional mode of instruction to which he refers is so rigid that it often discourages, if not prohibits, individual initiative and individual study at a rate which will produce more professionals - better trained and in less time - for the American public. Dr. Lieberman joins countless others in his belief that the answer to this problem lies in communication technology - powerful - and with unlimited potential waiting to be used.

Today, computer literature searches instead of laborious card-catalog searches are available; fiberoptic motion picture photography has taken the place of pages of description in a textbook and cut into fractions the length of time necessary to teach endoscopy and its vital importance. TV has made it possible for the resident or staff physician in a remote rural hospital to learn from grand rounds in the most sophisticated teaching hospitals of the country. All of these new media, and their programming, should be familiar to the medical student of today, the practitioner of tomorrow. Those of us who are involved in the health effort are vitally concerned with this problem of improved communication of information. We are concerned with all phases of information communication and consequently we are interested in the optimum use of all information media. We are concerned more with the rapid dissemination of information than with the media used. Naturally we are anxious to see the expanded use of audiovisuals, because we believe so strongly in their worth and their potential. Many of you have just recently become involved in the audiovisual program. Perhaps you are not quite sure why.

I recently attended the meeting of the Medical Library Association in Louisville. While there I met a large number of medical librarians who had found themselves with the new responsibility of handling the audiovisual program in hospitals, medical schools, regional medical programs, and such. All too frequently these librarians were disturbed about their new jobs, and



justly so. Many of these people had never had any dealings with audiovisual media. If they had "software" - a term used to describe films, slides, tapes, etc. - the material was not cataloged. If they had "hardware" or equipment, they were expected to operate the equipment, handle the selection, ordering, and return of films - and most of these people had never done this before. As one librarian told me - "I don't know a carousel from a carburetor and last week I was given 3500 slides, a room full of equipment, and told that I was the new audiovisual specialist...." I grant you - it was a traumatic experience for her.

For years libraries have included in their collections such non-book material as maps, charts, globes, exhibits, and works of art. But there has been a general reluctance to recognize or provide for the newer media - motion pictures, filmstrips, videotapes, audiotapes. Some of the reasons for this reluctance are apparent: such items are not as easily acquired, cataloged, and stored as are traditional library materials. Audiovisuals present special problems and require special consideration. But let us consider this undeniable fact - if the library is to keep pace with the now, it must become a learning resource center rather than a book depository. The librarian must become an information specialist. The library must be versatile enough to encompass the entire gamut of learning media. Because of their unique capability for transmitting certain types of information, the newer media deserve a place in the health sciences library. In its report to the National Library of Medicine, the Library Study Committee of the Association of American Medical Colleges stated, "The health sciences library serves as the point at which the health professional and the student intersect the scholarly record." The library, in a school system, hospital or training facility has become the logical place to house audiovisuals or audiovisual reference information. Since the facts and the future are quite clear, let's look at some of the problems that libraries will face in integrating the newer media with the traditional media. There are guidelines to follow in the cataloging of printed materials - but there are apparently no standardized rules for cataloging audiovisuals.

The development of an effective audiovisual program - whether it be a loan or reference program - is dependent upon thorough planning and definition of objectives. A number of factors must be considered and policies established prior to the actual setting-up of operations. The first is of course - type of program. Will the library acquire audiovisuals as permanent additions to the library, or will efforts be directed towards a reference program with acquisition limited to short-term loan from outside sources upon request of the user? Budgetary and space limitations will, of necessity, play key roles in this decision. Next, the scope of coverage must be considered. How much and what types of materials and equipment will be acquired? A thorough understanding of the desired use of the audiovisual library is mandatory in determining this scope. For example - if you are creating an audiovisual program for a hospital staff - you must consider - of course - the subject areas of interest to the staff, the time involved in using the available audiovisuals, and the location of the material in the hospital. Many hospital staffs find it most practical to use 8mm projectors at the nursing station or the staff lounge so that doctors and nurses may look at a film during a free period. Each librarian must make these decisions based on her knowledge of the needs and facilities in the hospital or school.

When the scope of service is determined, the librarian must consider solicitation of reference material or software. Selection of audiovisuals has been made difficult by the lack of inclusive listings and the scarcity of critical reviews of available materials. The librarian may turn to commercial firms such as the pharmaceutical houses, association films, Encyclopedia Britannica, to professional societies like AMA, American Hospital Association, A.D.A., the armed forces, colleges and universities and major reference services such as the National Medical Audiovisual Center. NMAC has now computerized its International Index of Medical Film Data containing detailed descriptive and source information on approximately 25,000 audiovisuals in the health-medical field. Approximately 200 new titles are added to the Index each month. Using this data NMAC publishes listings in selected subject areas and prepares special listings upon request. There are a few critical reviews available, such as Landers Film Review and the Educational Film Library Association Cards. The actual cataloging of the audiovisuals poses a problem for the librarian. She must decide whether to maintain a separate card file of audiovisuals, to interfile the cards in the regular card file, or whether a catalog of holdings will be sufficient.

At the National Medical Audiovisual Center we have established the world's largest collection of abstracts on medically related audiovisuals. This collection, the International Index of Medical Film Data, forms the nucleus of the Reference Section. The name, though somewhat, is not entirely self-explanatory. It is an index in that items are listed, briefly described, and pinpointed as to location; and it is international in scope. "Medical" is not quite the right word; nor is "film." Thirty years ago when the National Medical Audiovisual Center was established, it was conceived as serving the entire Public Health Service, and, consequently, the Index's scope included not only medicine but such aspects of public health as accident prevention, safe driving, civil defense, and water safety. Having established a reputation for reference service in these areas, we have continued to add to the Index data which may loosely be defined as health oriented. The Index is not solely a listing of films but rather of all audiovisuals. It includes - in addition to motion pictures - film strips, audio and video tapes, and slide sets. We have developed a standardized format for cataloging index entries. It is a combination of several existing formats, no one of which we felt adequate for our needs. We selected parts of the ALA rules for descriptive cataloging, the LC rules, and the NEA suggestions. We are now eagerly awaiting, as you, too, must be, the forthcoming revised Anglo-American rules for audiovisuals.

In end product of our descriptive cataloging, the first line is our film number. It is a numeric representation of the title, (that is, 64 refers to the P-H of the title, and the other five numbers further delineate the title as being in the P-H-Y-S-I-C-A-L-C-N section of the alphabet). The film number is not an accession number, a fact we have often regretted but which the size of the Index precludes our changing. Following the title line is a producer/sponsor line which includes country of production, year of production, or, (as seen here,) an asterisk if date is unknown. The physical description line

varies with the medium being described. (This is a 35 frame, silent, color, 35mm filmstrip.) When an audiovisual is in languages other than English, a notation of this is made before the series line. Following the series line is a brief content synopsis. Following this, restrictions, such as "Professional use only," are shown as required. Lastly are listed sale and rental sources in code. Of course, any filmography we prepare is accompanied by a key to these code numbers.

Subject cataloging for the Index is based entirely on our own classification scheme. The scheme has a hierarchy of 65 subjects, each descending from general to specific. In all, there are approximately 1800 subject categories. Each specific subject is represented by eight numbers, the first three representing the general subject area - the second three, the subdivision - and the final two, the specific subject. As you can see, there is ample room for expansion within the scheme.

