National
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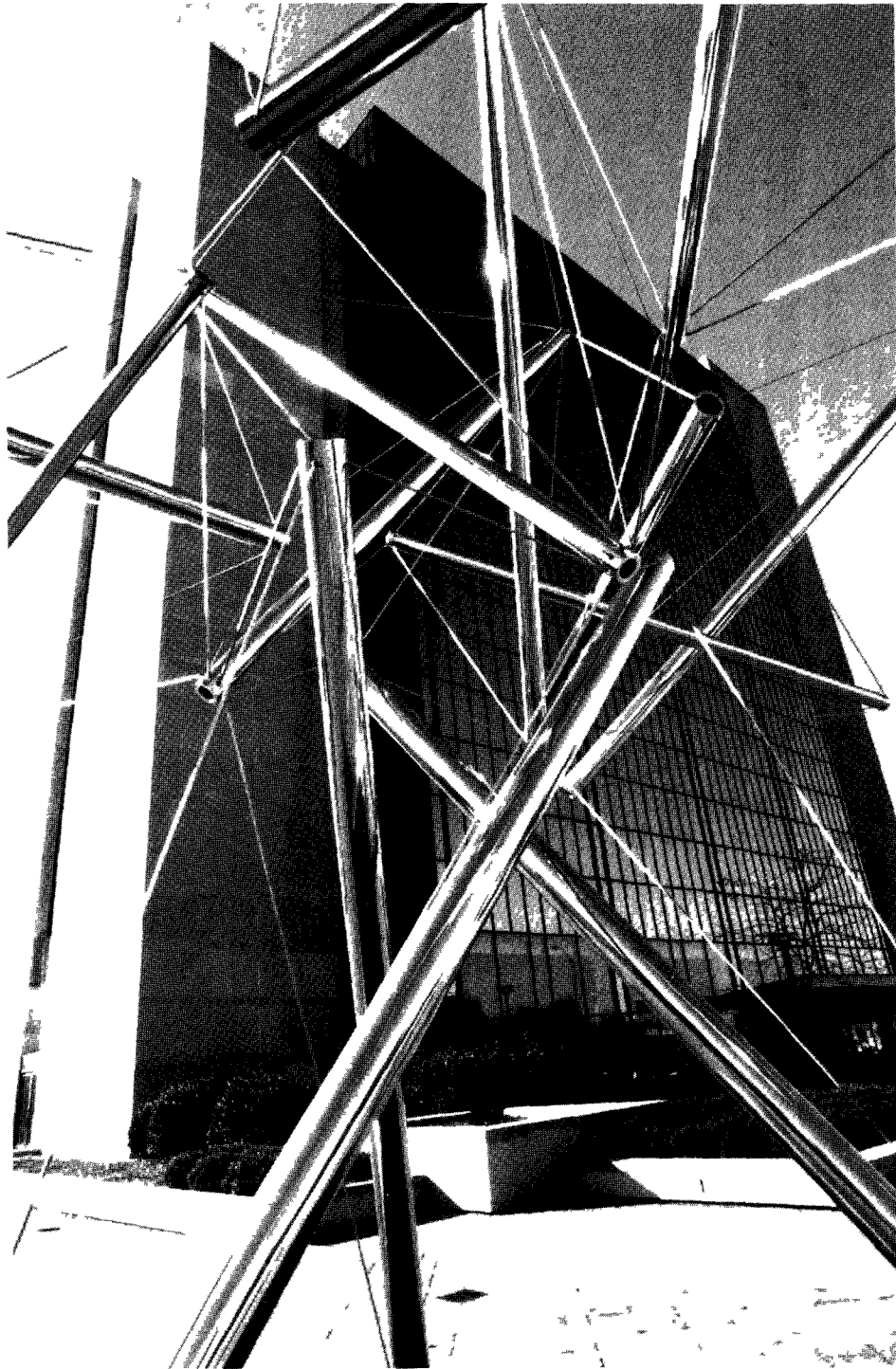
Programs
and
Services

Fiscal Year 1985

National
Library of
Medicine

Programs
and
Services

Fiscal Year 1985

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                          │   DIRECTOR*     │─ ─ ─ ─ ─ ┌─────────────────┐
                          │                 │          │ BOARD OF REGENTS│
                          │DR DONALD A B LINDBERG│      └─────────────────┘
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      │   OFFICE OF   │                    │ OFFICE OF INQUIRIES│
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      │KENNETH G CARNEY│                   │                    │
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Deputy Director for Research and Education   Dr Harold M Schoolman
Associate Director for Planning and Evaluation   Dr Henry W Riecken
Assistant Director for International Programs   Dr Richard K C Hsieh
Director of Information Systems   John Anderson

**Includes Regional Medical Library Program and Medical Subject Headings Section

2

Contents

"Portrait of Professor Gross," also called "The Gross Clinic," by Thomas Eakins (1875). This painting, perhaps the most famous in American medicine, was selected for the brochure and poster planned to commemorate the National Library of Medicine's sesquicentennial year in 1986. Eakins had attended lectures at the Jefferson Medical College (in Philadelphia, where the painting remains) and he had undoubtedly seen Samuel David Gross, Chairman of Surgery, both as lecturer and in the clinic. Eakins' students and friends posed as the spectators of the operation; Eakins included a portrait of himself sketching the procedure at the center left of the painting. The woman in the picture is a relative of the patient and her presence indicates that this is a charity case. The law at that time required that a relative be present for surgery on a charity patient.

Samuel David Gross was an early and ardent supporter of the National Library of Medicine (then known as the Library of the Army Surgeon-General's Office). As head of several physicians' organizations, Dr. Gross argued eloquently for federal funding for the Index-Catalogue then being proposed by the Library's director, John Shaw Billings.
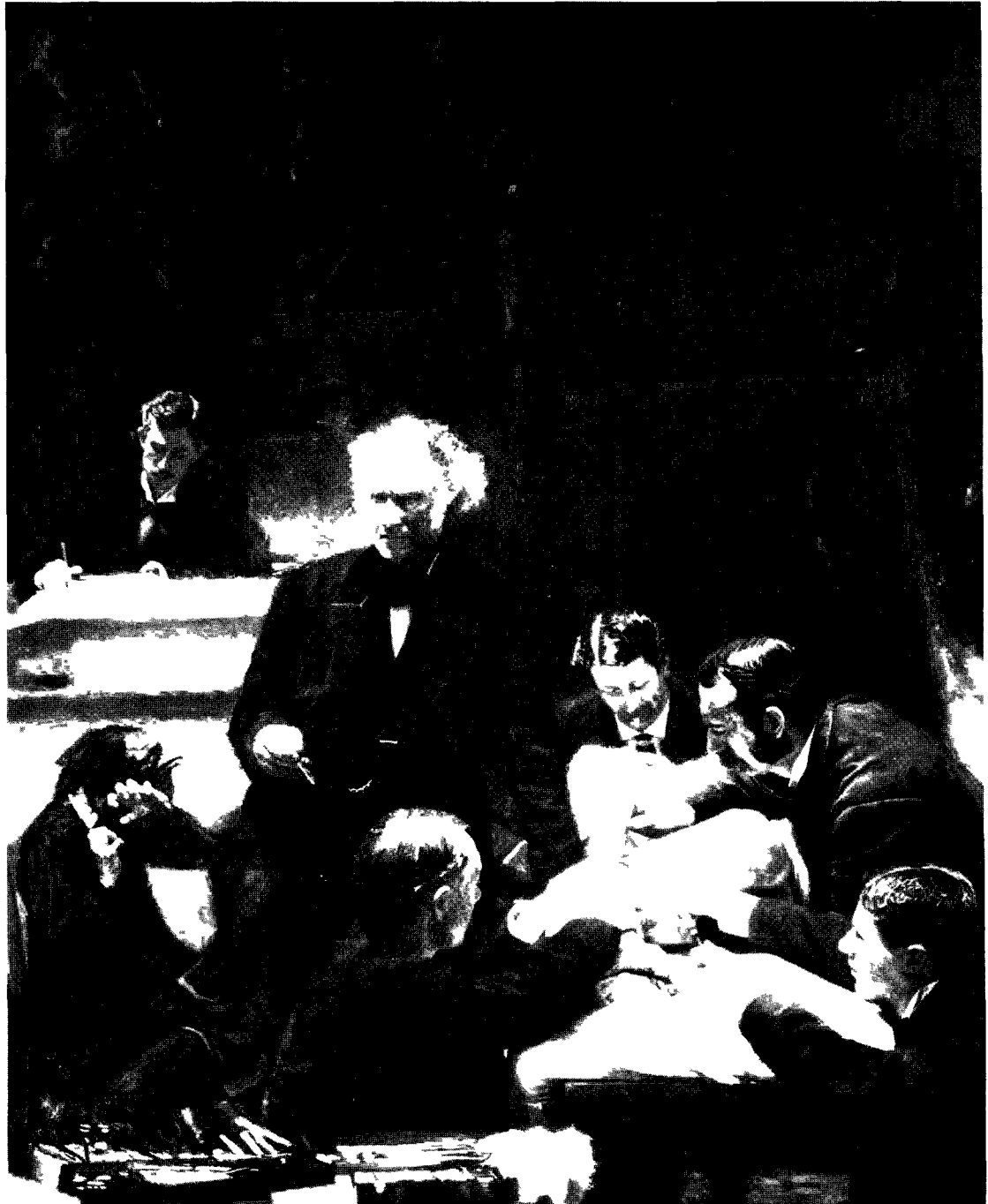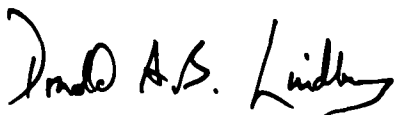
Preface

The National Library of Medicine is on the threshold of its Sesquicentennial. One hundred and fifty years ago, an army sergeant or perhaps it was a lieutenant, was ordered to spend $150 for "medical books for officers." That unremarkable routine, bureaucratic transaction was the beginning of what is now called the National Library of Medicine.

The two decades of ferment that began with the introduction of MEDLARS in 1964, was continued in Fiscal Year 1985. An ambitious long-range planning effort was begun, preservation was given new emphasis, work began on a Unified Medical Language System, and DOCLINE, a nationwide interlibrary loan request and referral system was introduced, as were TOXNET and a National Learning Demonstration Center.

These efforts, described in this report, were all made possible by a close collaboration between the Library and its constituents. I would like to express my sincere thanks—to those who work at the Library, to its advisors on the Board of Regents and other bodies, and to the health science community at large—for their support in the past year.

Donald A B Lindberg, M D
Director

A Note on the History of the National Library of Medicine

The National Library of Medicine began as a small collection of books in the office of the Surgeon General of the United States Army The year 1836 has been generally accepted for the birth of the Library, for that appears to have been the first year that funds were specifically earmarked in the budget for the purchase of medical books. The amount budgeted for this purpose, $150, seems trifling when compared to today's book prices and acquisitions budgets. The earliest known catalog of the Library, an 1840 handwritten document preserved in the History of Medicine Division, includes 134 book and journal titles.

Although the formal beginning of the Library of the United States Army Surgeon General's Office dates back to 1836, it was only after John Shaw Billings took charge of the collection in 1865 that it began to develop into a national library. Using this as a starting point, what follows are a few highlights* from the Library's history

1879

The first issue of *Index Medicus* issued by Billings. It continues to be published today, 107 years later

1866

Collection moved to Ford's Theatre, the authorities feeling the assassination of Lincoln there made it unsuitable for continued use as a theater.
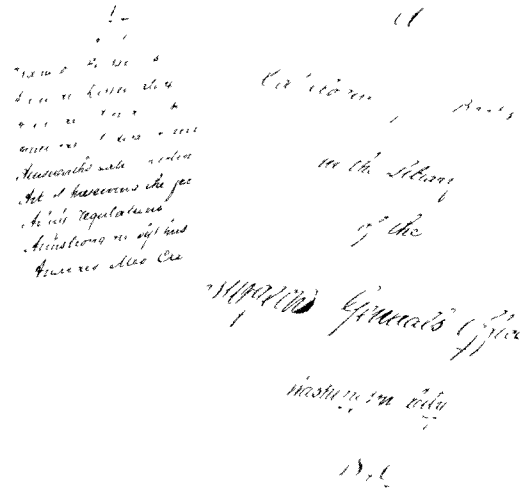

Ford's Theatre, the Library's home from 1866 to 1886. This photograph dates from the 1870s.

1880

In a curious footnote in history, Billings suggests to Herman Hollerith, a friend, that statistical data might be recorded by holes on cards and a machine invented for sorting and tabulating them Billings' idea bears fruit as Hollerith successfully implements the resulting machine in the 1890 Census; Billings' business acumen fails him as he declines Hollerith's offer of partnership to exploit the invention commercially. Hollerith sells his patents to a firm that becomes IBM.

The Library was housed in this building on the Washington Mall from 1887 to 1962. It was torn down in the late 1960s to make room for the Hirshhorn Museum of Art.

1887

Library moves to newly constructed brick building on the Washington Mall "Old Red," as it was called, continued as the Library's home until 1962 Old Red has since given way to the Hirschhorn Museum

1922

The Library of the Surgeon General's Office becomes the Army Medical Library

1940

Microfilming begins at the Library and is supplied on loan

1952

The Army Medical Library becomes the Armed Forces Medical Library That same year was organized the "Friends of the Army Medical Library," forerunner of today's 'Friends of the National Library of Medicine "

1956

Senators Lister Hill and John F Kennedy sponsor the National Library of Medicine Act, passed by the Congress and signed by President Eisenhower on August 3 The Library is now a civilian agency within the Department of Health, Education, and Welfare

1962

The Library begins operation in its new building on the grounds of the National Institutes of Health

1964

MEDLARS, the Library's computerized information retrieval system becomes operational A pioneering phototypesetter called GRACE (Graphic Arts Composing Equipment) sets the standard for computer-driven typesetting

1965

Medical Library Assistance Act becomes law It creates a program of grant assistance to medical libraries and for research in health communications

1967

The Toxicology Information Program is established at NLM

1968

The Lister Hill National Center for Biomedical Communications established by Act of Congress The Center applies the latest in computer, communications, and audiovisual technology to improve biomedical information transfer

1971

MEDLINE (MEDLARS Online) is inaugurated Today this world famous network serves health professionals worldwide with some three million searches each year

1980

The Lister Hill Center Building is dedicated

1985

The Library begins work on a 20-year plan and prepares to celebrate its 150th anniversary in 1986

Senator Lister Hill of Alabama, co-sponsor with John Kennedy of the National Library or Medicine Act of 1956. This bust, done by sculptor Robert Berks, is displayed prominently in the lobby of the Library's Lister Hill Center.

*A comprehensive illustrated history of the NLM is available in *A History of the National Library of Medicine The Nation's Treasury of Medical Knowledge* Wyndham D Miles Washington D C U S Government Printing Office 1982

Officers of the Library

Director	Donald A B Lindberg, M D
Deputy Director	Kent A Smith
Deputy Director, Research and Education	Harold M Schoolman, M D
Executive Officer	Kenneth G Carney
Special Assistant, International Programs	Richard K C Hsieh, D P H
Associate Director for Planning and Evaluation	Henry W Riecken, Ph D
Director, Information Systems	John A Anderson
Chief, Office of Inquiries and Publications Management	Robert B Mehnert
Director, Office of Computer and Communications Systems	John A Anderson
Associate Director, Library Operations	Lois Ann Colaianni
Associate Director, Specialized Information Services	Henry M Kissman, Ph D
Associate Director, Extramural Programs	Arthur Broering (Acting)
Director, Lister Hill National Center for Biomedical Communications	Daniel R Masys, M D

Directors of the Library

1865-1895	Col John S Billings	1924-1927	Col James M Phalen
1896-1897	Col David S Huntington	1927-1932	Col Percy M Ashburn
1898-1902	Maj James C Merrill	1932-1936	Maj Edgar E Hume
1902	Maj Walter Reed	1936-1944	Col Harold W Jones
1903-1904	Brig Gen Calvin DeWitt	1945-1946	Col L L Gardner
1904-1913	Brig Gen Walter McCaw	1946-1949	Col Joseph H McNinch
1913-1918	Col Champe C McCullough	1949-1963	Col Frank B Rogers
1919	Col Paul F Straub	1963-1983	Martin M Cummings, M D
1919-1924	Maj Gen Robert E Noble	1984-	Donald A B Lindberg, M D

1985 Special Initiatives: Looking Toward the Future

Planning

At their January, 1985 meeting, the Board of Regents asked the Director to work with them to prepare a long-range plan to guide the Library's future development The Regents' request was motivated by the need for guidance in dealing with an era in which the technology of medical information management is changing rapidly and in which there are many competing opportunities for the allocation of limited resources The Board believes that wise choices can be made only if there is a long-term vision of what the Library can and must become in order to discharge its mission in the 21st century Further, the Regents reasoned, preparation of a long-range plan could inform and be informed by the Library's users who could plan more effectively the use of their own resources if they knew how the Library expected to serve their needs

The Director responded to the Regents request by choosing a planning process that distributes the work of planning over five domains which encompass current programs and activities of NLM and also constitute a framework for thinking about the future These five domains are

I Building and organizing the Library's collection

II Locating and gaining access to medical and scientific literature

III Obtaining factual information from databases

IV Medical informatics

V Assisting health professions education through information technology

Planning Panels are developing recommendations and priorities for future NLM activities and programs for each domain

The Library has chosen a planning model that has three components First, it incorporates a distant, somewhat indistinct vision of the 20-year-off future in medicine, library and information science, and computer/communications technology That environment cannot be forecast precisely, so it is appropriate to speak of the distant goal as 'fuzzy' This goal is seen as a societal objective whose attainment involves many organizations and agencies NLM has a role to play in achieving the goal and it is necessary for NLM to plan its part

Second, while the 20 year goals are indistinct, there are opportunities leading toward the goals, and also impediments to achieving them Third, the specific steps that should be taken in order to remove the impediments and take advantage of the opportunities should be programmed for 3 to 5 years hence In effect the Planning Panels are invited to consider the vision of the 20-year future and recommend what role NLM should play in approaching this societal objective

The Board of Regents has asked that a draft of the long-range plan be ready for their review in June 1986 The Board will want to have an opportunity to consider the several recommendations that are anticipated to be the major product of the planning process and to examine their implications

Unified Medical Language System

The remarkable developments in computer and communications technology in the last decade or so have formed the foundation on which have been built equally remarkable information systems The speed and magnitude of these technological developments are illustrated by the comment of former Secretary of the Treasury, W Michael Blumenthal, that if a comparable growth had occurred in the automobile industry, we would now be driving cars that cost $4 50, weighed a pound and a half, and got a million miles to the gallon This spectacular growth of technology has led to applications in every aspect of medicine, unfortunately these applications have resulted in an enormous amount of inconsistent terminology in health science systems of all types

The Library, of course, has its own vocabulary—Medical Subject Headings (MeSH) It, at least, has some of the attributes required of any systematic vocabulary used for machine retrieval unambiguous definitions, organization by a set of rules, and standardized data entry and verification procedures Although there are other such vocabularies in use, the definitions, rules of organization, and procedures are quite diverse, so that the systems represented by these vocabularies cannot communicate with each other It is impossible to integrate information found in various systems, and even switching from system to system is extremely difficult because the user is faced with the formidable task of learning the language and organization of disparate systems Clearly, the indispensable need is for a universal medical language system

To create such a system and to ensure that it is adopted throughout the health professions would seem to be an impossible task Local and discipline-specific jargon, abbreviations, multiple meanings, terms that are inherently ambiguous, and centuries of usage, all argue that such an effort would be doomed to failure An alternative method, however, might be to translate existing medical language, wherever and however used, to a single, unambiguous form This "unified medical language" could then act as a bridge from and to the many actual vocabularies being used in a variety of medical settings

For example, a clinician taking a medical history could describe the patient's condition directly into the system, his words being translated into the unified medical language The terms might then be restructured in accordance with MeSH and an automatic search done on MEDLINE or other bibliographic database related to the patient's condition The translation could also be made to other databases which might then suggest appropriate laboratory tests, their relative costs, probable diagnostic considerations, indications and contra-indications of various therapies, and even into databases that keep track of the prevalence and incidence of specific diseases

In 1985, the Library took a lead role in beginning to develop such a unified medical language system The effort, in cooperation with the American Medical Association, university investigators, and other Federal agencies is seen as a long-term project

Preservation

The physical state of the collection, always a matter of concern, came under intense scrutiny in 1984 and 1985. A senior NLM Preservation Planning Team surveyed the collection and the environmental conditions under which it is stored (temperature, humidity, light, and pollutants). The team found that although the environment is relatively good, nevertheless some 8.8 percent or 113,000 volume equivalents of paper-based materials are brittle. This compares favorably to the condition of other research libraries, for example, Yale and the Library of Congress report some 25 percent of their collections are brittle.