Input into the Index is both orderly and chaotic; orderly in that we annually request from all sale and rental sources an updating of their additions and deletions. Orderly in that five government agencies - to be referred to later - systematically provide us with current information on their holdings. Orderly in that we scan the professional and industrial media journals for lists of new productions. Chaotic in that we are constantly inundated with individual new title flyers from myriad sources, with catalogs from new producers or film libraries, with actual films sent us by mistake. For each title added, a computer input document is completed and processed. From this data, two documents are created. (Like the sample entry you have just seen.) One is a master copy, similar to a shelf list, and one is a subject index copy. "All well and good" you must be thinking. But what do you do with this accumulated data?"

We perform, basically, three reference services.

1. We select and organize titles to be included in catalogs published by NMAC.
2. We compile listings of audiovisuals on specific subjects as requested by individuals.
3. We answer requests for information on specific titles.

Let me speak first about the published catalogs. These are of two types: recurrent and specialized. Our own NMAC Catalog is an annual listing of audiovisuals we distribute. Also, annually we publish the Film Reference Guide for Medicine and Allied Sciences, known affectionately as the FRG. The FRG is a combined listing of audiovisuals available from member agencies of the Federal Advisory Council on Medical Training Aids. This group, to which I referred earlier, encompasses, in addition to the National Library of Medicine, the departments of the Air Force, Army, and Navy, the Armed Forces Institute of Pathology, and the Veterans Administration. When the number of individual requests in a specific area reflects a widespread concern with the subject, we produce a specialized catalog. Recent examples of the selected listings

prepared this year cover Organ Transplants, Mental Health, Dentistry, Addictions, and Nursing.

In response to requests from individuals we search relevant subjects of the Index for appropriate titles. Last fiscal year we answered 12,103 such requests. This year the figure will be much higher. The types and origins of the requests are as varied as can be imagined. We have responded to requests for materials on health hazards of scuba diving, on in vivo action of intestinal villi, on chlorination of swimming pools, on zoonoses, bioelectronics, skin grafting, mercury poisoning, cryosurgery, immunosuppressants - and on and on. Perhaps our most delightful request was pencilled by a small boy who needed "a movie on Lister and how he discovered Listerine." Requests have come from professional health scientists in Amsterdam, Chile, Tel Aviv, the Congo, Sweden, and all the English speaking world. Some of you have undoubtedly already requested audiovisual listings from us. All of you, I am sure, are beginning to realize the potential aid to you of this service. As you build up audiovisual libraries, you and your patrons will need to know what is available on a given subject. You will need to provide this same information to your users if you plan to borrow rather than buy. Because they are annotated, our references will be more helpful to you than the unannotated audiovisual titles appearing in the NLM current catalog. Because our holdings are more comprehensive in the health sciences, we can provide greater coverage than the NUC's motion pictures and filmstrips. And - our service is free.

You may find that our system of cataloging will meet your needs quite well. With this in mind, I have brought each of you a copy of the procedural guide which we have written for our own use. The cataloging and indexing operations are described in depth in this guide. The time required for cataloging audiovisuals may be greater than for printed materials. Distributors generally provide enough descriptive information for the cataloging of audiovisuals... however, when such information is not available, the librarian will have to view or listen to the materials in order to catalog them. While books may be scanned for this purpose, audiovisuals would have to be viewed in their entirety.

The next major areas for consideration in creating your audiovisual program are equipment and space. The library should provide equipment and viewing areas for group and individual users. The type equipment will of course depend on budget, available space and time schedules. If it has been determined, for example, that doctors and nurses will prefer to use audiovisuals at their duty stations, it would be more practical to purchase 8mm projectors, audiotapes, slide sets and film strips than to purchase 16mm projectors and software. If the equipment is to be used in a central location, provision should be made for individual and group viewings. Rooms used for group viewings should be soundproof and air conditioned or very well ventilated. Desk type chairs should be provided. Room lighting should permit note taking during projection. The room should be of sufficient length to provide a comfortable viewing distance. Individual carrels may be provided for smaller equipment such as "moviolas," rear screen projectors, 8mm projectors, tape recorders, record players and other audiovisual equipment. If earphones are

provided in individual spaces, soundproofing is unnecessary. Several such individual study areas may be set up in a limited area. Since this smaller viewing equipment can be used in lighted areas, it is only necessary to keep the overhead lighting subdued. Careful consideration must be given to the problem of storage. Temperature, humidity, and dirt are of major concern when planning the audiovisual resources center. Care should be taken to avoid excessive heat or humidity in the storage area. Never store film near radiators, steam pipes or hot air registers. To lessen the dangers of damage from dust, concrete floors should be sealed, painted, tiled or carpeted. High temperatures may destroy audiotapes by transferring the magnetic effect from one layer to another. Heavy electrical wiring, generators, or magnetic door latches may demagnetize the sound on audiotapes. Storage rooms should have filtered air whenever possible. The temperature should be kept relatively constant at 70 degrees and the humidity at 40 percent. With all of these dos and don'ts, you may ask if there is anything simple about storing audiovisuals...yes...the shelving. With a few exceptions, audiovisuals can be stored on regular library shelving. Even 2 inch videotapes are not much larger than bound periodicals. It may be desirable to store filmstrips, slides and transparencies on special shelving to conserve space.

The learning resources center can be as simple or as elaborate as funds and facilities allow. The important thing is not the complexity of the operation, but rather the existence of the operation. I believe that when you have become really involved with audiovisuals, you too will see the unlimited potential they have to offer and will begin to see yourself as a key figure in the development of a comprehensive learning resource center.

The Lister Hill National Center for Biomedical Communications and  
Its Library Networking Projects

Ruth M. Davis, Ph.D., Director, Lister Hill National Center for  
Biomedical Communications  
(Presentation made by Davis McCarn, Deputy Director)

Scientists and doctors are increasingly warning us of advances imminent in biology and in medicine. There is a growing belief, moreover, that the 1970's may be characterized by developments in biomedical science and technology as spectacular as have been those of computers and information technology in this decade and of nuclear energy in the last decade. Society, as a result, may find itself confronted with a host of new and unfamiliar problems which current public attitudes, public policy-making structures and information processes are ill-prepared to deal with. Organized attention must be paid to means for bringing biomedical scientists into closer partnerships with legislators, policy-making groups in the executive and judicial branches of the government and with innovators in other areas of technology.

This is not a new phenomenon. It resembles the situation just twenty years ago when military technology brought a new policy-making responsibility and role to the community of nuclear scientists. Communication of information and ideas between nuclear scientists and policy-makers was the key to the happy resolution of what might otherwise have been a catastrophic upheaval of our nation's goals, assumed responsibilities and image in the larger world society of which we are just one member. So also will communication be the key to resolving problems faced by the medical community.

The experience of the last two decades has caused the Government to assume special responsibility for the integrity and sufficiency of man's environment and for dealing with the social questions that arise from such concerns. The social impact of science and technology is directly related not only to the integrity and sufficiency of man's environment but also to questions of individual and institutional obsolescence and of individual and institutional reactions to changing technology. The major problems that now confront us - peace, population, poverty, pollution, race relations and education - all have strong social components. Problems of such thrust transcend private interests and are matters of national and regional concern requiring national and regional instruments to deal with them.

One can find ready acceptance of the role of science and technology as culprit in precipitating many of these problems - if not all of them. It is more difficult to find as universal an acceptance that science and technology may also provide the means for their resolution. What can be ascertained, however, is a recognition of the need for closer interaction between technologist and policy-maker in the form of communication of problems, ideas, knowledge, information, grievances, goals and hopes.

Fortunately, exciting possibilities are developing today in the technology of communication. When they are put together they equate to a revolution - a communications revolution. It began in the world of solid-state



physics and suddenly in the last three years has started surging ahead in many new directions simultaneously. Transistors and integrated circuits have given us a communications capability unthinkable just five years ago. Satellites, switching devices, wave guides, miniaturized power supplies and control systems offer us a communications capability that outstrips our foreseeable needs. An unexpectedly fertile combination of communications and computer technology brings a new richness to communications.

### Establishment of Lister Hill Center

It was the anticipation of this strange new world limited only by the limits of one's ideas that provided the impetus for the establishment of the Lister Hill National Center for Biomedical Communications and the Department of Health, Education, and Welfare Biomedical Communications Network. Fortunately, there were individuals in all the policy-making levels in the Government, in Congress and in the Medical Community who foresaw the need for an intimate partnership between technology and socially and educationally oriented institutions and agencies. The culmination of a long and concentrated effort occurred on August the third, 1968, when the 90th Congress passed a joint resolution supporting the proposed Center for Biomedical Communications and designating it as the Lister Hill National Center for Biomedical Communications. The Center has been endorsed by the Scientific Community as an urgently required facility for the improvement of communications deemed essential to health services, education, research and practice and established as a part of the National Library of Medicine. Its designation as the Lister Hill Center was a tribute to the career of Senator Hill of Alabama, who has accomplished so much for the health of the American people.

There have been many significant activities and trends in the past few years that have led to the need for this National Center. The Federal Government has played an ever increasing role in the provision of health services and in the development and conduct of medical research and educational programs. The Veterans Administration is assuming an expanding role through a variety of programs for the improvement of health and health care. The establishment of the Regional Medical Program represents a milestone in the organization of national resources toward the improvement of the nation's health. All of this concentrated effort is in response to the demands of society for ever-improving health care and prevention of sickness. It is also a manifestation of the Government's recognition -- and more specifically of DHEW's recognition of its special responsibility for man's environment and well-being. Further impetus for the establishment of the Center has come from the national attention paid networks and communications as the best means for the improvement of the needed transfer of knowledge to support the variety of expanding medical programs. Finally it represents a response to the need for improvement in the coordination of technology and its application in the areas of communications, information, and computer science.

The Center has as its primary function the improvement of communications within the medical community. The LHNBC serves the Director, National Library of Medicine, in planning for and coordinating Departmental efforts

aimed at improved communications. It does this through its three assigned responsibilities:

- to serve as the focal point within DHEW for biomedical communications systems and network projects
- to apply existing and advanced technology to the improvement of biomedical communications
- to design, develop, implement, and provide technical management of a Biomedical Communications Network.

LHNCBC carries out its responsibilities through four branches. The Research and Development Branch sponsors and conducts research and development in biomedical communications sciences, utilizing relevant existing technology. The Network Engineering, Communications, and Operations Branch supervises the engineering and technical operations of the Network. The Network Plans and Management Branch plans biomedical communications, information systems, and network projects, and coordinates the biomedical communications project and network activities of other elements of DHEW. The Customer Products and Services Development Branch identifies needed products and services and acts as a liaison between the LHNCBC and the users in the medical community.

A staff of 12 personnel (nine professional and three clerical) was authorized at the end of FY 1969. In addition, the LHNCBC has three authorized consultants. The Secretariat of the Information Sciences Technology Panel (II) of the Committee on Scientific and Technical Information (COSATI), with a consultant, is also attached to the Center. Three staff members from the Council on Library Resources have been assigned to assist the work of the National Libraries Task Force, working through the LHNCBC.

LHNCBC has relied heavily on the opinions and recommendations made by the NLM Board of Regents and other recognized spokesmen in order to interpret the communications needs of the medical community and establish the necessary priorities. The VA Chief Medical Director is an ex officio member of our Board of Regents.

In December 1968, NLM sponsored the first conference to consider "Communications for Biomedical Education and Research." In February 1969, the Association of American Medical Colleges held a conference to examine the needs for a communications network and the potential for such a development. It considered educational resources of importance to the Biomedical Communications Network and suggested the following actions:

- support and cooperate in the development of new techniques and tools
- take the lead in developing criteria by which existing educational materials can be judged
- encourage institutions to share their resources and expertise.



The absence of an adequate body of organized information describing communications activities in the biomedical field resulted in a request for a Biomedical Communications Inventory. At the request of the Office of the Assistant Secretary for Health and Scientific Affairs, LHCBC has collected information on DHEW-sponsored projects involving the use of communications technology.

The project reports collected in the inventory were analyzed for completeness of reporting and for relevance to the planning needs of DHEW managers. In addition, the projects were categorized by a subject classification scheme developed for the purpose.

The inventory has enabled LHCBC to:

- assess biomedical communications activities within the Department
- identify biomedical communications managers within DHEW
- identify communications projects of broad interest to the biomedical community
- plan a continuing LHCBC inventory and analysis program.

The inventory program will facilitate the distribution of project reports to DHEW communications managers. The information contained in these reports is also being made available for on-line query via remote-access computer terminals throughout the Department.

Provision to managers and administrators of information derived from the Biomedical Communications Inventory and its accompanying analysis will be a significant step toward the effective coordination of communications activities both within DHEW and with other agencies of the Federal Government.

The Center is planning for implementation of a Biomedical Communications Network (BCN) composed of five major components. The first four are distinguished by the kinds of services being provided and the technology associated with those services. The fifth is a supporting service to the other Network components.

The components of the Biomedical Communications Network are: (1) the library component, which provides bibliographic references, or actual delivery of documents or abstracts; (2) the specialized information services component, delivering actual information on questions or problems of biomedical importance; (3) the specialized educational services component, which provides services primarily to support continuing medical education; (4) the audio and audiovisual services component, which delivers audio and audiovisual materials to medical and lay audiences; and (5) the data processing and data transmission component, the Network's technological backbone, which will support the service components.

The LHCBC prepared a management plan for building the Network; it was reviewed by the staff of the Library and approved by the Board of Regents. The Director, NIH, has also stated that he "fully supports" the ultimate goals and objectives of the Network. Thus, FY 1969 saw the beginning of the process of planning and specifying the BCN.

### Library Network Planning

Library networking is being actively pursued by the Center. Two specific services have received most of the attention so far: bibliographic access and document delivery. I will discuss these in turn.