The Preservation Planning Team recommended that the Library:

- Modify existing Board of Regents policy on preservation to link the NLM preservation program more explicitly to its collection development guidelines; to clarify the Library's responsibility for preserving the printed content as opposed to the artifact; and to define NLM's role in assisting to preserve significant biomedical literature held by other U.S. libraries.

- Establish a Preservation Section in the Reference Services Division.

- Expand preservation efforts, emphasizing mass deacidification and microfilming, and also by improving the conditions under which the collection is stored.

- Use the Electronic Document Storage and Retrieval system being developed by the Lister Hill Center as a laboratory testbed for research in preservation on optical disk. This effort should be coordinated with the Library of Congress, the National Archives, and other interested institutions.

- Encourage publication in archival formats, for example, permanent durable paper.

- Work through the Regional Medical Libraries to identify other biomedical collections that should be preserved and to assist in their preservation

These recommendations were presented to the Board of Regents at its September 1985 meeting. The Board voted unanimously to accept them in principle, and the recommendations are now being implemented by the Library's staff.

Snapshot of the Library on the Eve of its Sesquicentennial

Scene:

The Atlanta physician had never before treated a boy complaining of "numb chin." He sent the lad to the examining room to undress and quickly turned to his personal computer. He typed in the term "numb chin" and read from the screen a lengthy description of an article on just that subject. This information provided the vital clue the physician needed to diagnose a form of lymphoma.

Similar scenes are reenacted thousands of times every day in physicians' offices, research laboratories, hospital nurses' stations, medical schools—in short, wherever health professionals require information.

The system this physician tapped into is MEDLINE, one of the National Library of Medicine's online databases containing medical references, abstracts, and other information. MEDLINE is a computerized counterpart to *Index Medicus*, the monthly bibliography of journal article references which made its first appearance in 1879 and is still published by the Library today.

NLM's online files contain descriptions of some 6 million articles, books, journals, and audiovisual programs in subjects related to medicine and health. By creating standard machine-readable records for these items, storing abstracts of many of them, and describing their content using a special vocabulary (known as Medical Subject Headings, or MeSH), the Library's staff makes it possible for searchers to identify in minutes the specific documents most likely to contain the information that is needed.

Some health professionals, such as the physician in the scenario above, search NLM's online files directly, either on the NLM computer system or through commercial online database vendors that lease NLM files. Other users rely on medical librarians and information specialists to research the databases for them. To help health professionals and medical librarians search MEDLINE and other NLM online files effectively, NLM provides a range of online training classes and materials. Last year, more than 1,000 people took NLM-sponsored online training sessions. In addition, medical librarians throughout the country conduct special online training sessions for health professionals using *The Basics of Searching MEDLINE: A Guide for Health Professionals*, a new manual published by the Library.

The Library also looks for ways to make its online system easier to use. Some improvements now being developed are a microcomputer program called GRATEFUL MED that helps users search MEDLINE, aids that lead users to the most appropriate subject terms to search, and a simplified way of entering search requests on the NLM system.

Scene:

A veterinarian in Florida notices an increasing death rate in exotic birds and suspects that it might be linked to a recent ban on a pesticide used in bird feed. He calls the state's Toxic Substances Information Center which in turn quickly uncovers relevant information in NLM's online toxicology databases.

The field of toxicology, barely recognized as a distinct science 25 years ago, has grown at an unprecedented rate and has generated large quantities of data and information. The public interest in toxicology as a social concern and the resultant laws and regulation have fueled—and

been fueled by—extensive testing and research
Technological innovations in computers and
communication, advancing at a rate no less than
toxicology information, have resulted in
sophisticated systems for collecting, organizing,
and distributing this information From the early
days of toxicology to the present, the National
Library of Medicine, through its Toxicology Infor-
mation Program operated by the Division of
Specialized Information Services, has been a leader
in providing the toxicology community with
readily accessible quality information Detailed
information about the Library's toxicology infor-
mation services begins on page 00

Poison Control Centers throughout the country
are deluged with calls relaying poisoning incidents
Among the arsenal of tools used by many of the
centers are computer files such as the Toxicology
Data Bank, which contains specific information on
treatment of drug overdoses and other accidental
poisonings The Toxicology Data Bank and the
Hazardous Substances Data Bank, both developed
by the Toxicology Information Program, contain
fully referenced facts on potentially hazardous
chemicals, their properties, safety and handling,
toxicity, pharmacology, environmental fate, etc

Throughout the country, citizens concerned
about the effects of environmental chemicals are
able to call their local or regional medical libraries,
where the staff is trained to search the appropriate
computer files TIP's file, for instance, has been
used to retrieve references to journal articles for
individuals with the following questions "What is
the danger of spraying lawns with 2, 4-D?' "My
son has been sniffing butane lighters What are the
effects of butane?' "Is it possible for lipstick to
cause lip irritation?"

Scientific researchers, physicians, emergency
response teams, the media, legal professionals and
the general public all profit from the Library's
extensive computer storehouses of toxicological
information By providing information to meet
research needs and to prevent or remedy
hazardous situations, the Library strives to help
safeguard the health of the American public and
insure a clean environment

Scene

*The surgeon at the Bethesda hospital inspected
with some puzzlement the congenital anomaly
presented by the vessels in the chest of the man he
was operating on He recalled seeing drawings in
a journal that might shed some light on the
problem The article, brought from nearby NLM,
was propped up on a stand in front of the
surgeon who proceeded to complete the operation
successfully*

This true incident, which occurred in the
mid-1960s, impressed on the NLM staff as nothing
else could the crucial importance of the medical
literature to quality medical practice Of course, in
this case, the surgeon remembered a specific
article As the number of published medical
articles continues to increase dramatically, the
chance of a physician recalling precisely which
article is required becomes increasingly remote
However, as long as the physician can use
MEDLARS to quickly cull through millions of
references to journal articles, such reliance on
memory is unnecessary

Once a health professional or researcher has
used an NLM database to identify a useful journal
article, the next step is to obtain a copy of the
article For a limited number of journals, the user
can view an online version of the full-text of the
article on a database vendor's system More
frequently the user can obtain a copy of the article

immediately from the health sciences library where the search was performed But in some cases, the user must ask a medical librarian to obtain a copy from another health sciences library collection The chances are excellent that the user's request will be filled rapidly—thanks to a variety of services NLM provides to help health sciences libraries serve health professionals and researchers more effectively

NLM's assistance to other libraries begins when they receive new biomedical books for their collections Because NLM's authoritative cataloging records are readily available online and in printed catalogs, medical librarians can use the cataloging data NLM has prepared rather than spending time and energy preparing their own records Often the NLM cataloging record is actually printed inside U S biomedical books, as part of the Cataloging-in-Publication program directed by the Library of Congress The NLM classification, a scheme for arranging biomedical materials on library shelves according to their subject content, helps health sciences libraries organize collections in a way that makes sense to health professionals

Use of NLM cataloging records saves other U S biomedical libraries over three million dollars annually in staff time required to catalog incoming journals, books, and audiovisuals NLM cataloging records help librarians and library users to find materials in health science library collections throughout the United States and in many countries of the world

Faced with requests that cannot be filled from their own collections, health science librarians get help through NLM's Regional Medical Library Network In each of seven Regions in the network, a distinguished medical library serves under contract to NLM as the Regional Medical Library (RML) for that area The RML is responsible for coordinating the activities of health sciences libraries to improve biomedical information service to all health professionals in the Region, whether in cities, suburbs, or remote rural locations

The Regional Medical Library plays a critical role in implementing national policies and standards for referring document requests among health science libraries and in developing effective ways of handling requests within its Region The goal is to fill each request quickly and as close to home as possible Requests are referred to larger, more remote library collections if the materials are not available locally, with NLM serving as the backup for the entire network

NLM has recently introduced DOCLINE, an automated document request and routing system that cuts the time required to create a request and get it to a library that has the needed material Librarians using DOCLINE transfer information from MEDLINE or other NLM online files into the document request and avoid typing the author's name, title, etc, of the item being requested DOCLINE automatically routes requests for journal articles to libraries that own the journals The routing system relies on an automated file of the journal holdings for over 1,700 health sciences libraries throughout the country NLM developed and maintains this file with assistance from the Regional Medical Libraries The DOCLINE system will eventually route most of the estimated two million interlibrary requests for documents currently handled in the RML network each year

Libraries in the network can fill over ninety percent of the interlibrary loan requests made for U S health care practitioners and researchers The remaining requests come to NLM, which has by far the world's largest collection of biomedical literature NLM contains 1 75 million volumes of printed materials and 1 76 million items in other

formats—prints, photographs, historical films, audiovisual programs, microforms, computer software, and manuscripts. The figures on the overall growth of the NLM collection are in Table 1.

Some 229,000 books, journals, audiovisuals, pictures, pamphlets, and manuscripts were acquired for the NLM collection in 1985, at a cost of about $2,250,000. NLM fills over 1200 requests for materials from its vast collection every day. Forty percent of these requests are forwarded from other libraries; sixty percent come from visitors to the Library in Bethesda. Lending activities are described in the section on Document Delivery in the chapter on Library Operations. Statistics are in Table 7.

Scene:

A Virginia novelist working with the diary of a nineteenth century plantation owner asks NLM's historians to identify the modern day terms and the uses for some 20 drugs mentioned in the diary only by obsolete names. By using early sources the historians are able to identify them all, thus giving verisimilitude to the novelist's descriptions.

Most of the requests to NLM are for current materials and information needed to assist patient care and biomedical research. But the Library contains not only the latest published medical information, but also the earliest. NLM's historical films and still pictures are heavily used by people in the newspaper, book publishing, television, and motion picture industries. Footage from NLM's historical picture collection appeared in the Woody Allen movie *Zelig*. ABC recently requested pictures of quarantine measures taken in the U.S. in past epidemics for use in a "Nightline" show about the controversy over isolation of AIDS

victims. Medical and social historians draw upon the Library's magnificent holdings in rare books, pamphlets, theses, and manuscripts to further their research.

In addition to providing materials from its comprehensive collection, NLM also gives reference assistance to health professionals and researchers who don't know where to look for the information they need. The Library staff responded to almost 100,000 requests for information in 1985. Inquiries may be for specific facts on topics of current interest, for recommendations of audiovisual programs suitable for a specific educational purpose, or for information about the services provided by other organizations, such as local biomedical libraries or information clearinghouses operated by other federal agencies. Requesters include members of Congress, the Supreme Court, and the Office of the President who need information to make informed decisions regarding health policy and health care legislation.

While responding to current demands for its services, NLM also looks for better ways to organize biomedical information and make it available in the future. The Library faces the double challenge of preserving the paper records of the past for use by future generations and developing new services that take advantage of electronic forms of information and emerging information handling techniques.

TLX 033 FAIRBANKS AK MAY 18 315M

MOJAVE TRACKING STATION (RELAY THRU GODDARD)

"AT APPROXIMATELY 10:15 AM ALASKA DAYLIGHT TIME ON THURSDAY MAY 18, 1972, ST. PAUL ISLAND DECLARED A MEDICAL EMERGENCY AND REQUESTED ASSISTANCE OVER THE SATELLITE FOR A 39 YEAR OLD MALE PATIENT WHO HAD SUFFERED A HEAD INJURY AND WHOSE CONDITION HAD DETERIORATED TO INCLUDE PARALYSIS AND UNCONSCIOUSNESS. A COAST GUARD AIRCRAFT HAS BEEN DISPATCHED. MEDICAL FACILITIES IN ANCHORAGE ARE ALERTED AND A NEUROSURGEON IS STANDING BY."

TLX 038 FAIRBANKS AK MAY 19 400P

"PATIENT EVACUATED FROM ST. PAUL ISLAND TO ANCHORAGE PHS HOSPITAL BY COAST GUARD AIRCRAFT. PATIENT WAS IN POOR CONDITION UPON ARRIVAL. A NEUROSURGICAL PROCEDURE WAS PER-FORMED AND THE SUBDURAL HEMATOMA WAS REDUCED. PHYSICIAN REPORTS THAT PATIENT PROBABLY WOULD NOT HAVE SURVIVED MUCH LONGER WITHOUT SURGERY."

These two telegrams were received by the Lister Hill Center about an emergency in 1972 in which communication via NASA's ATS-1 satellite was credited with saving a life. The use of a satellite network to bring medical consultation to remote Alaskan villages was sponsored by the Library's Lister Hill National Center for Biomedical Communications in cooperation with the state of Alaska and NASA.

The Lister Hill Center is the NLM's research and development component, established in 1968 by a joint resolution of the Congress. The Center's offices and laboratories are located in the 10-story Lister Hill Center Building, dedicated in 1980.

The Alaska voice network was the first of a series of satellite-based communications experiments sponsored by the Lister Hill Center. Later experiments, using NASA's ATS-6 and CTS satellites, added video to the voice link and extended their use to medical education in Alaska and the Pacific Northwest and nationwide teleconferencing for the U.S. Public Health Service.

These experiments typified the Lister Hill Center's philosophy of

- identifying a communications need in the health sciences,

- applying the most modern technology to a solution, and

- developing a prototype system to demonstrate its feasibility to the medical community.

This is what was done with the Alaska satellite project, where the state, with private help, now operates the network. Another outstanding success following the same formula was the Lister Hill Center's experimental Computer Assisted Instruc-

tion (CAI) Network This system linked three university-based computer centers to a nationwide telecommunications network to allow students in almost 100 schools to have online access to dozens of computerized teaching modules After developing and operating the system for several years, the Lister Hill Center turned it over to an organization composed of users who continued to run it

The Lister Hill Center's communications specialists and engineers have been concentrating in recent years on videodisc, voice recognition, and microcomputer technologies There are exciting experiments under way to create teaching materials in basic medical pathology, radiology, and even realistic patient simulations for training

health practitioners Other Lister Hill Center research efforts are concerned with providing the Library with improved methods for acquiring, processing, and making available the biomedical literature The LHC has also created a prototype National Learning Demonstration Center that makes available for display and testing a wide range of computer-based teaching materials in the health sciences These programs are all described in the chapter on the Lister Hill Center

The Medical Library Assistance Act:
A Vicennial Vignette

The Library observes another anniversary in 1986 Twenty years ago, in 1966, NLM received its first appropriation under the Medical Library Assistance Act Since that time, many have benefited from grant awards made under the Act authors and scholars, researchers and academicians, librarians and media experts, computer scientists and linguists, as well as aspiring graduate and post-graduate students of librarianship, biomedical communications, and medical informatics

Although the Library's grant programs are modest in comparison with those of other components of the National Institutes of Health, it can be fairly said that they have had an impact on the nation's health out of all proportion to their size The following composite vignette is intended to illustrate the effects of NLM grant assistance

Scene

On a late Sunday afternoon in July an elderly farmer has fallen from his tractor and is pinned beneath the front wheels The rescue unit arrives and has little difficulty in freeing the farmer, who appears only to have superficial injuries However, an alert emergency medical technician notices an unsteady gait in the farmer's stride After the technician asks the farmer what he recalls about the fall, the farmer admits that he may have had a "dizzy spell" just prior to the accident Finally, after persistent questioning, the farmer admits having had three or four episodes of brief periods of dizziness and double vision during the past six months Some weeks previously, the paramedic had seen a training film about recognizing

neurological "events" He is persuaded to call the emergency room at the county general hospital The attending physician listens to the paramedic's report and requests that the farmer be brought to the hospital

In the meantime, the emergency room physician decides to do a quick medical records check She "calls up" the medical records department on the emergency room microcomputer She does this with ease and no hesitancy, for her first year at medical school included a learning laboratory class in computer competency, and before she entered her clinical science years she had purchased a second-hand personal computer

Entering the farmer's name and her own authorization number and password she verifies that the farmer had two prior hospital admissions since 1980 The farmer's medical records are a part of the hospital's permanent, common, computer registry His last admission was recent and the physician can retrieve preliminary information online from the active file Laboratory results, radiology and surgical pathology and outpatient pharmacy prescriptions are rapidly printed out There is no clue from past admissions and treatment protocol which she can immediately associate with the paramedic's observations

She decides to do a literature search to see if she can locate a case history article on brain tumors that she remembers reading in which the subject's symptoms were similarly undramatic and initially misleading until a nuclear magnetic resonance scan of the brain was conducted One of her orientation sessions to the hospital was a presentation by the librarian which included a demonstration of PaperChase, "an easy-to-use bibliographic retrieval system" The local system can locate all the MEDLINE-based holdings in the ten-hospital library consortium in the southern part of the

state She was familiar with NLM's MEDLINE, but only through searches done by the reference librarian at her medical school She establishes contact with the PaperChase files and, after just a few search commands, she finds the reference to the case history and notes that the journal is held by the private hospital across town (The consortium includes a very cost-effective arrangement for cooperative acquisitions) She sends an "electronic-mail" message to the library of the other hospital requesting that a copy of the article by forwarded on Monday