### Technology of Bibliographic Access

The computer system technology required for effective development of remote access bibliographic system is of recent development. Remote access, time-sharing computer systems, have been under development since 1963 when both the Massachusetts Institute of Technology's Project MAC and System Development Corporation project were initiated. These systems, however, were primarily designed for remote scientific processing, providing effective computer support of short mathematical calculations. The problem of providing remote access to large data bases is substantially different than that of merely providing remote mathematical support. Both MIT and SDC systems have been used in attempts to provide remote access to small data bases. The Technical Information Program at MAC provides such access to the literature in physics through citation indexing, but is relatively slow. The System Development Corporation developed a special On-Line Retrieval Bibliographic Information and Time-Shared (ORBIT) system for handling the bibliographic literature problem proved more efficient than the TIP System of MIT. The SDC system was used to provide a demonstration capability starting in 1966 with literature on foreign technology. It met with substantial success, handling data bases on the order of 200,000 citations. The National Library of Medicine began experimentation with this same system in 1967 with a small data base of neurology journals and monographs, which was used to introduce the Library staff to remote bibliographic access systems. The System Development Corporation has improved the ORBIT system under contract to the Lister Hill Center to make it substantially more flexible and to bring it to an operational capability on its IBM 360/67 computer.

As a result of planning begun in 1965, the State University of New York at Syracuse adapted an existing IBM program system, the Document Processing Package, to on-line retrieval of MEDLARS information which became available as an operational capability in December 1968. Thus, at least two systems have moved toward providing the kind of remote access to large data bases which we believe necessary to provide effective remote bibliographic access to the medical literature.

### Demand

The experience of many information systems would indicate that except in unusual circumstances where the information is of immense practical or

financial value, the demand for such services is very dependent on availability and ease of access and use.

Experience with a system comparable to the MEDLARS at the Foreign Technology Division of the Air Force System Command indicated that remote access can triple or quadruple the use of the data base. Thus, it becomes of substantial importance to look at what the factor might be in the medical community. One operational, on-line medical literature bibliographic retrieval system exists: the system of the State University of New York at Syracuse. That system has now been in operation since December 1968. The Lister Hill Staff has recently conducted an analysis of that system in terms of use of the MEDLARS data base.

On-line searching of the MEDLARS data base at SUNY has resulted in increased use of that data base. There are a variety of factors which must be considered, however, to demonstrate such increased use. Figures available for April of 1969 indicate that there were approximately 2,400 searches run on the SUNY system and 1,036 run on all other U.S. MEDLARS demand search systems combined.

While there were substantially more searches on the SUNY system, these searches do not cover comparable size data bases. The normal search on the MEDLARS system covered the period January 1966 to April 1969, and searched on the average about 636,000 citations. The SUNY data base on the other hand, has to be segregated to fit on the disc file storage. The maximum data base is roughly 90,000 citations; thus, each search on the SUNY system covers a substantially smaller number of citations than does a search on the MEDLARS system. A final factor considered in assessing the benefits was the total number of doctors in New York State as compared to those throughout the Nation. Approximately one-seventh (1/7.6) of the active M.D.'s reside in the state of New York. Parenthetically, it should be noted that some requests on the SUNY system do come from the National Library of Medicine and from the Countway Library in Massachusetts, and, therefore, the total fraction of the physician population may be slightly in excess of one-seventh, but the majority come from New York and this seems like a reasonable estimate.

On the basis of these figures, it would seem reasonable to assess the relative utility of the two data bases as equal to the ratio of their search rate per month, adjusted for the number of citations searched, and also adjusted for the number of physicians who could reasonably be using the service, i.e.,

Relative Utility =

$$\frac{\text{No. of requests on 1}}{\text{No. of requests on 2}} \cdot \frac{\text{Coverage of Data Base 1}}{\text{Coverage of Data Base 2}} \cdot \frac{\text{No. of potential users of 2}}{\text{No. of potential users of 1}}$$

This calculation for SUNY vs. MEDLARS would read:

$$\frac{2400}{1036} \cdot \frac{90}{636} = 7.6 \approx 2.5$$

or the relative utility of the SUNY system is 2.5 times that of MEDLARS. Thus it would appear that the availability of an on-line system in libraries has doubled the use of the citation information in the system. Use is the only unambiguous measure of the value of a service, and one can conclude that the on-line service is twice as useful as the standard MEDLARS service.

The evidence is clear that the on-line system at SUNY increases use, but how much of the total demand does it satisfy. In order to evaluate this in at least a rudimentary manner, the SUNY data were examined from another point of view. The access terminals for the SUNY system are concentrated in four cities; these cities have provided the major use of the system. Use in these cities for a three-week period during April to May 1969 is shown below:

Use of SUNY System

<u>City</u>	<u>Number of Terminals</u>	<u>Number of Requests</u>	<u>Number of Non-Federal Physicians</u>
Albany	3	127	1336
Buffalo	2	462	2282
Rochester	2	186	1631
Syracuse	4	541	1099
TOTAL	11	1316	6348

Syracuse, as the home of the system, has significantly higher use than any other city. If one drops this city, the remaining cities show a use rate of 2.3 searches per physician per year. If all the physicians in the state had had the access to the same service the total use would have been more than three times that actually experienced which was .65 searches per physician in New York State. In particular, it would appear that the physicians in the New York metropolitan area are under-represented because of the availability of only a single terminal in the Parkinson Information Center. If one adjusts this number of searches-per-physician downward to reflect the coverage of the data base (i.e., the fact that up to seven searches are required to cover 2 1/2 years of literature), it would still appear that, given ready access, there may be a demand for 100 to 300 thousand searches per year, eight to twenty-four times the number now processed by the MEDLARS system.

The real existence of such a demand is evidenced by the potential emergence of local commercial services such as the one in Seattle, Washington,

which proposes to provide searches on data base of 70 journals, answering queries by phone at \$5 a search. This fledgeling service generated enthusiasm in the Washington State Medical Association and in the Washington/Alaska Regional Medical Program.

### Access

The audience of potential users for such systems is still quite limited. This limitation is a result of both the kinds of equipment used to access the systems and the policies of the common carriers. The State University of New York system uses special terminal equipment which is connected by leased telephone lines to the computer; it cannot be expanded economically to a national audience without a major modification of the way in which access to the system is provided.

An alternative means of providing access through commonly used terminals, i.e., teletypes, using the dial-up telephone network has been used by the SDC system and by the MIT/MAC system. These alternative means of access also pose a substantial problem because teletypes must be leased along with the appropriate data set to provide access to the telephone network and the computer at a cost of approximately \$50-\$60 a month. Thus, widespread use of such systems presupposes a substantial investment in equipment at using locations.

The basis for this expensive course of action has never been clear. There does exist a major network, the TWX network, which interconnects teletypes across the United States through its own system. The Lister Hill Center believed that substantial economies in cost and development time could be achieved if this network could be used to provide access to a bibliographic system. Computers have been placed on the TWX network; both SDC and MAC were for a time connected to the TWX network. However, when they were connected to the TWX network, a special feature was added called "inverted frequency" which made it impossible for any regular teletype in the network to call the computer. This special feature was justified on the basis of avoiding unnecessary and mistaken calls to the computer system. All users thus had to lease new equipment or special devices to put on their existing teletypewriters.