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The scenario will be extended but events even to this point exemplify the operational results of a number of NLM funded awards Their representation is simplified but, in the context of their individual situations, their value and effectiveness are vividly displayed Included are awards for

• a cooperative program for sharing library-controlled audiovisual training aids among a number of rescue squad units,

• a highly reputed computer-based operation which electronically combines individual hospital department records (such as clinical laboratories, admissions, medical records, pharmacy and radiology) into a permanent, common registry accessible by a microprocessor,

• a successful program that demonstrated the value of a learning laboratory for improving computer literacy in a medical school setting,

• the well-known PaperChase bibliographic retrieval system, now commercially available and widely used,

• an experiment in using "electronic mail" software to facilitate various medical library services and, finally,

• consortia of libraries for the sharing of information resources

To bring the vignette to a conclusion will reveal the opening chapter of one of NLM's priorities for the future—Medical Informatics research and development

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By Tuesday afternoon the outpatient has seen his physician, had a neurologic examination, including a brain scan, and numerous laboratory tests All data and information, including the resident's work-up and the prior admissions, are now included in the database The farmer's physician has the foundation for a dialogue, not at this point with a department head of the hospital, or with a colleague at the large upstate medical center, but with an in-house artificial-intelligence-based system to assist in the diagnosis and drug therapy of almost 1000 diseases The system codifies the knowledge of experts in many fields and is supplemented by programs in probability theory It is interactive with the user, asking and answering questions, providing explanations for advice given, and suggesting additional tests The user can accept advice, ignore it (the reason must be documented) or suggest additions to the database

Responding to the command for a "combined analysis" of symptoms (possible conditions ranked according to the number of symptoms present) the system displays a list of eight possibilities, five of which have at least three of the symptoms in common Further narrowing begins when, through the keyboard the physician examines each of the five as its features compare to logged clinical data Finally, conclusions of the diagnostic phase are summarized for the Physician-User Category = Cerebral Thrombotic, Territory = Carotid systems,

Location = Ipsilateral with ocular disturbance (right eye) Following the summary is an explanation of how the conclusions were reached, and which of the symptoms and data led to the specific conclusions and which did not Also included are relevant citations to the literature

In the therapy phase, the system discusses" options with the physician Specifically, the use of anticoagulants or antiplatelet agents and surgical endarterectomy are weighed The physician informs the system of his choice—the anticoagulant COUMADIN The computer program is once again automatically directed to the medical record A "wait" instruction flashes on the screen but is shortly replaced by "caution" and the explanation

> *"Anticoagulant is contraindicated—patient's last hospital admission and treatment suggest that the hazard of hemorrhage might be greater than potential clinical benefits—consider instead , because "*

The clinical problem described is not a medi cally complex one and the complexities and technical aspects of the illustrated ' system" are absent In addition, the ' system" is not identified with a single operational entity, but is rather a composite of a number of such systems supported with NLM grant funds However, the scenario is only simulated and is not farfetched conjecture

Medical Informatics work in this area is still in the early stages and much more needs to be done See page 60 for a description of Medical Informatics research and development currently being supported by grant, work within NLM's Lister Hill Center is described beginning on page 53 Related also is another NLM program of high priority— Integrated Academic Information Management

Systems—which is described on page 60

Responding to the generally sad state of medical libraries in the early 1960's, those who framed the Medical Library Assistance Act built perhaps better than they knew Twenty years later it is apparent that the Act has been immensely valuable to the progress of American medicine Today's successful Regional Medical Library Network, the training of a generation of medical librarians and information specialists, the emergence of the field of Medical Informatics as a vigorous discipline, all owe much to this legislation The challenges facing the health professions today require continued extramural support for research, training, and the development of new communications modalities appropriate for the 1980's and beyond

Library Operations
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The Library Operations Division of NLM

- acquires and preserves the world's biomedical literature,

- organizes this literature by cataloging and indexing,

- disseminates indexing and cataloging data in publications, online files, and other machine-readable forms,

- lends copies of documents in the NLM collection, and

- provides reference and research assistance to health professionals

More than 250 librarians, technical information specialists, subject matter experts, health sciences professionals, library technicians, and administrative support personnel carry out Library Operations' programs and services. The staff is organized into four divisions Bibliographic Services, Reference Services, Technical Services, and History of Medicine, two special units the Medical Subject Headings Section and the Regional Medical Library Program Office, and a small administrative group in the Office of the Associate Director

Planning and Management

In FY 1985, Library Operations (LO) continued to work toward the four objectives in its strategic plan for FY 1984-1988 These objectives are

- to improve internal technical and bibliographic processing,

- to develop and implement programs that make it easier to identify, locate, obtain, and use biomedical information and literature,

- to develop and implement a program for the preservation of the biomedical literature, and

- to ascertain the information needs and information-seeking behavior of health science professionals and the history of medicine community, as a step toward improving Library Operations' products and services

Progress in these areas is described throughout this section

Automation of administrative management functions throughout LO continued, with a special emphasis on assisting secretarial and clerical staff to function more efficiently In FY 1985, electronic mail became a prevalent means of communication and the use of microcomputers in LO for controlling production, personnel, and budget data increased substantially

Staff working groups examined current employee training and development programs and recommended improvements in program content and format and in the distribution of training and development opportunities These recommendations are expected to lead to several changes in current practices Steps have already been taken to conduct microcomputer training classes at the Library

Collection Development

Collection development encompasses literature selection policies, identifying and acquiring biomedical literature in all formats and languages, and processing materials as they are received. The NLM collection currently contains more than 1,786,000 printed volumes and 1,756,000 other items, including audiovisuals, microforms, prints, photographs, and modern manuscripts. The Library's distinguished collection of rare books, pictures, and historical pamphlets was begun during John Shaw Billings' tenure as director of the Library from 1865 to 1895, and the Library has continued to acquire important historical items since that time. The rate of acquisition of current materials has increased to keep pace with the tremendous growth in biomedical research and publication following World War II.

Selection. As many of the Library's services are dependent on the materials in its collection, the policies governing which materials are to be acquired affect the scope of information services the Library can provide. In FY 1985, NLM published the *Collection Development Manual of the National Library of Medicine.* This publication, which supersedes the *Scope and Coverage Manual of the National Library of Medicine* published in 1977, is the most recent in a series of manuals developed to guide staff in selecting literature for the NLM collection. The first such manual was produced in 1951; new editions have appeared every five to eight years since that time.

Like its predecessors, the *Collection Development Manual* attempts to define "scope," or the range of subjects to be acquired, and "coverage," or the extent to which each subject is acquired for the NLM collection. It also attempts to clarify and

improve selection guidelines in several areas, including the behavioral sciences and chemistry. The new manual puts more emphasis on areas of growing interest to health professionals, such as diagnostic imaging techniques, medical informatics, and laboratory animal ethics. In addition to expanded and restructured scope and coverage guidelines, the *Collection Development Manual* includes an overview and history of the NLM collection; a description of the Library's policies for acquisitions, preservation, and collection weeding; and a statement of the relationships among the collections of NLM, the Library of Congress, and the National Agricultural Library (NAL). The publication of the new manual represents the culmination of a two-year effort involving more than 50 NLM staff members, a group of distinguished outside consultants, and Dr Faye Abdellah, Deputy Surgeon General, as Board of Regents liaison.

The Library's Learning Resource Center makes available some 15,000 audiovisual productions dealing with various aspects of health science education. These materials may be used at the NLM or borrowed on interlibrary loan.

Table 1
Growth of Collections

Collection	Previous Total (Sept. 1984)	FY 1985	New Total
Book Materials			
Monographs:			
Before 1500	568	0	568
1501-1600	5,658	22	5,680
1601-1700	9,918	31	9,949
1701-1800	23,940	102	24,042
1801-1870	39,586	78	39,664
Americana	2,327	4	2,331
1871-Present	457,379	11,601	468,980
Theses HMD	281,593	187	281,780
Pamphlets	172,021	26,891	198,912
Bound serial volumes	745,998	39,006	785,004
Volumes withdrawn	(27,448)	(2,618)	(30,066)
Total volumes	1,711,540	75,304	1,786,844
Nonbook Materials			
Microforms:			
Reels of microfilm	34,622	557	35,179
Number of microfiche	138,578	30,526	169,104
Total microforms	173,200	31,083	204,283
Audiovisuals	41,822	1,179	43,001
Pictures	75,124	298	75,422
Manuscripts	1,240,283	193,101	1,433,384

In FY 1985, NLM made information about the scope of the collection available in other ways as well. A joint statement was published by NLM and NAL clarifying the collection development policies of the two national libraries in the field of veterinary science. The Library also contributed data about its existing collection strengths and current collecting policies to the automated compilation of data on U.S. research library collections maintained by the Research Libraries Group.

Following the publication of the new *Collection Development Manual*, staff began the first of a series of collection evaluation and indexing

Table 2
Acquisition Statistics

Acquisitions	FY 1983	FY 1984	FY 1985
Current serial titles received	23,470	22,294	23,087
Publications processed			
Serial pieces	127,927	126,167	125,243
Other	25,479	27,456*	27,212
Total	153,406	153,623*	152,455
Obligations ($) for			
Publications	1,861,489	2,390,426	2,128,787
Included for Rare Books	57,610	88,088	116,154

*Revised figure

coverage studies in specific subject areas The initial study covers the field of medical informatics, defined as the application of computer and information science to medicine and health services Similar studies are planned for FY 1986 in health services research and various aspects of veterinary medicine

Acquisitions In FY 1985, 36,388 volumes were added to the NLM collection and more than 152,000 books, serial issues, and audiovisual programs were received and processed For the first time, NLM acquired a limited number of computer software packages on biomedical subjects for the collection, as part of a pilot project to determine the resources needed to acquire and catalog these items Expenditures for the historical collections increased by 25 percent Significant additions to these collections included the archives of the Medical Library Association, additional papers of Julius Richmond, former Surgeon General of the U S Public Health Service, the Albert and Mary Lasker Foundation Research

Award archives for 1968-80, a manuscript copy of a 1565 letter from the French diplomat Hubert Languet to the physician Caspar Peucer, relating the circumstances of the death of Vesalius, a manuscript letter by Florence Nightingale in which she writes of hospital sanitation and administration, a contemporary pencil drawing of the young Florence Nightingale by Sir William Boxall, Conrad Gesner's *Historia plantarum et vires ex Discoride, Paulo Aegineta, Theophrasto, Plinio, et recentioribus,* Basel, 1541, which enhances the Library's fine collection of the works of Gesner, and over 200 seventeenth century theses

Twenty-seven of the theses were a gift from the Denison Memorial Library of the University of Colorado Health Sciences Center Included in this group was Herman Boerhaave's Doctor of Philosophy thesis (1690) on the distinction between the mind and the body There were also several important additions to the historical film collection, and plans were developed for expanding NLM's collection of medical and health-related posters

Table 3
Cataloging Statistics

Item	FY 1983	FY 1984	FY 1985
Completed cataloging			
Full	11,322	11,243	11,529
Limited	7,126	6,267	5,647
Total	18,448	17,510	17,176

Collection Preservation and Maintenance.
Collection preservation and maintenance encompass such diverse activities as maintaining an appropriate storage environment, promoting safe handling of materials, providing physical or chemical protection to items, and making copies of items in archival formats. The development of a more comprehensive preservation program for the biomedical literature is one of four major objectives in the Library Operations' strategic plan for FY 1984-88. The earlier chapter in this report on special initiatives describes a preservation study and its recommendations.

Regular preservation and maintenance activities continued and expanded during FY 1985: 26,500 modern volumes were bound and 470 items were preserved on microfilm. The bindings for 1,363 rare books were oiled and 1,403 pages were mended; 202 rare books were restored and/or rebound. Fifty films in the historical film collection were transferred to new film stock. Arrangements were made to rebind and repair bound manuscript volumes. Work continued on transferring NLM's prints and photographs collection to acid-free folders.

Another section of compact shelving was procured according to NLM's plan for providing space for projected collection growth through the year 2004. Work was begun on obtaining improved humidification capacity for some areas where library materials are stored. NLM also signed agreements with two commercial firms allowing them to microfilm certain materials in the historical collections for subsequent sale in exchange for a free preservation master of the materials involved.

Bibliographic Control

Bibliographic control includes the development of intellectual schemes for organizing the biomedical literature by subject, cataloging all types of library materials in the field of medicine and health, and indexing journal articles on biomedical subjects. For over 100 years, NLM has produced cataloging and indexing data for use not only at the Library itself, but also by health professionals, researchers, and health science librarians around the world. The creation of intellectual access to the content of the biomedical literature is one of the Library's most significant services.

Table 4
Bibliographic Services

Services	FY 1983	FY 1984	FY 1985
Total citations published*	310,445	306,263	307,333
For *Index Medicus*	284,856	278,905	280,379
Recurring bibliographies	24	24	23
Journals indexed for *Index Medicus*	2,709	2,695	2,730
Abstracts entered	149,851	172,153	177,000

*Includes special list articles, audiotapes, and Health Administration citations

Thesaurus and Classification. NLM's Medical Subject Headings (MeSH) is a hierarchical thesaurus, developed in the late 1950's and first used in cataloging and indexing literature received by the Library in 1960. From an initial list of about 4,250 terms, it has grown to its current size of 14,411 subject headings and 39,697 chemical names. Since its inception, staff have endeavored to keep MeSH current with developments in medicine and health and with trends in biomedical terminology. A total of 183 headings were added to the vocabulary in FY 1985 Of these, 147 were entirely new and 36 replaced deleted terms An additional 177 headings were deleted Most of these represented rarely mentioned chemicals and plants. The chemicals were transferred from the regular MeSH to the chemical subfile Beginning with the 1986 publication, topical subheadings are interfiled with main headings in the *Annotated Alphabetic MeSH* in order to make these important qualifiers more noticeable to online searchers and other users of the thesaurus.

Work proceeded on the project to create a machine-readable "table" to relate MeSH terms used in cataloging to equivalent Library of Congress Subject Headings (LCSH) and vice versa.

Such a table will make it possible to improve subject searching capabilities in catalog files containing some records with MeSH and some records with LCSH terms. A machine match of terms in LCSH and MeSH was performed. A total of 4,419 or 32% of MeSH terms matched exactly; another 780 or 5% were near matches (e.g., singular vs. plural). Staff are now reviewing and matching terms that could not be handled by machine. The intellectual work associated with this project should be completed in 1986, but it is unlikely that the machine-readable version will be available for distribution before FY 1987 or 1988.

In addition to maintaining the MeSH vocabulary for use in subject cataloging and indexing, NLM also has developed the *National Library of Medicine Classification*, a scheme for the shelf arrangement of books by general subject, which is used by biomedical libraries around the world. The first edition of the *NLM Classification* was produced in 1951. It has undergone periodic revisions since that time, the most recent occurring in 1981. Any modifications made between editions are reported in the *Notes for Medical Catalogers*, which is published in the quarterly *National Library of Medicine Current*

Catalog and cumulated annually as a separate publication. The next full scale review of the *NLM Classification* is scheduled to begin in FY 1987.

Cataloging. Cataloging at NLM includes: (1) the creation of a standard description of each new work added to the NLM collection—author's name, title, publisher, date of publication, edition statement, etc ; (2) the assignment of MeSH headings to describe its subject content; (3) the assignment of a classification code or shelving number that identifies its principal subject focus; and (4) the maintenance of automated files of the authoritative forms of names used in cataloging records and the cataloging records themselves.

In FY 1985, the Library cataloged 17,176 books, serials, audiovisual programs, and Cataloging in Publication (CIP) galleys. In all, 11,529 received full cataloging, 5,647 items received limited cataloging. After reviewing acquisitions and staffing patterns, NLM decided to increase gradually the amount of cataloging and cataloging support done under contract, purchase order, and interagency agreement as part of a long-term strategy to improve the Library's ability to catalog newly acquired materials quickly, while reducing backlogs of uncataloged items. The amount of limited cataloging for monographs acquired from outside sources increased; the first contract for audiovisuals cataloging was awarded; contract assistance was also obtained for editing records to be contributed to the CONSER (consolidation of serials) database NLM also began an experimental program to incorporate cataloging records for individual programs in the videocassette series,

Network for Continuing Medical Education, supplied by its publisher into AVLINE (audiovisuals cataloging on-line file). The majority of the work

to upgrade names in NLM's name authority and catalog files to the form required by the current edition of the *Anglo-American Cataloging Rules* was completed under contract. The period of performance of this contract has been extended to allow upgrading of additional names used in cataloging the historical collections.

NLM continued to make substantial progress toward the goal of making descriptive cataloging records produced by the Library completely compatible with records produced by the Library of Congress (LC) and other U.S. research libraries. This will make it easier for health sciences libraries to merge records produced by NLM with records produced by other cataloging agencies. After a successful pilot project in FY 1984, NLM became solely responsible for the production of descriptive cataloging data for biomedical books covered by the Cataloging in Publication (CIP) program directed by LC LC now uses NLM's descriptive cataloging for these items, thus avoiding duplicate work. NLM also expanded its contributions to the national Name Authority Cooperation (NACO) project in January 1985 to cover all names used in full cataloging records

The amount of time needed to train new catalogers and to produce high-quality original cataloging records is a serious concern for NLM and other major research libraries. The application of artificial intelligence techniques to cataloging may eventually help to solve this problem. In FY 1986, NLM, LC, and NAL will examine the prospects for joint research on an expert cataloging system.

Indexing. Indexing at NLM is the creation of a record for each article in an indexed journal. The record includes a description of the article (its author's name, title, pagination), issue information

for the journal in which it appeared, and a number of MeSH terms assigned to describe in detail the subject content of the article

During FY 1985, the consultants who advise NLM on the selection of literature for *Index Medicus* reviewed and rated 297 journals Of these, 57 were accepted for inclusion in *Index Medicus* The consultants also reviewed currently indexed journals in the French language and on the topics of orthopedics and substance abuse Nine of these journals were dropped either because they had ceased publication or were considered to have limited value for *Index Medicus* users At the end of the year, there were 2,730 titles being indexed for *Index Medicus* and a total of 3,690 titles represented in MEDLINE, the Health Planning and Administration File, and POPLINE

A total of 307,333 citations for indexed articles were added to MEDLINE in FY 1985 Of these, 280,379 citations were published in *Index Medicus* Abstracts were added to the MEDLINE file for 177,000 or 59% of the citations added to that database Of the articles indexed for *Index Medicus* this year, 24% were indexed by NLM staff, 9% directly by foreign MEDLARS centers or through arrangements made by them with U S commercial firms, and 67% by NLM contractors The Chinese Academy of Medical Sciences began indexing all Chinese *Index Medicus* journals in January 1985

The online indexing system continued to function well for inhouse indexers, and use of the system was extended to contract indexers working in the local area If communications problems can be resolved successfully, the online indexing system will also be made available to contract indexers at more distant sites

Network Services

NLM's services to remote users throughout the U S include (1) distributing its authoritative cataloging and indexing data in publications, machine-readable formats and an online search service, (2) answering telephone reference questions and reference correspondence, (3) sending documents or copies of documents needed by U S health professionals and researchers, and (4) directing the Regional Medical Library Network, which links U S biomedical libraries in an effort to make quality biomedical information services available to all health professionals irrespective of their geographic location

Publications The Library first began publishing its cataloging and indexing data in a systematic way in the 1870's The *Catalogue of the Library of the Surgeon General's Office* appeared in 1872 The first issue of *Index Medicus* appeared in 1879, to be followed in 1880 by the first volume of the *Index-Catalogue of the Library of the Surgeon General's Office* In 1964, the Library introduced MEDLARS (Medical Literature Analysis and Retrieval System) which included the first publication-quality computerized phototypesetting capability and greatly improved NLM's ability to publish its indexing and cataloging data in a timely fashion Today NLM produces some 85 individual issues of various bibliographic tools on either paper or microfiche, including *Index Medicus*, *National Library of Medicine Current Catalog*, the *National Library of Medicine Audiovisuals Catalog*, the *Bibliography of the History of Medicine*, the *1984 Index of NLM Serial Titles* the *Medical Subject Headings*, and several specialized recurring bibliographies NLM collaborates with other organizations such as the American Hospital
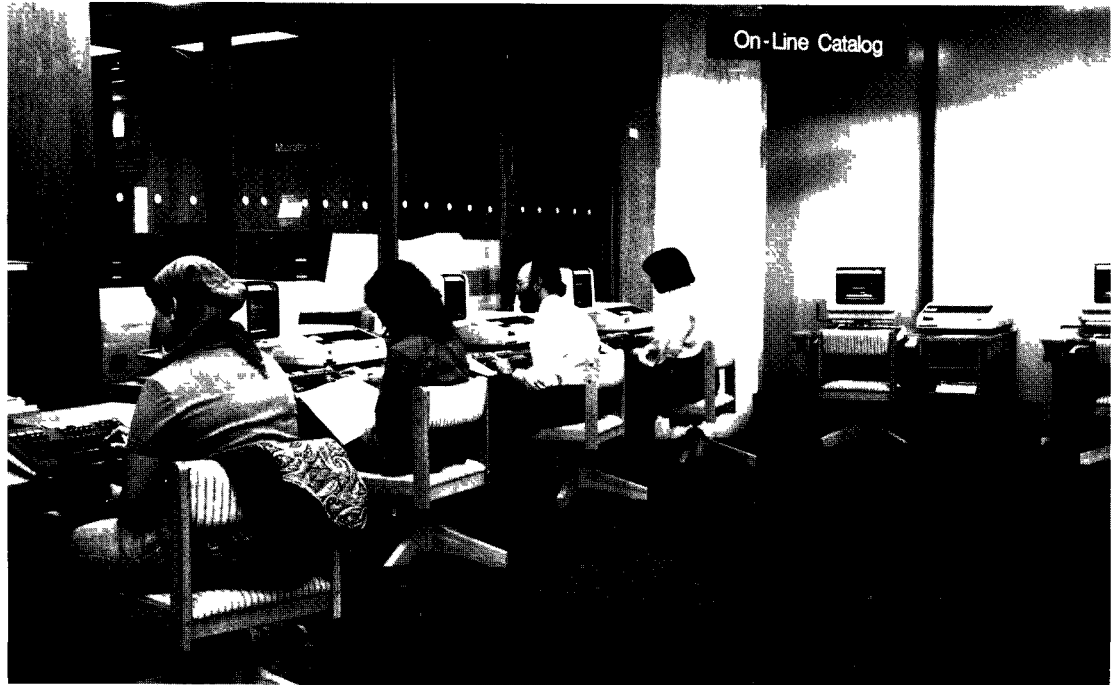
Association, the American Dental Association, and the American Journal of Nursing Company to produce some of these specialized indexes Probably the best seller is *Index Medicus*, NLM's major index to 2,730 biomedical journals, which had more than 5,200 subscribers in FY 1985.

An important new publication which will become available in October 1985 is the microfiche *NLM Catalog*, including records for approximately 575,000 books, serials, and modern manuscripts cataloged by NLM before 1985. A quarterly microfiche *NLM Catalog—Supplement*, covering cataloging records produced from 1985 to the present also will begin publication in FY 1986.

In addition to its catalogs and indexes, NLM also published several Literature Searches on specific topics of current interest, such as child abuse,

financing health care for the elderly, and acquired immunodeficiency syndrome (AIDS). The Literature Search on AIDS is updated quarterly to make the latest research results more readily available to investigators in this field. More than 72,000 copies of various Literature Searches were distributed by NLM in FY 1985. Health professionals may now request Literature Searches directly through GTE MEDMAIL.

In FY 1985, the 1984 *Cumulated Index Medicus* and the annual 1984 *National Library of Medicine Current Catalog* were printed on more permanent "acid-free" paper This is part of NLM's effort to reduce the future cost of preservation of the biomedical literature by encouraging publication in more durable media

From time to time, new editions of unique items in the NLM collection are published by

other organizations. In 1985, an edition of an 1839 William Budd manuscript from the NLM's modern manuscripts collection was published by Johns Hopkins University Press. The work, entitled "On the Causes of Fevers," was edited by Dr. Dale C. Smith.

Machine Readable Databases. Almost as soon as NLM's indexing and cataloging data were automated, the Library began to make these data available to other organizations in machine-readable form. Beginning in 1964, tapes of MEDLARS indexing records were made available to several U.S. institutions to support the decentralization of the MEDLARS demand search program. In 1966, the British Library became the first foreign institution to mount the MEDLARS tapes and provide search service to the international community. From these beginnings, NLM's tape distribution service has grown to include the dispatch of 2,000 tapes of various databases to 31 domestic and foreign licensees each year.

NLM is continuing efforts to ensure the broadest possible availability of its databases. In FY 1985, the Library began to distribute subsets of the MEDLINE database to U.S individuals and institutions; by the end of the year there were eight subscribers to this service The Library also developed a new policy to permit domestic licensees to redistribute portions of the file subject to certain conditions and restrictions NLM has entered into agreements with several commercial firms to allow them to produce compact disk copies of MEDLINE data on an experimental basis.

In order to make its cataloging records easily usable by the library community, NLM distributes them in standard MARC (Machine Readable Cataloging) format. In FY 1985, NLM's audiovisual cataloging records became available in this format for the first time. All NLM cataloging records are

Table 5
Online Searches

Online Databases	FY 1983	FY 1984	FY 1985
AVLINE	19,050	11,339	11,155
BIOETHICS	4,047	4,580	5,392
CANCERLIT	45,739	48,664	51,582
CANCERPROJ	3,099	1,797	1,875
CATLINE	250,729	156,914	138,818
CHEMLINE	40,880	32,614	28,459
CLINPROT	3,166	2,405	3,378
DIRECTORY	420	840	50
DIRLINE	1,389	2,446	2,758
EPILEPSYLINE	326		
EXPRESS	1,087	1,761	1,173
HEALTH	81,289	90,140	99,666
HISTLINE	4,460	4,173	3,766
HSDB			4,999
INFORM		47	117
INTOX			292
INTROMED		719	4,906
MEDLINE	951,582	1,199,482	1,282,755
MED80		247,046	353,978
MED79	28,482		
MED77	193,796	189,077	153,886
MED75	67,478	90,644	86,758
MED71	46,211	62,799	57,985
MED66	30,145	45,500	45,598
MESH VOCABULARY	20,469	12,141	10,083
NAME AUTHORITY	16,528	5,322	4,499
PDQ-Elhill	7,124	4,724	1,426
PDQ-User Friendly System		1,949	19,742
POPLINE	18,652	19,486	25,588
RTECS	17,578	8,512	10,535
SDILINE	18,619	25,979	28,856
SERLINE	48,941	29,887	30,307
STORED SEARCH	49	89	88
TDB-ELHILL	19,737	7,470	8,849
TDB-Toxnet			372
TOXLINE	67,381	75,190	71,959
TOXBACK76		2,889	20,216
TOXBACK74	11,651	11,518	
TOXBACK65	411	8,246	14,158
TOTAL	2,020,515	2,406,389	2,586,024

Table 6
Offline Searches

Online Databases	FY 1983	FY 1984	FY 1985
AVLINE	104	320	278
BIOETHICS	18	65	19
CANCERLIT	5,095	5,766	5,989
CANCERPROJ	31	10	18
CATLINE	137	333	357
CHEMLINE	14	20	81
CLINPROT	7	5	6
DIRLINE	1	8	3
EPILEPSYLINE	3		
EXPRESS	20	65	35
HEALTH	7,147	9,997	11,664
HISTLINE	3	9	5
HSDB			0
MEDLINE	26,771	26,628	19,949
MED80		25,803	26,653
MED79	8,972		
MED77	35,906	29,610	21,080
MED75	31,212	21,817	16,379
MED72	8,413		
MED71	15,501	15,432	10,309
MED69	5,966		
MED66	14,166	10,462	7,631
MESH VOCABULARY	6	8	17
POPLINE	6,342	9,688	12,804
RTECS	124	124	248
SDILINE	197,762	218,110	228,039
SERLINE	10	15	2
TDB-Elhill	117	103	243
TOXLINE	18,591	17,097	17,230
TOXBACK76		111	1,370
TOXBACK74	4,410	2,263	
TOXBACK65	4,984	1,996	1,164
TOTAL	391,833	395,865	381,573

now available in MARC. NLM also intends to distribute MeSH in MARC format after the MEDLARS III subject authority module is implemented in FY 1987 or 1988.

Online Services. The precursor to NLM's online search services, the MEDLARS batch search service, was implemented in 1965. General online access to MEDLARS data began in 1971 with the advent of MEDLINE, the first public online file accessible through a national telecommunications network. The original MEDLINE file contained citations to recent articles in a subset of the journals in *Index Medicus.* From that beginning has evolved NLM's current online services which include 27 different databases and 4.75 million MEDLINE citations from 1966 to the present.

Currently, there are 3,621 domestic institutions and 630 individuals with access codes to the NLM's MEDLARS system The number of individual health professionals and researchers using the system increased 326% during FY 1985, due in large part to the many special training classes in online searching for health professionals conducted by librarians throughout the country using materials prepared by NLM. NLM's *The Basics of Searching MEDLINE. A Guide for Health Professionals* was published in 1985 and is available through the National Technical Information Service (NTIS).

The average monthly connect hour usage of MEDLARS files was 19,613 hours, 2.5% higher than the average monthly usage in FY 1984. The total annual usage of NLM's MEDLARS system was 235,360 connect hours. The MEDLARS databases are also heavily used on the systems of other U.S. database vendors and foreign MEDLARS centers, which lease copies of certain NLM files.

In FY 1985, NLM extended the hours of

availability for the online system to around-the-clock service, seven days a week The monthly minimum charge for each online access code was discontinued, users are now charged only for actual system usage The new user-friendly TOXNET system, which provides access to chemical, toxicological, and hazardous waste data, became available to all users of NLM s MEDLARS system

Approximately 1,080 people received training in searching NLM databases in the 46 regular classes and 4 special classes held to prepare searchers to teach MEDLINE to health professionals in FY 1985 LO staff conducted 19 classes at NLM and 5 in other locations in the United States UCLA and the University of Nebraska, two Regional Medical Libraries which provide online search training for MEDLARS databases under contract to NLM, conducted 22 classes Health sciences librarians throughout the country also taught many special online searching classes for health professionals

Reference Assistance In FY 1985, NLM responded to 26,318 reference inquiries received via telephone or mail Requests may be for specific facts or information on a health related topic of current interest, for recommendations of audiovisuals or other materials appropriate for a specific educational purpose, or for a fuller description of certain films, pictures, manuscripts or books in NLM's extensive historical collections Many requesters are unaware of the biomedical information resources available locally or of the various information clearinghouses operated by other federal agencies In addition to providing some information to answer the immediate question, NLM staff also direct people to other agencies that can be of assistance NLM also responds rapidly, usually the same day, to a

variety of special information requests from members of Congress, the Supreme Court, the Office of the President, the Secretary of the Department of Health and Human Services, and other federal agencies

Document Delivery The Library began lending items in its collections to distant libraries and physicians on a regular basis in the 1870's By 1885, the number of borrowers outnumbered actual visitors to the Library In 1940, the document delivery service was enhanced when the Library began to offer microfilm copies of some items in its collection The first paper copies or photoprints of library materials became available in 1946 As demand for copies of journal articles in the NLM collection increased, the Library installed moveable cameras in the journal stack areas in 1962 so that articles could be filmed quickly without transporting materials away from the shelves The film was then developed in the Library and paper copies printed from it for delivery to requesters The mobile cameras remained in operation until 1980, when photocopiers that could be easily moved on wheeled carts became available to the Library

The introduction of MEDLINE In 1971 made it much easier for physicians and researchers to identify articles of interest and caused the number of requests for biomedical documents to increase dramatically nationwide Fortunately, the Regional Medical Library program provides support to health sciences libraries for responding to the increased demand and helps distribute the request load efficiently among these libraries and NLM

In FY 1985, NLM filled 109,304 requests for interlibrary loans or photocopies of books and journal articles, 89% were filled within four days of receipt NLM's loan service was expanded to

Table 7
Circulation Statistics

Activity	FY 1983	FY 1984	FY 1985
Requests Received:	395,957	358,654	390,058
For Interlibrary Loan	216,536	147,017	144,346
For Readers............................... .	179,421	211,637	245,712
Requests Filled:	332,478	299,681	327,125
For Interlibrary Loan	169,501	109,257	109,304
Photocopy	159,583	102,723	102,698
Original	9,918	6,534	6,606
For Audiovisual Loan	5,087*	4,183*	1,545
For Readers............................	157,890	186,241	216,276
Requests Unfilled:	63,552	54,737	57,347
Interlibrary Loan	41,941	33,577	27,911
Rejected...................	14,167	12,572	10,366
Referred	3,718	1,975	1,504
Returned as Unavailable.	24,056	19,030	16,041
Reader Service			
Returned as Unavailable................. .	21,611	25,160	29,436

*Includes videocassettes loaned by the Audiovisual Resources Section and motion pictures circulated from an off-site contract facility directly to individuals for educational use Beginning in FY 1985, all audiovisual programs in the NLM collection are available for loan, and the contract for motion picture distribution has been discontinued

cover all audiovisual programs in the NLM collection; over 1,500 audiovisuals were loaned during the year. When requests are received for documents not available in the NLM collection, the Library may refer these requests to other institutions that own the requested items. Since 1973, NLM has been referring requests it cannot fill to the British Library Lending Division. During FY 1985, NLM also made arrangements to refer unfilled requests in particular subject areas to the Asa S. Bacon Memorial Library of the American Hospital Association, the American Journal of Nursing Company, and the National

Agricultural Library (NAL).

NLM's automated support to document delivery activities was improved substantially during FY 1985. The new DOCLINE system, NLM's automated document request and referral system, became available for use by health sciences libraries throughout the country. One hundred thirteen network libraries were using the system at the end of FY 1985; during FY 1986, the Regional Medical Libraries will assist NLM in extending the use of DOCLINE to many more U.S. health science libraries. DOCLINE is linked to MEDLINE,

CATLINE, and AVLINE to facilitate generating requests It uses data in SERHOLD, NLM's computerized serials holdings database, to identify which libraries own requested journal articles and to route the requests to those libraries automatically SERHOLD now contains more than 700,000 holdings statements for some 1,750 U S biomedical libraries It is also used to generate Regional Union Lists Other efforts to enhance automated support for document delivery service included expansion of the number of electronic mail systems from which NLM accepts document requests and a test project to receive document requests via OCLC In FY 1985, NLM used telefacsimile equipment to fill three emergency requests from hospitals to provide articles related to critical patient care problems NLM intends to test broader use of telefacsimile for document delivery in FY 1986

Regional Medical Library Program The Medical Library Assistance Act of 1965 was a response to a growing concern that the nation's medical libraries did not have the organization, resources, and facilities needed to ensure that the results of medical research were communicated to health professionals in every area of the country The Act authorized NLM to use grant funds to assist U S medical libraries in a variety of ways, including the establishment of Regional Medical Libraries to coordinate a network of biomedical libraries and to act as back-up service centers for other health sciences libraries in particular regions In 1967, the Francis A Countway Library at Harvard University was awarded the first Regional Medical Library grant From 1968 to 1970, grants were awarded to nine other institutions to serve as Regional Medical Libraries There were 11 Regions in all, NLM itself

served as the Regional Medical Library for Region IV In 1971/72, the Regional Medical Library awards were converted from grants to contracts to allow for greater national coordination of the network

Initially, the Regional Medical Library program served as a vehicle for partially subsidizing the costs incurred by one library in filling an interlibrary loan request for another This encouraged the development of more efficient hierarchical patterns for referring loan requests throughout the country and of national standards for handling requests Once the interlibrary loan program was operating effectively, the amount of the subsidy was gradually reduced until it was eliminated in 1976 In 1982, regional boundaries were reconfigured to reduce the number of Regions from 11 to 7 This change was made to reduce the amount of administrative overhead for the program and make a larger proportion of funds available for network services New three-year Regional Medical Library contracts were awarded to seven institutions in 1982/83 At that time, NLM ceased to serve as a Regional Medical Library in order to concentrate its resources on serving as a national backup for the system

Today, approximately 2,000,000 requests for journal articles, books, and audiovisual programs are filled for health professionals by libraries in the Regional Medical Library Network each year The RMLs themselves fill 112,000 requests annually, NLM, as national backup, filled almost 111,000 requests in 1985 The Regional Medical Libraries also develop outreach services to health professionals in areas without adequate library services, promote resource sharing among health sciences libraries, encourage and support use of online services within their regions, and provide training and consultation to hospital librarians to improve
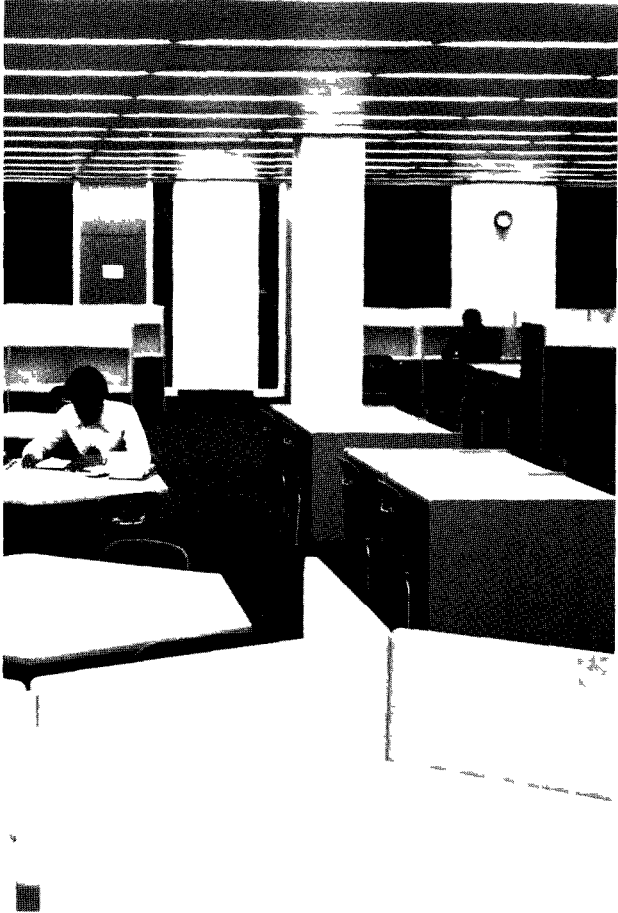
**University of Illinois at
Chicago Library of the
Health Sciences**

Region 5
**University of Texas
Health Science Center
at Dallas**

Region 7
**UCLA Biomedical Library,
Center for the
Health Sciences**

Region 2
**University of Maryland
Health Sciences Library**

Region 4
**University of Nebraska
Medical Center Library**

Table 8
Reference Services

	FY 1983	FY 1984	FY 1985
Reference Section			
Requests by telephone....	15,157	20,069	21,746
Requests by mail	386	527	512
Readers assisted	42,318	39,255*	42,176
Total	5⁻,861	59,851*	64,434
Audiovisual Resources Section			
Requests by telephone.	2,123	2,473	2,472
Requests by mail	2,300	1,579	1,588
Readers assisted	220	383	385
Total	4,643	4,435	4,445
Total reference service	62,504	64,286*	68,879
Reading Room users registered	23,096	26,273	27,579

*Adjusted figure

information services to health professionals

In FY 1985, the recompetition of the RML contracts for the period 1986-90 began. Initial technical and budget reviews were completed for all proposals received. The contracts will be awarded between October 1985 and January 1986 The new RML services contracts will place greater emphasis on cooperative collection development and preservation activities, while continuing document delivery and information access programs.