The medical library community is well versed in the use of the existing TWX equipment. For example, NLM now receives over 1,200 requests for inter-library loans per month over the TWX network. These come from several hundred different libraries across the nation. A review of the directory of the TWX network indicates that there are 120 hospitals on the network, 150 pharmaceutical firms, 125 schools including many medical schools, and a sprinkling of clinics and physicians. On the basis of this review, it seemed clear that if a computer system could be tied to the normal TWX network, an immediate user community could have access to this medical data base without additional investment for terminal equipment. Accordingly,

the Lister Hill Center has identified one phone company which has indicated a willingness to connect a computer to the TWX network.

### Costing of Bibliographic Access

We have done a cost analysis of providing bibliographic access to the entire medical community which I would like to describe in some detail.

The purpose of the Bibliographic Access System is to make the MEDLARS data file available to physicians nationally by way of remote terminals. The following is a discussion of the anticipated demand for such service and the computer facility related cost associated with meeting this demand. On the basis of experience at the current on-line bibliographic access system at the State University of New York (SUNY) at Syracuse one might expect as a conservative maximum about 1.0 requests per year per physician. Giving all active (est. 1970) physicians on-line access this translates into 310,000 requests per year.

The following are figures on Automated Data Processing Equipment (ADPE) used by the Federal Government.\*

TABLE 1

Components of ADP Operation Costs

	<u>Lease Costs (\$ x 106)</u>	<u>Percentage</u>
Rentals	377.9	39
Personnel	417.2	43
Contract Services	98.9	10
Other	<u>75.2</u>	<u>8</u>
	969.2	100

From this it can be seen that rentals comprise 39 percent of total leased ADPE. The rental cost at SUNY is currently \$23,500, so that a government leased operation could be expected to run about \$60,000 per month for a single operation or \$720,000 per year. Assuming that the increased personnel for adding another computer at the same location is negligible, the additional cost per computer added would then average about \$282,000 per year. It is also assumed that the first computer could route its workload to the second with no appreciable loss in efficiency.

\* Inventory of Automatic Data Processing Equipment,  
FY 1968, G.S.A., p. 26.

The present system has a peaking factor of 1.2; this is the ratio of the maximum hourly usage rate to the average hourly usage rate. The specific experience was

maximum hourly rate = 25 searches

average hourly rate (April-May 1969) = 20.5

peaking factor =  $\frac{25}{20.5} = 1.2$

If the system was operated eleven hours a day and the peak rate was one search per minute the daily rate would be  $\frac{11 \times 60}{1.2} = 550$  searches per day.

Assuming 260 work days, this corresponds to 143,000 searches per year.

The SUNY system, however, cannot handle one search per minute. In order to determine a reasonable search load a multi-server queue model was used. Based on the SUNY experience, service time is about 1.2 minutes. A service goal of 90% of searches being processed in five minutes or less was adopted because it seems reasonable and corresponds to the maximum use of the SUNY system. Given this service criterion the maximum search demand rates can be computed.

Table 2 shows the maximum search demand rates which can be handled and still meet the service criterion for various numbers of computers.

TABLE 2

Number of Computers vs. Maximum Utilization

<u># of Computers</u>	<u>Maximum Utilization Within Service Goal* (Requests/Minute)</u>	<u>Demand (# of Searches)</u>
1	.4474	64,000
2	1.3662	195,400
3	2.3295	333,100
4	3.3068	472,900
5	4.2909	613,600
6	5.2788	754,900

\*Service goal 90% of searches take 5 min. or less.



Using the total demand hypothesized in the first paragraph above, the costs for meeting various percentages of that demand can be calculated. These costs are shown in Table 3.

TABLE 3

Percent of Reasonable Demand vs. Annual Cost

<u>% of Reasonable Demand</u>	<u>Annual Cost (\$1000)</u>
0	720
20.6	720
20.7	1002
63.0	1002
63.1	1284
100	1284

These costs are graphed in Figure 1.

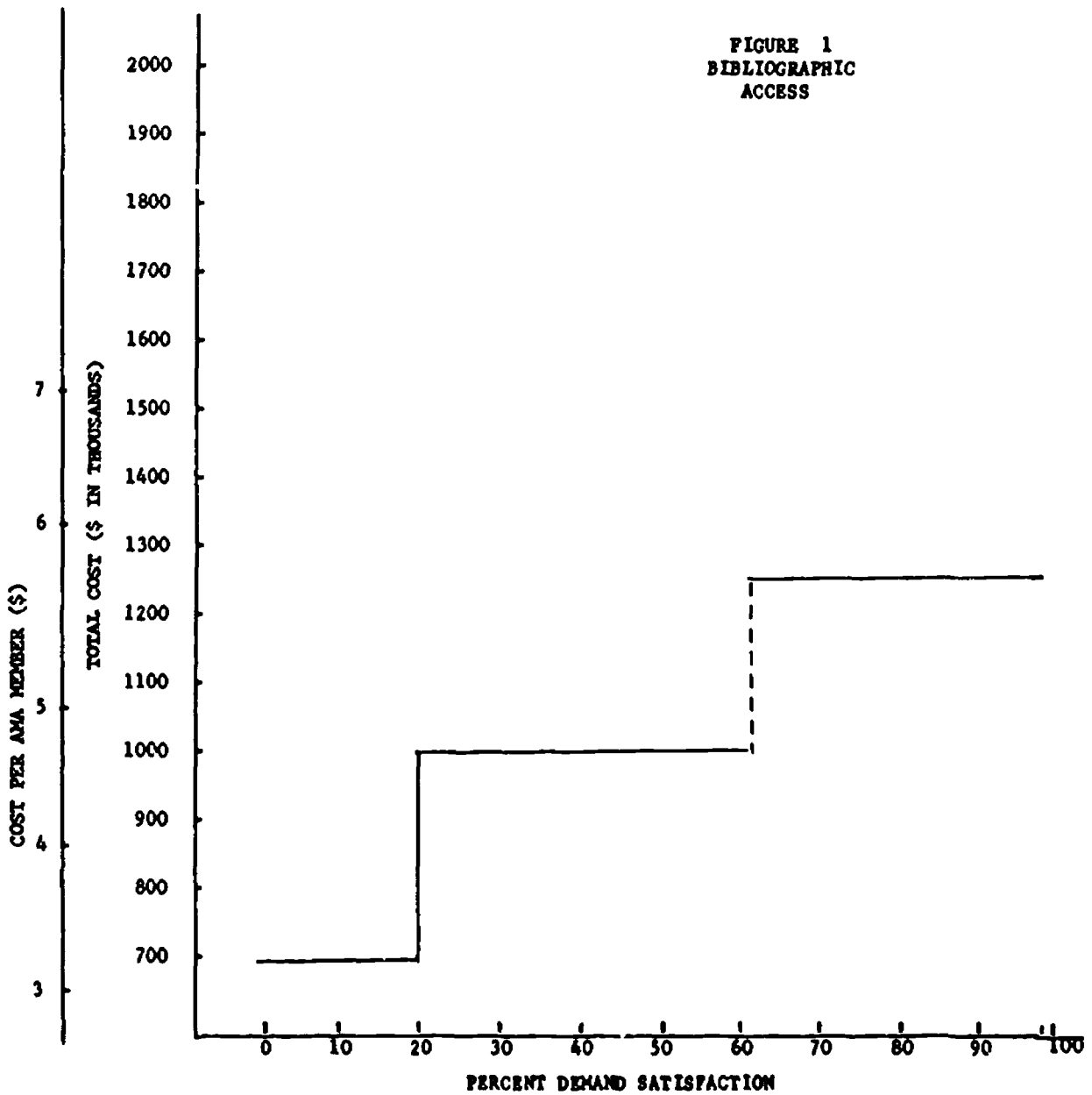
Experimental Service

The Center is now contracting with the System Development Corporation to provide an experimental service in bibliographic access. It will be possible for either Teletypes on the telephone network with standard 103A2 data sets or Model 33 or 35 Teletypes in the TWX network to access the computer system in Santa Monica. Five special lines will be installed by the General Telephone Company to connect the IBM 360/67 to the TWX network. SDC will provide the computer time and an additional disc storage unit to allow the provision of bibliographic access to about 150,000 citations out of the MEDLARS data base. Thus, this available storage space will be adequate to provide access to a consensus list of medical journals over the five-year period covered by MEDLARS.