Onsite Services

NLM provides a variety of services for people who come to the Library in Bethesda These services include reference and research assistance, access to materials in the collection, guided tours and briefings on NLM's services and operations, and special programs related to the history of medicine. NLM also directs a special one-year onsite training program for library school graduates with high potential in the health sciences library/information field

Table 9
History of Medicine Activities

	FY 1983	FY 1984	FY 1985
Acquisitions			
Books	253	271	438
Modern manuscripts	46,313	33,024	193,101
Prints and photographs	346	459	298
Processing			
Titles cataloged	862	349	326
Modern manuscripts cataloged	51,353	36,209	91,304
Pictures cataloged	188	1,436	163
Citations indexed	6,178	6,000	4,954
Pages microfilmed	103,930	80,817	94,594
Public Service			
Reference questions answered	2,378	2,659	3,903
ILL and pay orders filled	2,575	2,118	2,042
Reader requests filled	5,236	5,061	4,981
Pictures supplied	2,209	2,627	3,252

Reference and Research Assistance Since the 1870's the Library has been available to any researcher who wished to make direct use of its comprehensive collection and services. In FY 1985, a record number of people came to NLM to use its two Reading Rooms and Learning Resource Center. These visitors requested that 245,712 books, journals, and audiovisual programs be retrieved from NLM's closed stacks, 16% more than the number of items requested last year. Onsite users also asked 68,589 reference questions and received the results of 3,670 online searches. Use of NLM's collection of modern audiovisuals, historical films, and picture collections continued to grow.

During FY 1985, an improved version of CITE/CATLINE, NLM's prototype online catalog, became available to the public, and plans to remove the card catalog from the main public service area were developed and approved. The space vacated by the removal of the card catalog will be used for a combination of reference service and exhibits In a complementary project, staff prepared plans to redesign, recarpet, and refurnish the main Reading Room. The two areas will be renovated in early FY 1986.

Public Tours During FY 1985, LO staff conducted 158 regularly scheduled tours for a total of 591 visitors. Of these, 24% were students, interns, or

collections extensively. They are also available for staff consultation, for one or more public presentations, and for assessing segments of the collection

Dr. Thomas Hall participated in the prototype of the Visiting Scholar Program in 1985. Dr. Hall used the NLM's collections for his research on the influence of Descartes on medicine and delivered a public lecture at NLM on "Physiology and the Kuhnian Hypothesis — Evolution or Revolution" on June 3. Dr. James Harvey Young is the first competitively selected Visiting Scholar. He will come to the Library in FY 1986 to pursue his research on the history of the Food and Drug Administration. NLM has also contracted with Dr. Morris Collen to write a history of medical computing using materials available at NLM and elsewhere and to advise the Library on important documents to acquire in this field

The responsibilities of some staff in NLM's History of Medicine Division include research using NLM's historical collections. Staff research was published in several publications and also presented at invited lectures during the year. The series of internal seminars given for History of Medicine staff by staff and other scholars using the NLM historical collections continued in 1985.

residents; 24% were librarians or others associated with the information science field; 13% were health professionals; 8% were NLM or NIH staff; 18% were foreign visitors; and 13% belonged to other categories. Another 1,100 (104 groups) received special programs and tours arranged by the Office of Inquiries and Publications Management (Office of the Director). Many individual visitors also received special briefings on library programs and services.

Special Historical Programs NLM's new Visiting Scholar Program was initiated during FY 1985. Under this program, each year a recognized historical scholar is invited to spend from 6 to 12 months at the Library. Scholars are expected to engage in research that will use the NLM historical

Services to NIH and NLM Staff. NLM provides special support to some National Institutes of Health (NIH) programs, although the NIH Library has the primary responsibility for library and information services to NIH employees. Library Operations' staff prepare Literature Searches for distribution to the participants in many of the NIH Consensus Development Conferences and provide Public Health Service officials with up-to-date information on publications dealing with acquired immunodeficiency syndrome (AIDS) through special monthly supplements to the quarterly

Literature Searches on AIDS. The NIH Library relies on NLM's Learning Resource Center to provide audiovisual services to NIH employees. Library Operations' staff members also serve on advisory committees to the NIH Library, as advisors to public information clearinghouses operated by various institutes, and on special committees formed to address high priority health issues

A Staff Library is maintained to assist NLM employees in obtaining the information needed to meet their various job responsibilities. In FY 1985, a microcomputer support center was added to the Staff Library facilities, online search and interlibrary services were expanded, and a new brochure describing Staff Library policies and services was issued.

NLM Associate Program The Library's first postgraduate training program for health sciences librarians ran from 1957 to 1964. After a brief hiatus, the program was restructured and reinstituted in 1966 as the NLM Associate Program, which has continued to the present The one-year competitive program provides three to six library school graduates an opportunity to learn about the full range of activities performed by NLM and other health sciences libraries, to use the latest information technology, and to develop their skills through the conduct of special projects Associates also visit various types of health sciences libraries/information centers and other national libraries and attend professional meetings.

Since 1966, a total of 88 people have participated in the Associate Program Of these, 81 percent are still in the library and information field. Thirty-two percent are currently employed by NLM, including several who have left the Library to work in other health sciences libraries

and later returned. Thirty-three percent are now working in other health sciences libraries; 8% in other types of libraries; and 8% in other aspects of the information field. Five Associates completed the program in August 1985; three new Associates began their year at NLM in September 1985. In FY 1986, NLM will offer an international traineeship for one librarian from outside the United States to participate in the NLM Associate Program. In this arrangement, NLM will provide the training, but will not assume the cost for the trainee's travel or stay in the U.S.

NLM *in the headlines* . . .
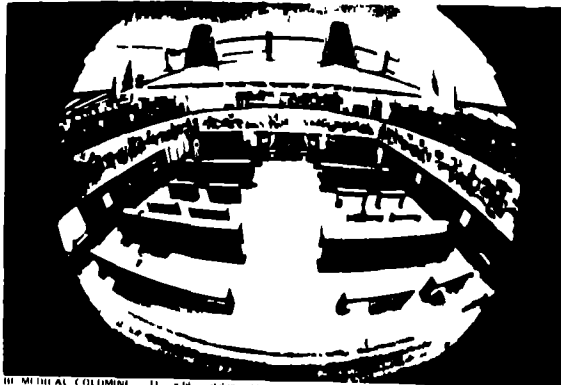
National information center

Growing library offers medical data

MEDICAL LIBRARY

Medicine's ancient lore is valued too

Online Computer Database Provides Information on Health Organizations

Medical Library Is as Modern As Trip to Moon

Medical Data on Only Minutes Notice

A Computer System at the National Library of Medicine near Bethesda Makes World Knowledge Quickly Available
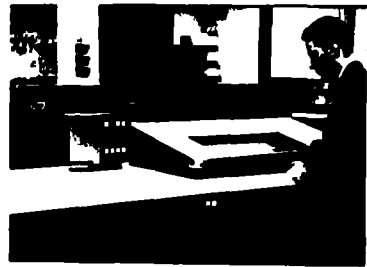
Microanatomy Tutorial at The National Li

New computers spe

Medical Schools Urged To Use National Library

Mecca for Researchers From All Over

Library of Medicine works

PDQ: Where The Best Care Is

A Data Bank To Help Fill The 'Cancer Gap'

By RONALD KOTULAK and JON VAN

Services from the National Library of Medicine

12 nations linked to huge data bank
MEDLARS provides access to medical literature

Automatic Journal Search Is Quick, Cheap, Thorough

DATABASES

Swamped Medical Library Inches Toward Retooling

DATABASES

Library Initiates Biomedical Holdings

'Medical Libr

MDR May/June 1985

A H P   **JANUARY, 1980**

IEDLARS, Heart of National Library of Medicine's Network of Knowledge

Computer indexes medical data

Spreading the Medical Word

National Library of Medicine Marks 150 Years of Preserving What's Been Learned

by Judy Arroy

Applications
of Medicine

Intelligent Images,
National Library of
Medicine Share
Nebraska Award

with Sciences _____ Sept Oct 1985

I Intelligent Images,
National Library of
Medicine Share
Nebraska Award

Online Computer Database Provides
Information on Health Organizations

BETHESDA, Md.

20 THE KANSAS CITY TIMES,
Thursday, April 30, 1979

A Computer Hook-Up
Way to Medical Data

By Phillip S. Trimble

Cancer treatment data
offered by computer

March 28, 1981   HEALTHCARE NEWS   Page one

d data to medics

NASHVILLE TENNESSEAN   November 23, 1976

Computers come
to aid of doctors

By Sandra Rubin Tessler

ledical Data To Be Flashed

int Library
nputer Link
in 3 Years

Lister Hill Medical Center
Announces TIME Project

Medical computer
links country, city

By Cheryl Fischer

A bank of medical memories

WORD FROM WASHINGTON

Your National Library of Medicine

Is Government at Its Best

Andy Rooney

PUSH-BUTTON BRAINS PRODUCE . . .

FASTER FACTS
FOR DOCTORS

The National Library of Medicine collects
and dispenses knowledge electronically
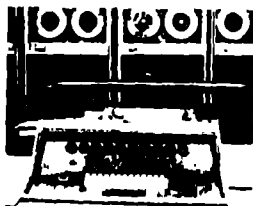
FMH physicians purchase
global database system

By GWEN McKENTIRE
News Post Staff

THE POST
Saturday October 17, 1981   A-3

UNIQUE MEDICAL LIBRARY
TO SERVE MIDDLE EAST

Mathias asks recognition
for national medical library

NLM Launches Automated ILL System

NLM Develops Subset Policy

U S MEDICINE

Medical Library Has
Variety Of Functions

Satellite Links Remote Alaskans with Doctors

Specialized Information Services

Henry M. Kissman, Ph.D.
Associate Director, Specialized Information Services

Introduction

The field of toxicology, barely recognized as a distinct science 25 years ago, has grown at an unprecedented rate and has generated large quantities of data and information. The public interest in toxicology as a social concern and the resultant laws and regulation have fueled—and have been fueled by—extensive testing and research. Technological innovations in computers and communication, advancing at a rate no less than toxicology information, have resulted in sophisticated systems for collecting, organizing, and distributing this information. From the early days of toxicology to the present, the National Library of Medicine through its Toxicology Information Program operated by the Division of Specialized Information Services, has been a leader in providing the toxicology community with readily accessible quality information.

Established in 1967, the Toxicology Information Program (TIP) is a direct outgrowth of the recommendations made by the President's Science Advisory Committee in 1966 which found that "there exists an urgent need for a much more coordinated and more complete computer-based file of toxicological information than any currently available and further, that access to this file must be more generally available to all those legitimately needing such information." The TIP was created to meet these needs. It continues to search for innovative ways to provide toxicology information services to its growing user community.

Over time, TIP has concentrated on providing three types of services: publications, query response services, and online retrieval. TIP's early efforts were directed to publications and query response while it investigated the rapidly changing computer and telecommunication technologies as means of designing automated toxicology information systems. Ultimately, interactive online retrieval services were to play—as they still do—the major role in TIP's activities. Following NLM's pioneering lead in developing MEDLINE, the earliest significant online bibliographic retrieval system, the TIP in 1972 unveiled TOXLINE, the first online retrieval service for the toxicology literature. The same year saw the development of CHEMLINE, an online chemical dictionary that facilitated the searching of TOXLINE and other information sources

In the late 1970's, TIP made publicly available two toxicology data retrieval systems, the TDB (Toxicology Data Bank) and RTECS (Registry of Toxic Effects of Chemical Substances). TDB is built and maintained by the TIP. RTECS is produced by the National Institute for Occupational Safety and Health as a publication and is maintained as an online service on the NLM MEDLARS network. The most recent of TIP's online services are DIRLINE (Directory of Information Resources Online) and HSDB (Hazardous Substances Data Bank) Other major TIP developments have been the creation of TOXNET (Toxicology Data Network), a new integrated software system which facilitates the building and searching of factual databases, and micro-CSIN, which permits and assists the rapid retrieval of information from a variety of disparate online systems.

Throughout its history, the TIP has maintained a linkage to the toxicology community through TIPCOM (Toxicology Information Program Committee), an advisory committee, which has been operated for the Library by the National Academy of Sciences (NAS). Through the years, TIPCOM has been staffed by some of the leading toxicologists in the United States. Many of these

scientists have also been active in the Society of Toxicology and other professional groups, and, thus, have been able to keep close track of the information needs of toxicology and related fields.

This year, as part of its long-range planning effort, TIPCOM has recommended that NLM investigate the adequacy of information handling in the burgeoning field of biotechnology. Areas that might require attention are nomenclature, linkage among sequence data banks, and current strategies for capturing information and data from the biotechnology literature for subsequent search and retrieval. In response to these recommendations, NLM will support a National Academy of Sciences Workshop on Biotechnology Nomenclature and Information Organization in May 1986.

Online Services

As mentioned, TIP is responsible for several of NLM's online services such as CHEMLINE, TOXLINE, RTECS, DIRLINE, TDB and HSDB. Prior to this year all the TIP-managed online databases operated under the NLM ELHILL software. With the advent of TOXNET, some of these files are now accessible through it, while others remain in the ELHILL system.

I. Databases under ELHILL

CHEMLINE (Chemical Dictionary Online) is an online chemical dictionary and directory file which allows users to verify chemical nomenclature and structure, and to formulate optimum search strategies for other NLM files. Each chemical record also has pointers to these other files which may contain information about that substance. CHEMLINE is built and maintained in collaboration with Chemical Abstracts Services (CAS). It is updated bimonthly and regenerated annually, and now contains over 650,000 records.

During FY 1985, efforts continued to improve CHEMLINE to meet the changing needs of its users. An important tool to accomplish this was a questionnaire-based survey of 1,390 users of online chemical databases, including CHEMLINE. Respondents indicated general satisfaction with CHEMLINE, but also identified changes that might further assist users. A final report on the survey and its results is being prepared for publication.

A major augmentation to the nomenclature coverage of CHEMLINE was the addition of some 14,800 drug names, taken from the publication *USAN and the USP Dictionary of Drug Names*, to over 5,500 CHEMLINE records. These data were obtained through an agreement with the United States Pharmacopeial Convention. The project of adding ring structure information to records for cyclic compounds in CHEMLINE was continued with the enhancement of 9000 records.

TOXLINE (Toxicology Information Online) is an online bibliographic retrieval service, produced by merging "toxicology subsets" from some eleven other secondary sources, including *Biological Abstracts, Chemical Abstracts, Government Reports Announcement and Index* (report literature), *International Pharmaceutical Abstracts* and *Index Medicus*. TOXLINE and its two backfiles TOXBACK76 and TOXBACK65 now contain some 1,770,000 records.

Three new subfiles were added to TOXLINE this year. These were subsets from the *Hazardous Material Technical Center Abstract Bulletin* (a Defense Department-sponsored project), *CIS*

Abstracts (from the U N 's International Labour Organization), and from CRISP (Computer Retrieval of Information on Scientific Projects), the NIH grants information database Another major enrichment of TOXLINE was initiated by a change in the contract with BIOSIS through which NLM obtains material from *Biological Abstracts* Input from this source will triple to about 37,000 records per year with increased coverage in the areas of occupational exposure to chemicals, disposal methods, and environmental effects of chemical waste dumps

RTECS (Registry of Toxic Effects of Chemical Substances) This online data retrieval service is based upon a database which NLM obtains from the National Institute for Occupational Safety and Health This year, NLM enriched this file by adding Chemical Abstracts Service (CAS) Registry Numbers to RTECS records which did not have them These identification numbers are crucial for unequivocal data retrieval and for matching RTECS records with those in other fields Some 4,700 records were enhanced in this way, another 14,000 remain to be processed RTECS now contains some 76,000 records.

DIRLINE (Directory of Information Resources Online), an online directory which refers MEDLARS users to organizations and other sources that can provide information in specific subject areas, has been available as one of the NLM online services since August 1984 At present, DIRLINE receives records from the Library of Congress' National Referral Center (NRC) database and from DHHS' National Health Information Clearinghouse (NHIC) database The NRC component contains some 14,000 records while the NHIC file has approximately 950 records

II TOXNET and its Files

TIP's major file building and enrichment efforts this year continued to be supported partially with Superfund resources Superfund—or CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act of 1980)—charged the Department of Health and Human Services with certain responsibilities for the cleanup of abandoned chemical dump sites and responses to accidents involving hazardous chemicals The lead agency in the Department for Superfund-related activities is the Agency for Toxic Substances and Disease Registry (ATSDR) Relevant information activities, such as file building and creation of improved access methods to information resources, are carried out by NLM under an agreement with ATSDR The predominant TIP activity supported by Superfund has been an enhancement of its data retrieval service, TDB, which involved among others, the development of TOXNET, a new file building and online search system

It is best to describe these efforts by starting with TOXNET This system, developed jointly with the Lister Hill Center, became fully operational and publicly available to domestic MEDLARS users on July 1, 1985 TOXNET, operating on a Data General minicomputer in a contractor facility, consists of modules for online file building, review and editing, electronic mail/messaging, in-process control/tracking and online search and retrieval Several contractors build TOXNET files online, while reviewers at a variety of sites inspect the files and recommend changes online The NLM MEDLARS user can search TOXNET in a query language that appears very similar to ELHILL while offering enhanced capabilities An even more user friendly access system, using menus, is being

designed for the novice or occasional user

In addition to the NLM TOXNET file described below, the CCRIS (Chemical Carcinogenesis Research Information System) file of the National Cancer Institute, is expected to be mounted in TOXNET early in FY 1986. Later in the year, RTECS will be moved from ELHILL to join the other TOXNET data files. TOXNET will eventually contain a cluster of toxicology data banks and will accommodate cross-file searching.

TDB (Toxicology Data Bank) is an online interactive data retrieval service focusing on the toxicological properties of selected chemical substances. TDB now contains over 4,100 records, each consisting of 96 data elements. This file is an expanded version of the discontinued ELHILL/TDB and has, itself, been used as a starting point to develop the even more extensive HSDB (see below). As stated, both TDB and HSDB file building and enrichment have been partially supported by Superfund.

In line with the changes in scope and coverage of the TDB, it became necessary to restructure the 10-year old review mechanism for the TDB. At the same time, the NIH Division of Research Grants, which operated the TDB Peer Review Committee (PRC) for NLM, recommended that the Library replace this committee with a new mechanism for reviewing file content. Accordingly, the PRC was dissolved in June, 1985. A new scientific review panel appointed by NLM and operated by a contractor, will be in place in October 1985. It will be cofunded by the Department of Defense (DOD) and will review TDB and HSDB content as well as some material from the DOD-sponsored Hazardous Material Technical Center.

HSDB (Hazardous Substances Data Bank) is another online data retrieval system. At this time it describes the same 4,100 records that are contained in TDB. Each record has 144 data elements. The scope of HSDB includes and expands upon that of the TDB by providing fuller information primarily in the areas of environmental fate and exposure, standards and regulations, monitoring and analysis, and safety and handling. Data are extracted from TDB source materials as well as from various other sources, such as Government documents and material safety data sheets. HSDB is edited and then scientifically reviewed by the new scientific review panel.

INTROTOX, a small subset of the HSDB file, was created as a practice file to allow users to experiment with searching the TOXNET system at a reduced rate.

User Support for the online files is an ongoing TIP function. The manual and pocket cards for the TOXLINE and CHEMLINE services were revised and a videocassette describing the entire Toxicology Information Program was produced. A specialized training program was initiated at professional meetings of technical societies such as the American Chemical Society and the Society of Toxicology. This training is provided in conjunction with the meeting exhibit program, to acquaint potential users with the toxicology information services of NLM. A microcomputer demonstration diskette to introduce prospective users to the online services was developed.

Information Services to Other Agencies

The Toxicology Information Program continues to provide information services to several other Federal agencies and to chair two interagency committees

Collaboration with the Agency for Toxic Substances and Disease Registry (ATSDR) ATSDR—a unit of the Centers for Disease Control—is the lead agency for Superfund activities in DHHS, all Superfund-related NLM activities proceed under an interagency agreement with this agency Some of the major file enrichment activities carried out with partial Superfund support already have been described and so has the development of the file building and online access capabilities represented by TOXNET Another project in this cluster is the development of a microcomputer workstation for chemical emergency response information

Since 1983, TIP, in collaboration with the Lister Hill Center and ATSDR, has worked on a *microcomputer workstation* designed to permit rapid retrieval of information located in a variety of different online databases in different vendor systems It will be used in chemical emergencies such as spills or fires This workstation, based on a software system called micro-CSIN (i e , the microcomputer version of the Chemical Substances Information Network), was first implemented and tested last year in a CODATA microcomputer This year, the system was rewritten in the C language for the much more widely available IBM PC XT and AT microcomputers

The workstation will assist individual searchers, from beginners to experts, to use most online information sources effectively Extensive help messages underlie all of the micro-CSIN menus and options Pre-programmed searches—called scripts—make certain types of searches such as those for the toxic effects of a chemical, run almost automatically Three such scripts, CHEMID (chemical identity), TOXCHEM (toxic effects) and BIBLIO (general bibliographic) have now been implemented and can be used in accessing and searching a variety of services including those of NLM, System Development Corp , BRS, CAS ONLINE and the Chemical Information System (CIS) The workstation is now being field-tested by ATSDR and by several other Government and industrial organizations

As another Superfund-supported function, the Program furnishes information support in the form of on-demand literature searches to the inter-agency Hazardous Waste Information Evaluation Subcommittee

Interagency Subcommittees NLM through the TIP continued to chair the Toxicology Information Subcommittee (recently renamed Subcommittee on Information Coordination) of the DHHS Committee to Coordinate Environmental Health and Related Programs and the CSIN Subcommittee of the Interagency Toxic Substances Data Committee—a body governed jointly by the Environmental Protection Agency and by the Council on Environmental Quality The continuing work on the micro-CSIN workstation, an outgrowth of the original interagency CSIN project, has been described

The Toxicology Information Subcommittee sponsors and monitors the following three projects which the TIP operates

TOX-TIPS (Toxicology Testing-in-Progress) is a monthly publication that describes ongoing or planned toxicity testing in Governmental, industrial or academic laboratories As a current awareness

service, the publication also carries reports on new testing methodologies published in the literature This year, TOX-TIPS added a new alerting service to articles on "alteratives to animal testing" Emphasis is placed on references to articles reporting new *in vitro* methods, use of isolated organ systems, or computer-based modeling systems for biological activities Coverage of DHHS activities in the animal alternative area is also provided

Two other Subcommittee-supported projects feed directly into the TOXLINE database One of these is Research Projects (RPROJ), it carries information about ongoing research in toxicology The other—called Toxicology Document and Data Depository (TD3)—contains information about the toxicology report literature This year, the Research Projects file was augmented with a "toxicology" subset from the NIH CRISP (Computer Retrieval on Scientific Projects) database Through the TD3 project, toxicology-related reports from the *Government Reports Announcement and Index* database of NTIS continue to be added to TOXLINE

In May 1985, TIP co-sponsored a *State/Federal Workshop on the Joint Development of Environmental and Toxicological Information Resources* with the National Governors' Association (NGA), the Association of State and Territorial Health Officials, the Centers for Disease Control and the Environmental Protection Agency The objective of the Workshop was to explore collaborative means of building databases and improving access methodologies for State agencies faced with problems of remedial or acute responses to chemical emergencies stemming from chemical dump sites or accidental spills of hazardous substances Most States have difficulty in amassing or getting ready access to current, accurate and complete information about chemicals and their biological and environmental properties By bringing together representatives from key States and Federal agencies, the sponsors hoped to create a framework for future collaboration in these areas Some 15 States and several Federal agencies were represented at the Workshop A report is being prepared and will be distributed by the NGA to the participants, Governors and health officials in all the States and Territories, and to all others who request copies

SIS/DEA Collaboration SIS supplied a subset of data on selected chemicals from the Hazardous Substances Data Bank for inclusion in the Drug Enforcement Administration's Controlled Substances Information System (CSIS) The set of chemicals for which NLM provided information consisted of materials known to be used in the production or refinement of controlled substances, and included starting chemicals, intermediates, solvents and waste products CSIS is a law enforcement-oriented, encyclopedic database of information on approximately 1,500 controlled substances, and provides online information to authorized DEA personnel on substance hazards, toxicity, use and physical properties

Lister Hill National Center for Biomedical Communications

Earl Henderson*
Acting Director

The research programs of the Center focus on the information needs of the biomedical community and on matching those needs with potential solutions offered by evolving communications and information technologies Early efforts included collaborative projects with federal agencies, consortiums of health organizations, educational groups, and medical disciplinary organizations Computer assisted instruction networks, CTS satellite communications, and early online searching prototypes for MEDLINE are examples of projects in the Center's first ten years

A longstanding goal was achieved in the spring of 1980 with the dedication of the Lister Hill Center building adjacent to the main library building In 1983 the breadth of LHNCBC research interests was expanded through an organizational merger with the National Medical Audiovisual Center, NLM's division charged with the enhancement and use of audiovisual and educational technology

The Center has gradually turned to research-oriented projects with long-term potential for improving patterns of information processing, analysis and retrieval Document image processing, videodisc-based computer assisted instruction and simulation, and artificial intelligence in both expert systems and natural language processing research are among important areas currently under investigation by Lister Hill Center staff Because of these efforts, future users of information services may be able to receive better and more complete information in the form it is best understood and applied

The LHNCBC is managed by a Director and a Deputy Director who provide leadership to the Center's six branches and four laboratories

- Communications Engineering Branch
- Computer Science Branch
- Information Technology Branch
- Audiovisual Program Development Branch
- Health Professions Applications Branch
- Training and Consultation Branch
- Document Image Processing Laboratory
- Microcomputer Technology Laboratory
- Computer Science Resource Laboratory
- Multimedia Development Laboratory

The Board of Scientific Counselors (BoSC) meets to assess the quality of the intramural research programs within the NLM with particular attention directed toward LHNCBC It is composed of scientific and technical experts who review ongoing and proposed intramural research and development programs as well as advise on the performance of staff scientists The BoSC meets two to three times a year to review and make recommendations on the Center programs to the Director, NLM and Director, LHNCBC

Information Technology Programs

These are programs that provide access to large-scale information sources and utilize state-of-the-art technology to solve problems in health education, medical research, and information sciences Current programs within the Center are

Distributed Information Systems (DIS) In 1982 the Distributed Information Systems Program was established to investigate the effective management and dissemination of information from "informational" databases, i e, full-text, non bibliographic systems Whereas traditional retrieval systems have concentrated on bibliographic databases within a time-shared, main-frame environment, the DIS program has concentrated on having the various tasks associated with information retrieval distributed to mini- and microcomputers in order to increase the efficiency of a central computer and provide intelligent, convenient interfaces for the user

The efforts of the Information Technology Branch have benefited from a collaborative program with NLM's Specialized Information Services in which the results have been applied to operational systems The Interactive Information Management System project is designed to produce a working model for testing and demonstrating advanced information management and retrieval techniques which can be applied to full-text databases The project has been built upon concepts and code developed for previous Lister Hill Center projects On July 1, 1985 several of these concepts became operational in the NLM TOXNET system which offers to the public online access to the full-text of toxicology databases

A second project in the DIS program is the Network Access Information Workstation The purpose is to develop a user-friendly microcomputer workstation that can facilitate access to different online information sources The workstation provides automatic logon to online databases, automated search sequences (scripts) for accessing up to 200 different online databases, transformation of retrieved data to standard formats, and transfer of data to a user's personal

filing system The prototype has been based upon a design for the Chemical Substances Information Network which was originally implemented on a DEC VAX 11/780 The workstation has brought the functionality of the VAX implementation to an inexpensive personal computer and in the process has provided greater flexibility and ease of use In collaboration with Specialized Information Services and the Council on Environmental Quality, a version of the workstation that has been tailored for access to hazardous waste information will be field-evaluated by several government agencies including the EPA and the Centers for Disease Control (CDC) in Atlanta

The third DIS project is the implementation of an extended MUMPS programming language environment under the UNIX operating system MUMPS is one of the ANSI-standard languages and has been extensively used in biomedical computing applications Two of the strong points of the language are its interpretive nature and an embedded database management system, which are two features missing in UNIX Since a significant amount of software, including the Interactive Information Management System, has been developed for NLM in a version of MUMPS, the translation to a language that operates under a portable operating system such as UNIX would increase the availability of this software and save the effort or recoding these applications in another language The Information Technology Branch has begun testing commercial implementations of MUMPS that exist under UNIX with the purpose of defining the functions necessary to provide a translation of NLM software and an optimal MUMPS environment in UNIX

The Information Retrieval Testbed System (IRX)
This program evolved from earlier work in the
area of natural-language queries and statistical
retrieval techniques As part of the effort, a system
called ANNOD (A Navigator of Natural Language
Organized Data) was developed as a query system
for the Hepatitis Knowledge Base The objective of
the present effort is to create a testbed system that
will permit evaluation of the performance of
different information retrieval strategies The basic
set of component programs, including word
stemming, thesaurus building, ranking and display
of retrieved output, has been developed under the
UNIX operating system and will permit systematic
testing of different retrieval strategies and their
dependency on the types of databases searched

Allied with the study of full-text retrieval
strategies is the investigation of providing online
access to medical reference works such as the
textbook on medical genetics, *Mendelian
Inheritance in Man* by Dr Victor A McKusick of
Johns Hopkins University Online access to
reference works holds great promise for enhanced
access to information, more timely updating, and
specialized capabilities for authors of both single
and multi-authored texts The initial restructuring
for online access to *Mendelian Inheritance in Man*,
has been completed and implemented in an initial
version of IRX for evaluation in a clinical setting
as part of a collaborative project with Johns
Hopkins University Efforts are also being directed
to the problem of linking disparate data sources
into a virtual single database in order to provide a
uniform interface not only to textual, but to
tabular and visual information as well

*Electronic Document Storage and Retrieval (EDSR)
Program* The Lister Hill Center's interest in
various electronic and optical technologies arises
to a great extent from their applicability in
meeting the mission objectives of the National
Library of Medicine These include the preserva-
tion and archival storage of biomedical literature
and the processing of this information for use by
researchers and practitioners Since most of the
collection is in the form of printed matter, the
Lister Hill Center is pursuing a research and
development program involving optical, electronic
and computer based technologies for the capture,
storage, processing, retrieval, transfer and display
of biomedical documents

The first phase of this program, now completed,
was to design and develop a modular laboratory
facility in the form of an experimental prototype
system capable of the electro-optical capture of
paper documents in both loose-page as well as
bound volume forms, the storage of the digitized
image data on suitable media, and the retrieval and
display of the exact images on high resolution
softcopy as well as hardcopy devices More
recently, a rapid linking up of document images
with bibliographic citations from NLM's medical
databases with document images was accomplish-
ed Also, the recent incorporation of digital optical
disk storage units has expanded the store of online
images available for experiments In addition, it
allows investigation of storage density, response
time, image access and retrieval, and other issues
pertinent to the use of optical disk technology for
image archiving

This laboratory facility also offers the oppor
tunity to do research in the areas of image
enhancement, image data compression and
omnifont text recognition in addition to the
above-mentioned experiments designed to answer

key questions regarding the role of electronic document storage and retrieval technology in medical library information processing

Medical Information Programs

These are programs that use advanced technology systems, including artificial intelligence techniques, to improve the transfer of medical information for health care providers. Current programs are

Expert Systems A research program in artificial intelligence concentrating on expert systems has been established at LHNCBC during FY 1985 Expert systems are computer programs which combine knowledge of a particular subject area with inferencing mechanisms enabling the programs to use this knowledge in problem-solving situations. The Expert Systems Program addresses research issues in the application of these artificial intelligence techniques to the development of knowledge-based consultant systems in medicine and medical education

Efforts in this area in FY 1985 have been directed to both the intramural aspects of building an in-house artificial intelligence systems development capability and the extramural aspects of technology transfer, research community-building, and information dissemination appropriate to the Library's mission

The creation of an in-house capability was accomplished in several steps. As part of a long-standing collaboration between Dr Donald Lindberg and Dr Casimir Kulikowski of the Department of Computer Science at Rutgers University, the Rutgers artificial intelligence software framework called EXPFRT was successfully transferred from the Rutgers DECsystem-20 mainframe computer to the Lister Hill Center

VAX-11/780 computer. Two existing expert systems of many years' development, AI/RHEUM (for diagnosis and therapy recommendations in rheumatology) and AI/COAG (for consultation in problems of hemostasis), were brought from the University of Missouri by Dr Donald Lindberg and Dr Lawrence Kingsland Finally, a project team consisting of an experienced expert systems researcher, two computer specialists, and a hemostasis/blood banking subject matter expert was assembled

During FY 1985 efforts were directed to 1) refining the AI/RHEUM diagnostic system in preparation for its validation and evaluation as an example from which to generalize a paradigm for the evaluation of other medical expert systems, 2) improving the AI/RHEUM therapy recommendation system and testing it with additional clinical cases, and 3) extending the AI/COAG system to provide recommendations on blood component transfusion therapy for cases of major trauma

In its current state, the AI/RHEUM diagnostic system contains in its knowledge base information on 26 rheumatologic diseases. It reasons from 877 patient findings (basic information such as signs, symptoms, laboratory tests and radiographic observations) through 547 intermediate hypotheses to these 26 disease conclusions. It has 181 definitions available on line for those patient findings which might not be familiar to its intended users, physicians who are not themselves rheumatologists. This system has been tested with more than 500 clinical cases. Its overall level of agreement with a consensus diagnosis of Board-certified rheumatologist clinicians is above 90%

The AI/RHEUM patient management system provides therapy recommendations for patients having one complex disease, rheumatoid arthritis. It assesses patient condition on the basis of specific

information requested and makes treatment suggestions on several levels, from basic measures through more complex drug therapies This system has "Tell Me More" statements available in many categories for users who would like detailed information supporting its recommendations

The AI/COAG consultant system for problems in human hemostasis is designed in several modules The first module performs a differential interpretation of six coagulation laboratory screening tests, and offers "Tell Me More" and "Tell Me Reference" information to support its conclusions The second module acquires and stores a detailed hemostasis history It prints a summary record for the user, and analyzes the history to determine whether a hemostatic defect is present which would make a further workup desirable The third module, still under development, makes recommendations for blood component transfusion therapy in cases of major trauma

Proposals for additional expert systems projects addressing different research questions are being considered for the coming year These proposals involve the addition of an interactive videodisc capability to an expert system, the interfacing of such a system to existing large databases for reference information, and the creation of a hybrid expert system having an image analysis front end

The extramural aspects appropriate to artificial intelligence research at the National Library of Medicine have been addressed in three ways 1) exploring issues of technology transfer by focusing on methods of delivering these large-scale artificial intelligence programs on powerful microcomputers more widely available than the mainframe systems on which many such programs have been developed, 2) hosting a 2½ day Artificial Intelligence in Medicine workshop for 140

attendees, and 3) developing a series of three 15-minute videotapes on medical expert systems

Dermatologic Diagnosis Videodisc Project This project involves developing an experimental videodisc and associated computer software to assist practitioners to identify and classify dermatologic lesions The videodisc will include images selected to represent common dermatoses, and the software will guide practitioners in retrieving individual images or classes of images that can assist practitioners in the diagnostic process

The dermatology project completed the preparation of its pilot videodisc, which includes almost 700 images of dermatologic lesions representing 30 common dermatoses Project staff also developed a classification scheme for the physical description of lesions, began the expert review and revision of this scheme, developed a C-language program to control access to disc images, began development of a unified dermatologic lexicon, and began a collaborative relationship with the American Academy of Dermatologists This collaboration serves to improve the processes of expert review of content and strategy, acquisition of additional images/dermatologic cases, and field testing