The contract provides for the conversion of a MEDLARS produced tape on this data base to the SDC computer system and the provision of five months of service starting in April 1970. This service would be provided each day from 11:30 a.m. to 3:30 p.m. EST/EDT. The cost of calling the system would be borne by the user, and TWX charges from \$.20 to \$.60 per minute depending on whether the station is calling from across the continent or from 50 miles away. In addition, SDC will provide on-site training at a designated set of locations to users of the system, and will run a spot survey on organizations which will use the system without training. The SDC system is a system which can be used without training, and instructions are provided from the terminal giving a minimum amount of information about how to call in to the system. In addition, the language interface, the way the user phrases his request, is variable under this revised ORBIT system and can be modified during the service period as a



FIGURE 1  
BIBLIOGRAPHIC  
ACCESS



result of the experience gained in the use of the system. Cost of this effort with SDC is being negotiated at about \$100,000.

### Relationship to MEDLARS II

This experiment will assist us in planning the services to be expected from our developing new system MEDLARS II which is scheduled to provide on-line access in the fall of 1971.

### The Individualized Biomedical Communications Module

To complement bibliographic access we have also been devising new methods and forms for books and journal literature. For journal literature we have been investigating facsimile transmission and remote browsing, which will be considered first.

We have funded a costing study of demonstration capabilities of facsimile delivery of medical literature using the Wide-band Dial Service (WDS) of AT&T and standard xerography techniques. Initially, such a service would be established with other elements of the NIH for research and then with the National Naval Medical Center for support in patient care problems. Finally, it would be extended to the Regional Medical Libraries in New York, Chicago, and Los Angeles to provide more dispersed, decentralized access to the holdings of the NLM.

A costing study has also been done for several remote browsing techniques. One such system, which operates as follows, was proposed in the study. At the central library, a page of the book or magazine was scanned by high resolution television camera. The resulting video signal was transmitted over a broad band transmission line to the appropriate hospital, which was identified by a digital address that was sent with the video signal. At the hospital central control unit, the video signals corresponding to scan lines from the high resolution camera were digitized and stored in a disc memory, and used to refresh a monitor TV presentation. The proposed system had the capability of serving several thousand hospitals and providing remote viewing simultaneously to users at up to 274 hospitals. At the library, 274 cameras were provided with access to microfiche files of the library contents and were connected on a time-sharing basis to a broad band (4 MHz) transmission line.

The proposed system has several interesting features. For example, the high resolution camera frame of approximately 1,000 lines consists of four interlaced fields. The number of picture elements in one field is therefore about the same as in one frame of commercial TV material and can be transmitted in a four megahertz wide transmission line channel in one thirtieth of a second. Thus using conventional transmission channels it is possible to send enough information to give a low resolution but useful picture in one fourth the time required for a high resolution picture. This is the basis for the so-called FT mode of operation in which a unit of transmission time called a transmission frame is used to send low resolution pictures to four users as an alternative to sending a high resolution picture to one user. A second interesting feature is a scheme whereby one line from each of the four interlaced fields can be

sent to one user, a second line from each of the four fields to a different user etc. in one transmission frame in such a way that as many as 274 users simultaneously receive a portion of the page his camera is scanning. This so-called ST mode of operation would normally follow FT operation and would result in a high resolution fill-in of the low resolution picture received previously. An extension of the basic scheme in the ST mode removes any restriction on the relationship between the time of scanning a line by the camera and the specific time allotted to transmission of this line in the transmission frame. Thus the 274 or so users are completely independent of each other in regard to time sharing of the common transmission channel. A third feature of the system is a scan time conversion at the hospital control unit, which makes it possible to display a 1000 line frame on the monitor even though only 250 lines are received in a monitor frame. (one thirtieth second)

I want to describe briefly another technically feasible system for remote browsing which is basically similar to the one just described, but which includes provision for a 60 field per second interlace at the monitor and differs slightly in the values of some of the numerical contents.

In this system overall control of remote browsing, as well as of information retrieval through the question/answer routine, is provided by a master control computer. Communication from the hospital units takes place through data sets (one per hospital unit) which are connected to the computer through a multiplexer. The computer, in turn, is connected to the local control units of the cameras by an interface control. The interplay between the several control areas is illustrated by the response to a request to view a particular document. The request arrives at the library on the data set assigned to the particular user, and is forwarded by way of the multiplexer to the master control computer. In response to a signal from the computer, the interface control initiates a search for an idle camera. If no idle camera is found, the interplay control requests the computer to return a busy signal to the user. If an idle camera is found, it is assigned to the user and the interplay control requests the computer to ask for the identification of the desired document. After the ID number of the desired document is returned to the master computer, it is relayed by the interface control to the microfiche file and search system. After the desired microfiche has been retrieved and placed in front of the scanning camera, the interface control requests transmission mode and time slot assignments from the computer. After these details have been received, the connecting of the camera to the time-shared transmission line is, in general, under the control of the local camera control until a full page is transmitted or another request (such as magnify a particular portion of the page) is received from the user.

In the summer of 1968, the Lister Hill Center advanced the idea of an Individualized Biomedical Communications Module, which is directed more to books than journals, although it is suitable for any form of literature. It is a versatile, portable, audio and visual set designed for the individual or for the small group. It permits instant use at a desk, in an office or at home. In addition, its audio component, a cassette tape recorder can be used in cars, trains, or in other travel modes. The concept of a portable information retrieval system was intended to promote individual instruction, self-education, rapid information gathering and retrieval.

Actually, the Lister Hill Center has, since 1968, promulgated the concept of Biomedical Communications Modules (BCM). In the October 1968 paper, "Some Comments on Technological Considerations," a set of these modules were identified along with examples of their usage. The individualized BCM was first on this list.

As a consequence, the Lister Hill Center put together a simple version of a portable kit, as a first attempt to develop an individualized BCM. The module is an ordinary government issue attache case containing:

. a light-weight, compact projector capable of displaying:

- 35 mm slides
- 35 mm film strips
- microfiche
- microfilm
- aperture cards
- microjackets

. a light-weight, compact cassette tape recorder capable of recording two hours of listening material on a cartridge 4" x 2 1/2" x 3/8".