Automated Classification and Retrieval The purpose of this program is to develop computer systems that will improve and automate the classification of published literature and aid the retrieval of useful information The ultimate objectives of the project are to (1) automatically classify articles and (2) permit content addressable, natural language computerized searches The classification system should permit efficient and precise searches by subjects and the relationships between the various subjects in the text The program includes projects in the area of natural

language understanding, knowledge representation, and information retrieval Currently the Center has a contract with Carnegie-Mellon University to conduct research in knowledge representation and natural understanding and to develop tools to support research in those areas The research has focused, in general, on the problem of classifying literature in the domain of rheumatoid disorders and, in particular, in the development of a conceptual hierarchy, knowledge bases, and fundamental concepts for the semantic representation of titles and abstracts in the domain The tool development effort has involved (1) a Natural Language Interpreter, (2) a Frame-based Knowledge Representation System, (3) a User Interface

Two intramural research projects were initiated One is Knowledge Refinement with the objective of discovering methods to incrementally refine and merge hierarchical structures such as MeSH and SNOMED

The second project, Indexers Aid, is to develop a system for classifying concepts and relationships in medical articles as frame representations and providing knowledge-based assistance in the assignment of MeSH indexing terms

Computer-Based Education Technology Programs

These health education programs use interactive videodisc technology to improve the transfer of health information and enhance student learning Current programs are

TIME (Technological Innovations in Medical Education) This project explores the use of microprocessor, videodisc, and speech recognition technologies to enhance the education of medical students Using these combined technologies, the

project is developing patient simulations to provide a contextual framework for acquiring medical knowledge and learning clinical decision making

The TIME simulation prototype, described in last year's report, is "The Case of Frank Hall " The delivery system consists of an IBM PC/XT microprocessor, a Votan voice system (VPC-2000), three LDV-6000 Pioneer videodisc players and a Sony color monitor The capabilities of the new technology for random access of high quality video and multiple audio tracks, coupled with the intelligence capacity of the computer, make possible the creation of an effective interactive simulation which encompasses sophisticated educational strategies while supporting engaging dramatic situations

The Frank Hall prototype embodies five characteristics which distinguish the TIME model as a unique resource in medical education

1 Uncued interaction allows the learner to use his/her natural spoken language while dealing with the patient

2 Multiple health problems require multiple diagnoses for appropriate management

3 A full range of medical, social and clinical information available to the learner in dynamic visual and audio form portrays the drama of the patient's condition and life situation

4 Probability-based occurrences and outcomes reflect the real clinical environment

5 A dynamic, time-related management process responds to the learner's independent, uncued interventions

The prototype provides formative feedback by immediately portraying the impact of the learner's clinical interventions, and summative feedback which conveys his/her overall diagnostic and management performance as a physician with the situation at hand Also, included in the summative feedback are the medical expenses incurred by the patient as a result of the clinical course chosen by the student

Two more TIME simulations will be created using the knowledge and experience gained from the prototype The plan for FY 1986 involves the completion of the simulation concerning a geriatric patient with a hip fracture and a variety of related medical and sociological problems Following this, one other patient simulation will be created These three will be used in four or five medical schools as a part of the Introduction to Clinical Medicine curriculum Appropriate interviewing, question-naires and performance evaluation instruments will be developed to assess the effectiveness and educational value of the TIME model in this setting

Computer-based Curriculum Delivery Systems (CCDS) This project seeks to develop prototype instructional systems and to evaluate their dissemination and use by health professions students and practitioners

During the year, CCDS continued with field testing of the first of four microscopy-pathology videodiscs and collected over 1000 faculty and student evaluations of the disc from 36 parti-cipating U S and Canadian medical schools Based on these, the program's software was modified and distributed as Version 2 0 to participating schools The CCDS project is also working with three other specialist groups to develop prototype educational videodiscs in juvenile suicide risk assessment, radiology, and in orthopaedic surgery

Bibliometrics

Broadly defined, bibliometric studies examine statistical frequencies and relationships found in a defined body or collection of professional literature These studies may describe certain statistical features of a literature or may relate these features to the nature and extent of the literature's use Current studies within LHNCBC

Library Growth The Library Growth project completed a successful search to locate the large statistical database created at Purdue University during the 1964-72 period, obtained the similar but more recent statistical data from the Associa-tion of Research Libraries, acquired other similar data from Mr Richard Lyders at the Houston medical campus, and collected supplementary statistics from the National Center for Educational Statistics in Canada These collected statistics now include the several customary or traditional indexes of library size or library capability and they cover a time span which ranges between seven years (1977-83) and 34 years (1951-84) Libraries represented in the data include 58 older members of ARL, about 50 newer members of ARL, including NLM, and about 125 medical school libraries in the U S and Canada Preliminary data analyses were begun during the year and, early in FY 1986, these will be extended to include "validation" studies of previous growth forecasts, new forecasts of research library and medical library growth, and preliminary studies of "personality" differences among libraries

Online Trends The "Online Trends" study begun this year will analyze and report trends in the development of online biomedical files in the U S, 1974-1984 The data to be analyzed are being drawn from published literature which describes

new, developing, or continuing online files that incorporate biomedical content

Iowa Study The Iowa study of health professions faculty was completed during FY 1985 Although it experienced some early delays, this contract study now represents a thorough description/analysis of the process by which health professions educators seek, find, and evaluate or judge audiovisual teaching materials The study is based on responses of a national sample of 1000 educators Prior to conducting the survey of educators, the project also prepared a literature review that examines the question How do faculty select print or nonprint teaching materials? Briefly, the review concludes that the literature presents little credible, generalizable evidence that describes the selection procedures used by faculty

Multimedia Development Programs

These programs use the rapidly changing technology of video communications to inform, educate, or motivate health professionals and students in the health sciences Current projects include

Leaders in American Medicine This is a series of videotaped interviews recording the memoirs of eminent American medical scientists and teachers The tapes have been produced through the collaborative efforts of Alpha Omega Alpha (National Honor Medical Society), American College of Physicians, and NLM The tapes constitute a unique resource for men and women embarking on medical careers, as well as a permanent record of some of the physicians and basic scientists who helped shape medicine in the United States The distinguished list includes such luminaries as Dr

John F Enders, University Professor Emeritus, Harvard University, Dr Helen B Taussig, Professor of Pediatrics Emeritus, Johns Hopkins University, Dr William B Bean, Osler Professor of Medicine, University of Iowa, and Dr J Willis Hurst, Chairman and Professor, Department of Medicine, Emory University It is expected that these audiovisual memoirs will be a valuable resource for future generations of physicians and for historians concerned with medical education and biomedical science

History of Medicine An experimental videodisc of more than 1000 selected visuals from the NLM historical collection was produced to test the feasibility of using this technology as a means of selecting prints or photographs for research or educational purposes by authors, teachers, students and other library patrons

Artificial Intelligence in Medicine (AIM) A series of videotapes and videodiscs on major expert systems in medicine The initial set was produced for the artificial intelligence in medicine workshop in July 1985 This series is intended for professionals knowledgeable in computer science and artificial intelligence techniques as well as for other persons interested in expert consultant systems in medicine

National Learning Demonstration Center

The National Learning Demonstration Center (NLDC) opened in March 1985 as a facility where various computer-video information and educational technologies can be demonstrated, reviewed, and evaluated The establishment of the NLDC resulted from interdisciplinary efforts within the Lister Hill Center and guidance provided by an

advisory group of outside consultants

The recent GPEP (General Professional Education of the Physician) report of the Association of American Medical Schools emphasized the need to exploit new technology in the service of medical education The NLDC will assist this effort by providing visibility to effective applications of these technologies In addition, the NLDC may also serve as a laboratory for comparative studies and evaluation of such technologies Exhibits presently available in the NLDC represent health sciences computer-based and video-based educational materials, relevant information systems, and demonstrations of LHNCBC computer-based research projects

NLDC staff assist visitors in a variety of ways Individual or small group tutorials are provided depending on the interests, needs and time commitment of visitors Tutorials range from a general overview of computer-based and video educational/information systems in the health professions to self-tutorials and hands-on experience with individual systems Demonstrations are also provided to illustrate the diversity among system attributes and the alternatives available for courseware design and delivery

The NLDC occupies a room on the B1-level of the Lister Hill Center It comprises 12 carrels, a reception center, and a small conference area The carrels are modular and can be easily reconfigured or augmented as requirements change

NLDC staff have hosted over 3000 visitors since the Center opened in March 1985 Present efforts are directed towards developing a series of audiovisuals and self-directed learning aids for visitor use The NLDC will also be expanded into a second demonstration area in the near future

Extramural Grants and Contracts

William G Cooper, Ph D *
Associate Director, Extramural Programs

The "Vicennial Vignette" earlier in this report gives a fictional introduction to the subject of the Library's grant and contract programs Wyndham D Miles, in his book, *A History of the National Library of Medicine—The Nation's Treasury of Medical Knowledge*, states "It was inevitable that the Library would become involved with grants after it became a part of the Public Health Service and closely associated with the National Institutes of Health " It is probably fair to assume that it was to some degree a consequence of organizational association and even geographical proximity that NLM became involved with a type of grant activity

However, it was not by chance that some form of aid, at some point in time, and administered by some public entity, would finally be established to correct the disparity which in the early 1960s existed between the Federal investments in the creation of health science information and knowledge and the neglect of programs for the efficient organization, rapid transmission, and effective utilization of this expanding corpus This was inevitable, just as today it is inevitable that, independent of any NLM involvement (but, we hope sustained by it), the next decades of continued effort by health knowledge brokers to keep pace with the health knowledge creators will focus more and more on technological tools which seem almost daily to offer new opportunities and challenges

The following are brief summaries of FY 1985 activities in the various categories of grant and contract assistance Training, Research IAIMS, Resource Grants, Publication Grants, and the Special Foreign Currency Program In addition, there is a brief section on grant expenditures and legislative activity

Training Program

Computer speed, reliability, and storage capacity probably will continue to increase for the next few decades, and component size and cost per storage unit will continue to decrease Although there will be a need for more and more trained personnel, most medical schools have yet to include Medical Informatics in their curricula

The academic discipline of Medical Informatics represents the convergence of computer and information science with the delivery of health care The new discipline emphasizes the role of knowledge in professional life and seeks to develop better ways to organize, retrieve, and utilize health knowledge To expand this emerging field, NLM continued to support five awards, initiated the previous year, in the Health Computer Science Research Training Program Twenty-one postdoctoral trainees were supported in FY 1985 Of these, 18 were physicians, 2 had a Ph D degree, and one had both the M D and Ph D

The five training sites and directors are

Marsden S Blois, M D
Professor and Chairman
Medical Information Science
University of California, San Francisco

Lael Gatewood, Ph D
Associate Professor and Director
Health Computer Sciences
University of Minnesota

Robert A Greenes, M D, Ph D
Associate Professor and Director
Computer Science Division
Department of Radiology
Harvard Medical School
Brigham and Women s Hospital

Stephen G Pauker, M D
Chief, Division of Clinical Decision Making
New England Medical Center (Boston)

Edward H Shortliffe, M D, Ph D
Assistant Professor of Medicine
Stanford University

Research Grants

Using various grant mechanisms, the Library supports research into fundamental questions of attributes, organization, and utilization of medical knowledge This program initiative—Medical Informatics—has been responsible for significant advances in how health knowledge is organized and utilized for medical problem solving In FY 1985 an increase in NLM's appropriation emphasized the importance of informatics research and made it possible to expand research activities

At major research institutions, such as MIT, Stanford, Yale, and the University of Pittsburgh, NLM awardees are using artificial intelligence methodologies to develop expert reasoning systems where the computer functions interactively with the human user At Stanford University, a protocol management system for oncology is well advanced and is being disseminated to other sites At Yale University, the development of an expert system which provides a critique of the physician s chosen course of action has attracted much attention from computer scientists and clinicians

The evolution of computerized expert systems depends in large part on understanding the human reasoning processes in the exercise of judgment—clinical judgment in this case At several institutions, NLM-supported investigators are studying various aspects of clinical judgment and the nature of clinical decision making These range from a major theoretical investigation at the University of Texas-Austin through more applied system studies in specific medical domains at Latter Day Saints Hospital in Salt Lake City, among others

Related work in Medical Informatics includes work at the Massachusetts Institute of Technology on a computerized searching intermediary which

allows the user to search several medical bibliographic databases simultaneously The system also takes account of such constraints as time and cost Mount Sinai School of Medicine in New York is the site of a scholarly investigation of the validity of clinical trials reports The objective is to derive standards and guidelines for assuring scientific validity of the clinical trial design and its ultimate journal report

Access to recorded knowledge is essential not only to those who investigate biological phenomena and deliver health care, but to all those who are concerned with the ethical and humane dimensions of human health With the availability of especially appropriated funds, NLM has jointly sponsored a major bibliography of the entire bioethics literature The literature acquisition and indexing is performed at Georgetown University's Center for Bioethics The indexed material is made available for computerized bibliographic searching by NLM through its online database, BIOETHICSLINE In a related effort, the Library also supports a national clearinghouse and reference center for bioethics, also based at Georgetown University

IAIMS Program

NLM provides grant support to assist in the planning and development of Integrated Academic Information Management Systems (IAIMS) and in the conduct of research related to IAIMS activities The IAIMS concept is to use computer and communications technologies to bring together operational and academic information in support of health research, education, patient care, and management The goal is to integrate the library systems with the multitude of individual and

institutional working information files at health science centers In FY 1985, nine institutions received support for IAIMS planning and development, and three of these also received IAIMS research grants

Grant support is available for 1) institution-wide IAIMS strategic planning and policy analysis, 2) IAIMS model development and testing, involving some segment or cross-section of the completed IAIMS strategic plan, and 3) implementation of the detailed and tested plan for full-scale, institution-wide IAIMS development The three phases of IAIMS activity are considered sequential, and the successful completion of each phase is the prerequisite for further support

Grant awards were made for the second year of IAIMS Phase I planning to the Baylor College of Medicine and the University of Cincinnati to continue activities begun in FY 1984 The Oregon Health Sciences University also continued IAIMS Planning under contract support Two new IAIMS Phase I grants were made to begin planning at Harvard University and Johns Hopkins University

Four IAIMS Phase II model development and testing awards were made in FY 1985 to Columbia University, Georgetown University, the University of Maryland, and the University of Utah These four institutions, previously supported by NLM contracts, had completed IAIMS Phase I planning, and had published IAIMS Plans for their institutions Based on their plans, they successfully competed for grant awards to begin model testing of IAIMS concepts on a small scale in their institutions

In January 1985, NLM invited investigator-initiated Research Grant applications for innovative research to support the planning, development, and implementation of IAIMS The first IAIMS

Research Grants were awarded to the Baylor
College of Medicine to study the problem of
integrating several local area networks (LANs) and
designing an advanced workstation, to
Georgetown University to identify information
needed in an interdisciplinary cancer center
environment and how specialized library databases
respond to those needs, and to the University of
Utah to demonstrate how an IAIMS environment
can support the research and development of
microcomputer databases of significant value to
clinical medicine

During the past two years, the NLM had been
urged to further promote the IAIMS concept,
especially to those who may be involved in future
IAIMS development or may be affected by work
associated with IAIMS planning and implementa-
tion Accordingly, NLM hosted a symposium on
IAIMS planning on October 17, 1984, attended by
more than 150 individuals representing some 75
institutions in 32 states In addition to learning
about how the IAIMS concept was developed,
they heard reports of approaches and issues
regarding strategic planning for information
management in academic medical centers by Dr
Thomas Q Morris, Columbia University,
Ms Naomi C Broering, Georgetown University,
Dr Marjorie P Wilson, University of Maryland,
and Dr Homer R Warner, University of Utah
These four individuals shared their frank percep-
tions of the complex issues raised by the IAIMS
effort and commented on the costs and lessons
learned More than 1,000 copies of the published
symposium proceedings have been distributed

Medical Library Resource Grant Program

The purpose of this program is to improve
medical library collections and enhance services
Resource Grants are of two types Improvement
and Project Resource Improvement Grants, which
are available to consortia as well as single institu-
tions, assist in collection development In the past
year, such grants were awarded to nine consortia,
which included 99 institutions, and to 8 single
institutions

Resource Project Grants are directed towards
established health science libraries and enable
them to undertake a new service or expand an
existing one Of the five new Resource Project
Grants awarded during the year, four involved
extending library and information services to users
in remote areas

- The University of Nebraska Medical Center
Library will establish libraries at three family
practice sites to demonstrate a new role for
health science librarians and to promote
independent information-seeking behavior of the
residents

- The University of Utah, Eccles Health Sciences
Library will test the use of microcomputers by
medical students, while engaged in preceptor-
ships at rural family practice sites, in communi-
cating with their peers, faculty and library staff

- At the University of Oklahoma Health Sciences
Center Library, a library-clinical consultation
program will be developed to address the infor-
mation needs of health professionals practicing
in rural, underserved areas of the state

- In central California at the Merced Community
Medical Center two previously funded library
consortia have combined to undertake an

audiovisual cooperative project to support the education and training of health professionals in five rural counties

The fifth Resource Project Grant was awarded to Meharry Medical College Library to process, preserve and publicize a black medical history collection

Publication Grants

The Publication Grant Program provides selective, short-term support for a variety of not-for-profit biomedical scientific publications, expediting access and availability of health information for U S practitioners, research scientists, planners and educators

Projects prepared and/or published in the U S under this NLM program include critical reviews and monographs on special areas of medical research and practice, publications on biomedical communications and in library and information sciences, secondary literature tools (such as annotated bibliographies, atlases and catalogs), temporary support for periodical publications, studies in the history of medicine, translations of current foreign biomedical monographs, and proceedings of symposia related to U S health needs

Together with its complementary activity, the Special Foreign Currency Program, the Publication Grant Program assists the advancement of the medical sciences and aids in the dissemination and exchange of scientific and other information important to the progress of medicine and health

During FY 1985, NLM awarded 16 Publication Grants, totaling $403,000 Of these, 9 were new awards, including one for a study which will synthesize the last two decades of research on

hospital organizations and produce a book that emphasizes practical recommendations for improving hospital performance The average amount of a Publication Grant in FY 1985—approximately $25,000 in both direct and indirect costs—reflects the continuing emphasis in this program upon high quality, but low-cost projects that are scheduled for early publication

Among the studies published in FY 1985* which the Publication Grant Program funded was a critical review on *Human Underwater Vision Physiology and Physics*, by Jo Ann Kinney (Bethesda, Maryland Undersea Medical Society, Inc , 1985), which presents current knowledge about vision, visual perception, and the visual system under water The summarized information comes from international diving research and includes that conducted by the author and her colleagues at the Vision Department of the Naval Submarine Medical Research Laboratory over 20 years Another significant volume published this year is a reference source for physicians and other health care professionals *AMA Handbook of Poisonous and Injurious Plants*, by Kenneth F Lampe and Mary Ann McCann (Chicago, Illinois American Medical Association, 1985)