In order to make the projector extremely versatile, each type of visual aid has a specific adapter, easily attached and detached, to permit its use. In addition to a microphone, the reader has an auxiliary input jack permitting direct recording. The recorder has both battery and alternating current operating selection.

The projector permits visual display on a wall, a sheet of paper or any available front or rear projection screens. Its picture size may vary from 8 1/2" x 11", at a short distance, to conference wall screen size for a group display. Incandescent or ambient lighting will not interfere with the projected image. It weighs three pounds and is 8" x 6" x 3" in size.

Through the use of microfiche adapter a larger saving in source documentation is achieved. The projector handles microfiche ratios of standard reduction from about 15 to 40. It should be noted that a one-inch stack of microfiche sheets (250 sheets) is the equivalent of 8,000 pages or 50 documents of 160 pages each. These same 250 sheets weigh about 13 ounces while the corresponding weight of 8,000 pages is 31 pounds. This amount of reading material will easily fit into an attache case. The adapter permits either individual or group viewing of the microfiche. It would be extremely difficult to carry the weight of books and journal articles.

The 35 mm slide adapter with the cartridge holder has a capacity of 36 slides. It functions in a semi-automatic form and when used in conjunction

with the tape recorder play feature permits one to view slides following verbal instructions on the tape. Also included is a single slide adapter to permit content confirmation or small quantity slide use. Individualized education becomes a reality.

The 35 mm film strip adapter allows both the use of the standard film strip cartridge (approximately 36 frames) and a non-standard role up to 100 frames or more. This adapter which permits the display of the microforms may be used for individual or group viewing.

The cassette tape recorder permits individual or small group listening, uses battery or normal 110-120 V. power, is a two-track system and has between 30 and 120 minutes of play or record capability depending on the type of cartridge and track combination used. It plays audio messages that have been recorded and stored in cassettes and will record conversations, discussions, meetings, conferences using cassette tapes. A high quality instrument, it weighs 3 pounds and is 5 3/4" x 8 1/2" x 2" in size.

The attache case weighs about four pounds, the projector, three, the recorder, three, and the adapter accessories weigh two pounds. The entire kit weighs only twelve pounds and lends itself to being carried anywhere.

The Lister Hill Center has one of the attache cases. A number of others have been made up and prepared for individuals within the medical or scientific community who have personally paid for them.

Microfiche materials deserve special attention. Both the government and industry have put a large investment of resources into their development and use. The medical community has not, as a whole, focused attention on their possible potential for individualized education. Fortunately, all facets of microfiche from production to viewing to transmission are still sufficiently fluid as to permit a large group of users to exert a constructive impact on the direction of their development.

This is not as true with visuals or A-V materials. True audio materials for individualized education are not as expensive or technically complex an area with which to deal.

Microfiche are not yet easy or comfortable to use. The principal problems isolated such as white letters on black backgrounds, the long throw needed for viewing text at highly reduced ratios and inability to cheaply produce regular sized hardcopy of individual pages can be resolved technically. They will be economically practical only when there is a market of at least the size predicted above.

The EDUCOM microbook project now estimates the cost of producing a first batch of 300 microfiche copies of any book of up to 540 pages at \$100 or 33¢/book. After this initial production a microfiche or "a book" can be reproduced at 10¢ a copy.

Using these cost estimates 7,000 copies of the 700 standard texts or reference books used in medical schools could be produced for \$116,900. This implies that each student entering medical school could be provided with his individual library of 700 books for just under \$17.00, the cost now of at most, two such books.

Costs now of recording education material on an audio-cassette runs about \$3.00 for a two-hour tape. Mass reproduction means will soon be available. Reproduction by individuals is already possible, easy and essentially free.

Achieving agreement as to a course of action regarding use of an individualized education module by medical schools and by continuing education spokesmen can be immediately translated into significant savings for the medical, dentistry, nursing, and pharmaceutical fields.

We believe that an individualized education "kit" is just over-the-horizon and feel that this is the time to plan for its proper use. We also believe that such planning and equipment is almost immediately applicable to other education uses; for example, that of providing information to health allied professions and to the general patient population.

We hope to show this type of approach to education will have as one of its immediate effects an increase in proficient health manpower.

## MEDLARS II: A Status Report

Ralph Simmons, Project Manager, MEDLARS II  
National Library of Medicine  
(Presentation made by Lillian H. Washington, MEDLARS II Staff)

The National Library of Medicine initiated MEDLARS in January 1964, following three years of detailed planning and system development. The principal objectives of this system, as stated by Library management in 1961, were to: (1) improve the quality and broaden the scope of Index Medicus; (2) reduce the time required for its preparation; (3) make possible the production of similar publications; (4) provide for the inclusion of citations derived from other sources, as well as journal articles; (5) improve retrospective search service; (6) increase the depth of indexing; (7) increase the volume of articles processed; (8) reduce the need for duplicative operations at other libraries; and (9) provide statistics for management of the system. This was an ambitious program but has been successful in most of the more important objects. A comprehensive description of the system is presented in the publication MEDLARS 1963-1967 by Charles J. Austin (U.S. Dept. of Health, Education, and Welfare, Public Health Service, Bethesda, Maryland, 1968).

Workloads and maintenance requirements have long exceeded the design characteristics of MEDLARS I. Serious limitations of the first generation system include the insufficient processing and memory capability of the present computer equipment and the degree of human effort required in developing, maintaining, and using the controlled vocabulary. The present system is capable of sophisticated manipulation of data once indexed and will retrieve citations as requested by searchers. The processing and memory capacity can be expanded through additional equipment, but the professionals involved in the system must be aided if they are to be able to keep up with the expansion and increasing complexity and sophistication of the state of the art. Therefore, the Library determined to develop a replacement system, MEDLARS II, which would take advantage of the more recent advances in computer technology as well as the latest developments in information science, in order to provide increased capability to the Library's programs.

Implementation of plans to acquire a new computer and a greatly augmented MEDLARS system began in FY 1966. With the aid of a contractor, the requirements for the next generation of MEDLARS were defined. On August 4, 1967, qualified firms received the National Library of Medicine's Request for Proposal for a new system to meet future data processing and information system requirements. These requirements include: an increase in the level of MEDLARS bibliographic services provided, including demand searches and recurring bibliographies; an automated acquisitions and cataloging system; an on-line augmented MeSH vocabulary to aid indexers, searchers, and catalogers; and additional chemical search capabilities (while at the same time maintaining present computer support to MEDLARS stations). Also, the new equipment must be capable of expansion to accommodate computer processing required by: (1) a graphic image storage and retrieval system (closely linked to the MEDLARS search capability); (2) a toxicology information exchange; and (3) an intramural research and development program in information retrieval and scientific documentation.



The Library conducted a detailed evaluation of each of the bids received and on June 11, 1968, a contract was awarded to the Computer Sciences Corporation (CSC) for the design, development, and implementation of MEDLARS II. Also, the Library elected to obtain the equipment configuration proposed by CSC, namely, the IBM 360/50.

The contractor, CSC, began the groundwork for the system design with an analysis of programming languages, software developments, and functional requirements. NLM personnel were required to assist CSC in their understanding of NLM's requirements by evaluating and responding to documentation produced by the contractor. This documentation included preliminary design work in the software and applications areas of MEDLARS II and functional requirements pertaining to various data bases. CSC also prepared a draft purchase order, which was utilized to order the IBM computer equipment. Much of the contractor's effort during the early months has been directed toward the development of the software design and implementation for the system. Significant progress has been made in the system executive, the data base manager, and other specialized software elements.

Due to the importance of the MEDLARS II project, the Chairman of the Board of Regents of the Library requested the R&D Subcommittee of that Board to review the status of the project. It was requested that this review cover the project efforts of both the Library and the contractor, CSC. The review meeting, held in San Francisco April 18, 1969, was attended by representatives of CSC, NLM, and the Board of Regents.

In the interim, a decision to reorganize the management of MEDLARS II was made by the Director, NLM, for the purpose of concentrating resources on the project. In March 1969, I was assigned the responsibility for the project and as Project Manager I report directly to the Director, NLM. A small staff was assigned to me exclusively for the project. This staff has the full responsibility for the development and implementation of MEDLARS II. In addition, I am able to draw on the personnel resources of the Library on an "as required" basis. There are two advisory bodies for the project, i.e., the User Review Group and the Research and Development Subcommittee of the NLM Board of Regents. The former is concerned primarily with the adequacy of the system to meet the functional requirements and the latter is to provide policy guidance and advice to the Director as requested. The Office of Computer and Engineering Services (OCES) provides assistance to the project through its organizational structure. OCES is responsible for the installation, maintenance, and operation of all equipment required for the project.

As a result of a comprehensive evaluation of the project and the Board of Regents' review, the contractor was requested to reorient his staff and to modify his approach to a total systems design from a data base frame of reference to that of association to library functional capabilities. CSC has responded to this request and is working on the development of the system under a revised contract negotiated and signed on June 20, 1969.

The design of MEDLARS II is being developed in two phases, namely the INITIAL and EXTENDED modes. INITIAL processing is characterized by "batch"

computer operation and can be described as having the same capabilities as MEDLARS I but with the addition of an augmented MeSH vocabulary, new equipment, and selected supporting products.

The EXTENDED system will provide the user with on-line access to the computer. The final MEDLARS II will provide for major functional activities to be conducted through the use of remote (located internal and external to NLM) terminal devices. These activities include acquisition and ordering, cataloging, interlibrary loan activities and physical location data, vocabulary browsing, search output, and total bibliographic control, as well as extended capabilities for management information.

The INITIAL phase of MEDLARS II will utilize the IBM system 360/50 and operate in the multivariable tasking (MVT) of the Operating System. The equipment configuration includes a central processing unit, 1 core memory module of 512,000 bytes, large core storage (LCS) of 1,000,000 bytes, four 2314 direct-access storage devices (DASD), four 9-track tape drives, two 7-track tape drives, two printers, a card reader and card punch. The hardware configuration for the EXTENDED phase will be designated as a result of the full system design effort.

The INITIAL system will be operational by May 31, 1970, and the EXTENDED system by June 30, 1971.

To date, the MEDLARS II project effort resulted in the completion of several major events:

#### I. Overall Functional Design Specification

The general objectives of this specification are to: (1) provide a response to all stated functional requirements; (2) correlate NLM functional activities with hardware and software design; and (3) serve as a system baseline to define and control the development of the final product, MEDLARS II.

The Computer Sciences Corporation's submission, in two volumes, represents the most comprehensive documentation received by the Library from the contractor. Volume I primarily concerns itself with incorporating the capabilities requirements into an overall system design specification. Its content is divided into three sections: (1) an introduction outlining the logical divisions of the specification; (2) a description of the MEDLARS II enhancement of current operations and an articulation of the system capabilities; and (3) a precise description of how the system will function. Section 3 is subdivided into two segments and an appendix:

- . Application Design Segment - a formal presentation of the design effort from a functional viewpoint, including general flow charts.
- . Software Design Segment - a general description of the system's software capability and concept including design criteria, language and language processor, functions of the executive, and the data management system.

Appendix A - Design Scenarios - These are, in effect, blueprints of how the system will appear in an operational mode and, as such, reflect the fabric of the total system. They permit the review of actions required by the system to support any library functional activity from input, or initiation, through final result.

Volume II includes the functional requirements. This section is divided into two segments, outlining the requirements accommodated by the design and those not to be accommodated, with an explanation for their exclusion. The purpose of this section is to establish a requirements baseline or system design foundation. Hardware, performance, and personnel requirements are also presented as a part of Volume II. Some of the principal considerations presented in the hardware requirements section include thruput time, system queries, core usage, and secondary storage. The performance requirements presentation includes workloads and timings stated by functional areas and an analysis of batch and on-line procedures.

All of the capabilities of MEDLARS I are included in this design, in addition to the expanded MEDLARS II provisions, which include:

- a query capability over the entire data base,
- on-line access to files,
- ADP assistance for indexing, cataloging, and vocabulary control,
- maintenance, retrieval, and manipulation of vocabulary,
- ADP support for control and administration of the system,
- browsing capability of the data base,
- format flexibility, and
- ADP support to receipt activities and to maintenance of the collection.

Five functional modules were specified in the design: (1) Receiving & Routing; (2) Cataloging & Indexing; (3) Vocabulary Control; (4) Information Retrieval & Publication; and (5) Maintenance and Selective Use of the Collection. For each module the design included a presentation of the scope, purpose, material processed, and module description.

## II. Other Events

The other events completed by the contractor were the production of a Project Control Document and a Training Plan for the INITIAL system.

### a. Project Control Document

This document serves as the management plan for the project, and appropriately provides:

- for reviews to insure quality,
- means to identify problems and to check on project status and/or progress, and
- a performance plan with PERT charts indicating intermediate milestones.

This document also establishes procedures for periodic reporting to CCC and NLM managers. It describes:

- the organization of the two project managements and
- procedures designed to insure systems response to requests.

The document is to be modified and amended as the project progresses. For example, a test plan is under development and will be made a part of the Project Control Document.

#### b. Training Plan

It is the purpose of this plan to provide a curriculum for the instruction and training of NLM personnel and others providing MEDLARS services. The training effort includes classroom instruction and the preparation of all required material and training aids. All training must be completed before the functional modules can be declared operational. This document represents the first increment to and not the representative plan required to do the job. It is the intention of MEDLARS II management to solicit the participation of the Technical Bulletin readers in the evaluation of the Training Plan and involvement in the training itself at the appropriate times.

### III. Other Activities

There were many associated tasks completed during this quarter in support of subsequent contractual events, including those scheduled for the immediate future. Some of the most important accomplishments were in software areas. The contractor is presently well into the coding, testing and debugging of specific components required by the system's software.

In addition, the first draft of data elements, or fields, has been agreed upon for inclusion in MEDLARS II files. The development of file structure is presently under way; and conversion programs are currently being specified and implemented (the conversion of the data bases is to take place in February). We also plan for demonstrations of various functional capabilities of the INITIAL system in March, for subsequent operation in late May 1970.

The orderly transition to MEDLARS II is of prime concern to NLM. Currently in development are plans for the scheduling of discussions and detailed presentations of the system to members of the library community involved with MEDLARS.