Representative of some of the significant studies which have been supported under the Publication Grant Program is *Viral Infections of Humans Epidemiology and Control*, 2nd ed , edited by Dr Alfred Evans The *American Journal of Tropical Medicine and Hygiene* finding the quality of the book to be "excellent" and the information in it "authoritative," concluded "The book provides an excellent source of reference for epidemiologists, virologists and public health workers '

The Special Foreign Currency Program

The oldest of the Library's extramural support activities, the Special Foreign Currency Program, continues today to be a very valuable supplement to the Publication Grant Program Authorized under Public Law 83-480, as amended, the Special Foreign Currency Program utilizes appropriations of U S -owned local foreign currencies to fund biomedical writing and publication projects in cooperating countries

During FY 1985 the P L 480 Program sponsored 77 projects, totaling $956,069 U S equivalent dollars More than 60 percent of the current program is in India, 20 percent in Poland and the remaining projects in Egypt, Israel, Pakistan, and Yugoslavia

About half of the awards in the Special Foreign Currency Program support the preparation of scholarly research monographs and translations of classics in the history of medicine Another fourth of the program supports the preparation and publication of state-of-the-art, analytical reviews and monographs, which explore the status of research and practice in health care and biomedical research The program also funds a few secondary literature tools, such as the *Quarterly Bibliography of Major Tropical Diseases*, printed in India through the Public Law 480 Program and distributed in cooperation with the World Health Organization

The first of a new series of *Resources in Medical History*, selected in collaboration with the American Association for the History of Medicine and published under the Public Law 480 Program, appeared in 1985 Rudolf Virchow's *Collected Essays on Public Health and Epidemiology* (New Delhi Amerind Publishing Company Distributed from Canton, MA by Watson Publishing International, 1985) Edited by the distinguished American pathologist and medical historian, Dr L J Rather, this two-volume collection, originally assembled by Virchow in 1879, has never been previously available in English Virchow's unique stature as an internationally recognized physician-scientist-statesman, coupled with his deep involvement in public health reform, make these papers of particular importance

Although political complexities between the United States and Poland in the last few years have impacted upon P L 480-funded collaborative science activities in that country, NLM-supported studies written by Polish scientists continue to be received This year saw the publication of a significant monograph by Professor Waldemar Olszewski, M D of the Medical Academy of Warsaw, entitled *Peripheral Lymph Formation and Immune Function* (Boca Raton, FL CRC Press, Inc , 1985) This study makes much Polish and Russian literature on the subject, hitherto inaccessible to the international biomedical community because of language barriers, available for the first time The audience addressed by the publication includes oncologists, transplantologists, physiologists and surgeons interested in lymphatic pathology

The Program also sponsored the publication in 1985 of an overview of problems connected with research on the processing of information under stress, based on classic experimental studies initiated by Russian authors in the 1970's NLM's P L 480 Program commissioned the translation in Yugoslavia and the printing in India of V P Zinchenko *et al The Psychometrics of Fatigue* (Distributed from London and Philadelphia by Taylor & Francis, 1985)

Figure 1

NLM Extramural Programs
Twenty Year History of Obligations

Millions of Dollars

Fiscal Year

Excludes Appropriations for Construction 1968
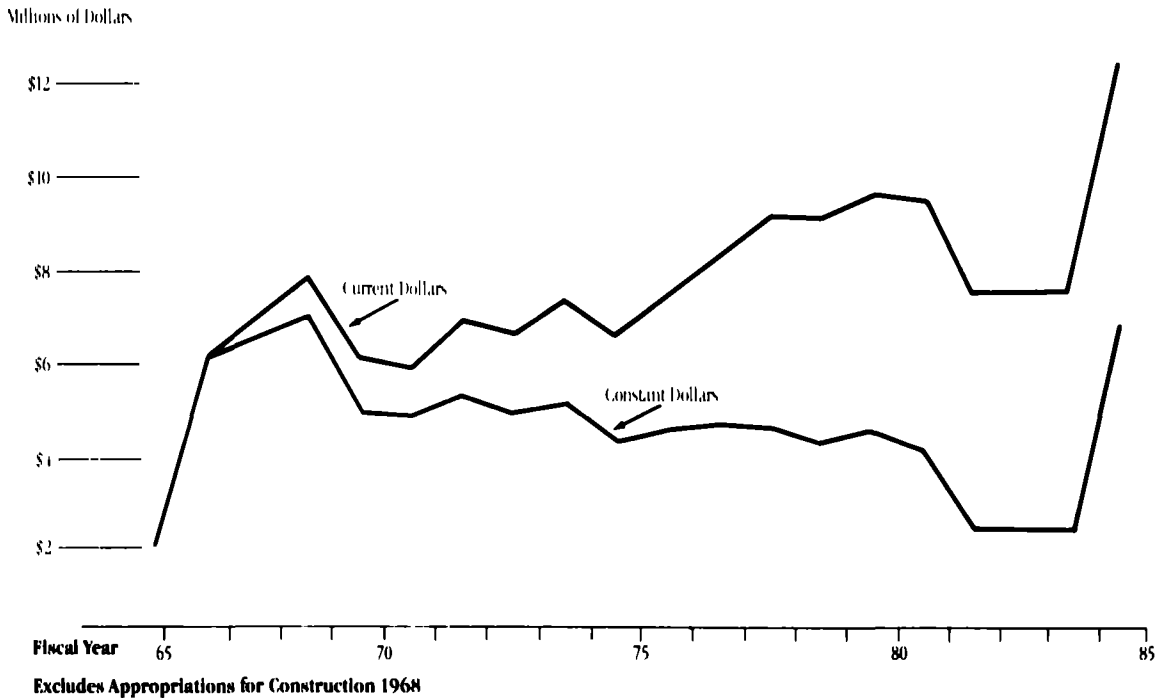
Grant Expenditures and Legislative Activity

A Continuing Resolution (P.L 98-473) provided an additional $3.5 million in FY 1985 for NLM's extramural programs in Medical Informatics research and the development of Integrated Academic Information Management Systems (IAIMS). These additional funds increased the extramural programs budget to $12 2 million in FY 1985, contrasted with a $7 5 million spending level for each of the three previous years Thus, 1985 represents the highest NLM grant appropriation, except for 1968 when NLM received its only allocation for the since-repealed Construction

Grant Authority. The grant spending level for FY 1985, modest in relative terms, nevertheless represents more than a 60 percent increase over FY 1984. Table 10 represents grant expenditures by program for FY 1985 and the two previous fiscal years. Figure 1 illustrates in current and constant dollars the 20-year history of NLM's extramural programs funding In constant dollar terms, the FY 1985 budget is very close to the 1969 level. However, considering overall 1985 budget constraints and the amount and specifications of the increase in NLM's extramural programs spending authority, the budget is surely evidence that computerization has come of age vis-a-vis

Table 10

Extramural Grant and Contract Program

(Dollars in Thousands)

Category	FY 1983		FY 1984		FY 1985	
	Number	Amount ($)	Number	Amount ($)	Number	Amount ($)
Research	29	$2,782	29	$2,399	39	$ 5,431**
Resource Projects	11	575	16	1,114*	25	2,507***
Resource Improvement	29	636	22	614	17	528
Training	9	733	9	786	5	1,091
Special Scientific Projects	1	34	0	0	0	0
Regional Medical Libraries	7	2,300	7	2,000	7	2,054
Publications	19	440	20	587	15	403
Total	105	$7,500	103	$7,500	108	$12,014

*Includes IAIMS Resource Projects (2) $134

**Includes IAIMS Research Projects (3) $571 and Research in Medical Informatics (31) $4 489

***Includes IAIMS Resource Projects (8) $1 146

health science knowledge management

For the first time since September 30, 1982, funding levels are stipulated by the authorizing legislation for the programs administered by NLM under the Medical Library Assistance Act The Health Research Extension Act of 1985, a comprehensive bill authorizing funds for major National Institutes of Health activities, including MLAA programs, was enacted into law on November 20, 1985 when Congress elected to override the President's earlier veto of the measure

The new law (P L 99-158) extends the authorization of appropriations for the Medical Library Assistance Act programs for three years, at funding levels of $12, $13, and $14 million for FY 86, FY 87, and FY 88 respectively, and raises the dollar limitation on individual MLAA resource grants to medical libraries to $500,000 (instead of $200,000) in any fiscal year

International Programs

Henry W Riecken, Ph D *
Acting Special Assistant for International Programs

> ' if the entire medical literature of the world with the exception of that which is collected in the United States were to be now destroyed nearly all of it that is valuable could be reproduced without difficulty "
>
> John Shaw Billings
>
> Our Medical Literature
> Transactions of the International
> Medical Congress (7th London, 1881)

For more than a century, the National Library of Medicine has collected foreign medical literature and cultivated relationships with medical libraries and information centers abroad The initial motive for this policy was certainly to keep the U S health establishment as well-informed as possible about developments in the laboratories and clinics of other nations, and the very first number of *Index Medicus* in 1879 reflects that concern About three-quarters of the journals indexed in that "Classified Record of the Current Medical Literature of the World," were published abroad Although that proportion had diminished to about 65 percent in the 1985 *List of Journals Indexed* in *Index Medicus*, Billings' claim that the United States was a repository of the world's medical literature can be sustained as well today as it was a century ago, and Billings' ambition for the National Library of Medicine to take a major part in maintaining the storehouse continues to be a basic tenet of the Library's program

International MEDLARS Centers

During the hundred years of *Index Medicus* the stature and significance of U S medical research and practice has grown enormously and it has accordingly become essential for physicians everywhere to be informed about it

Furthermore, the indexing scheme that Billings began has assumed a worldwide importance that its initiator may not have anticipated The classic printed *Index Medicus* now occupies the shelves of all the world's medical libraries Its counterpart, in modern dress, is the online Medical Literature Analyses and Retrieval System (MEDLARS) that is currently accessed worldwide through 14 centers in as many foreign countries (Table 11)

This network of foreign partners is more than a set of agreements to distribute services The various MEDLARS centers contribute intellectually as well by helping to identify significant literature, by indexing and cataloging in unfamiliar languages and alphabets, and by collaborating in a variety of technical tasks including training, documentation, system performance assessment and other ways of sharing time, talent and resources with no transfer of funds, i e , quid-pro-quo arrangements

International MEDLARS centers are established by agreement between the Library and an appropriate instrumentality of the respective national government, usually the Ministry of Health or the Ministry of Information which is asked to designate the host institution for the center Accordingly, the MEDLARS center may lodge in a library, a medical research institution, a governmental scientific research council or an independent center for scientific and technical information Although the matter of regional coverage is just as complex and delicate as the issues of trans-border data flow, the National Library of Medicine imposes no restrictions on how and where individual MEDLARS centers may offer their services, and it does keep itself informed on such decisions and actively encourages mutual communication among centers New

requests to the Library for MEDLARS services or proposals to establish additional centers are brought to the attention of the partners.

Such developments *inter alia* occupy the attention of the partners at the biennial meetings of the International MEDLARS Policy Advisory Group (IMPAG) The next meeting of this group in October 1986 will be concerned with operational experience, networking, regional coverage and collaborative efforts, as well as with preparations for the installation of MEDLARS III, the latest revision of the system.

International Cooperation

In addition to these specific national partners, NLM has enjoyed collaborative activities with the World Health Organization, and its affiliated Pan American Health Organization. With WHO, the Library compiles and distributes the *Quarterly Bibliography of Major Tropical Diseases* and *Bibliography of Acute Diarrhoeal Diseases* and, with PAHO the *Bibliography of Respiratory Infections in Children*. NLM is responsible for carrying out the literature searches, classifies the articles retrieved and prepares camera-ready copy, which WHO prints and distributes to thousands of institutions in developing countries.

NLM and WHO have also continued a collaborative arrangement to provide photocopies of journal articles for the use of health professionals in developing countries in Africa, the Eastern Mediterranean and South East Asia. Library resources in the developing countries are usually insufficient and their need for biomedical and health information can be met only by drawing on the collections of the developed world. Even though NLM provides more than 5,000

photocopies a year to developing countries (more than 80 are eligible for interlibrary loans), this number can only partially meet the need and other developed country resources must contribute too

Recent and Forthcoming Developments

Further progress in establishing a MEDLARS center in the People's Republic of China occurred in July 1985. Dr. Richard Frey, Vice-Director of the Institute of Medical Information of the Chinese Academy of Medical Sciences (Beijing) visited NLM to discuss the configuration of computer hardware, the technical demands of ELHILL software and the training of system operators. The determination of the Chinese to establish a center is quite evident and preliminary plans have been made for further technical discussions and assistance from NLM staff to take place in Beijing next year. The timetable for installation of the system and its shakedown envisions operation by the end of 1986. Meanwhile NLM continues to provide Selective Dissemination of Information (SDI) searches to the Chinese Academy, with the active involvement of one of its librarians who has completed a period of study and practicum at NLM.

FY 1985 also saw further progress in discussions with India regarding the development of a MEDLARS center in new Delhi. Mrs. Sarala Grewal, Secretary for Health in the Ministry of Health and Welfare, called at NLM to acquaint herself better with the institution and to report that the Prime Minister had taken an interest in MEDLARS and encouraged the Ministry of Health and Welfare to proceed. A proposal has been approved by the Ministry and forwarded to the Ministry of Economics for review

Visitors

NLM continues to attract the attention of hundreds
of foreign visitors each year, including doctors,
medical librarians, public health specialists, and
government officers Many of these visitors have
responsibilities for medical, scientific or technical
information in their own countries Their interest
in NLM is more than cursory, and they are offi-
cially received and briefed on relevant aspects of
NLM operations and research The visitors came
from the following 29 countries Australia, Bahrain,
Bangladesh, Cameroon, Canada, Cuba, Denmark,
Egypt, Finland, France, India, Israel, Italy, Japan,
Kenya, New Zealand, People s Republic of China,
Philippines, Poland, Singapore South Africa Spain,
Switzerland, Taiwan, Tunisia, United Kingdom,
Venezuela, Yugoslavia, Zimbabwe

Eight official delegations came to scrutinize one
or more facets of NLM and to pursue technical
issues in information and library science usually
with a view to identifying applications that might
prove useful In addition to foreign visitors, NLM
enjoyed the company of more than a dozen
trainees, students, and professionals in observer
roles for short periods

The interests of foreign visitors are diverse A
Japanese bioengineer would like to know NLM's
experience with satellite networks for the trans
mission of information He believes that
establishing such a network would be a prudent
strategy for a country at considerable risk of earth
quake destruction of its telecommunications Two
physicians from Colombia call to explain the
relocation of its MEDLARS center and their plans
for extending services to medical schools in
Central America and the Caribbean A represen-
tative of the Egyptian Academy of Scientific
Research and Technology drops by to inquire into

some of the technical details of the MEDLARS
tapes and some further information about the
computer hardware needed to mount them Two
members of the professional staff of the Centre
National de la Recherche Scientifique seek an hour
or two of consultation about NLM's automated
procedure for handling serials and to inquire into
how MEDLARS III will change that procedure A
delegation of information specialists from the
Institute for Scientific and Technical Information
of China have been taken on a tour of the
Library Now they want to pursue some questions
in greater depth, particularly the operational details
of NLM's journal article indexing who chooses
articles to be indexed? if not all indexing is done
at NLM by in-house staff, how is quality control
exercised? how much does indexing cost? how
long does it take to index an issue of a journal?
and so on They leave, as most visitors do, with
some answers and some further questions,
stimulated by what they have seen and heard
They will bring both back to their home institu-
tions Many will write for more information, come
back for another visit They have become part of
NLM s circle of acquaintances

Table 11
International MEDLARS Centers

Country	Title of Organization	Sponsoring Organization
Australia	National Library of Australia (NLA)	National Library of Australia
Canada	Canada Institute for Scientific and Technical Information (CISTI)	National Research Council
Colombia	Panamerican Federation of Associations of Medical Schools (PAFAMS)	COLCIENCIAS, Colombia ICFES, Colombia
France	Institut National de la Sante et de la Recherche Medicale (INSERM)	Ministere de la Sante Publique et de la Securite Sociale
Germany (FRG)	Deutsches Institut fur Medizinische Dokumentation	Der Bundesminister fur Jugend Familie und Gesundheit
Italy	Istituto Superiore di Sanita (ISTISAN)	Ministero Della Sanita
Japan	Japan Information Center of Science and Technology (JICST)	Science and Technology Agency
Kuwait	Arab Centre for Medical Literature	Ministry of Public Health
Mexico	Centro Nacional de Informacion y Documentacion en Salud (CENIDS)	Ministry of Health and Welfare
South Africa	Institute for Medical Literature	South African Medical Research Council
Sweden	Karolinska Institutet	Swedish Medical Research Council
Switzerland	Dokumentationsdienst der Schweizerischen Akademie der Medizinischen Wissenschaften (DOKDI)	Schweizerische Akademie der Medizinischen Wissenschaften
United Kingdom	The British Library	The British Library
Intergovernmental	Centro Latino Americano de Informacao em Ciencias da Saude (BIREME)	Pan American Health Organization

International Organizations

NLM is linked to opposite numbers abroad through membership in the International Council for Scientific and Technical Information (ICSTI). This organization serves as a meeting ground for information and abstracting agencies, commercial and governmental in a number of countries around the world including the United Kingdom, France, Germany, South Africa, Netherlands, Canada, Japan and the USSR. Common interests include economics of primary and secondary publications, trans-border flow of information, electronic publication, standardization and the information needs of developing countries

Administration
Kenneth G. Carney
Executive Officer

Financial Resources

In FY 1985, the National Library of Medicine had a total budget authority of $55,848,000 Table 12 displays the FY 1985 budget authority plus reimbursements from other agencies, and the allocation of these resources by program activity

Table 12
Financial Resources and Allocations FY 1985
(in thousands of dollars)

Budget authority	
Appropriation, NLM	$55,910
Funds withheld pursuant to P L 98-473	-62
Subtotal	55,848
Plus Reimbursements	1,912
Total	$57,760
Budget allocation	
Extramural Programs	$12,240
Intramural Programs and Services	39,384
Library Operations	(26,429)
Lister Hill National Center for Biomedical Communications	(8,451)
Toxicology Information	(4,504)
Research Management and Support	6,136
Total	$57,760

Personnel

John E. Anderson was appointed Director, Information Systems in November 1984. He had previously served as a Special Expert in the Office of the Director, NLM with responsibility for providing advice and technical direction for the computerization of library activities.

Duane W. Arenales was appointed Chief of the Library's Technical Services Division (TSD) in February 1985 Ms. Arenales has been at NLM since 1971. In 1978, she was named head of the Loan and Stack Section of the Reference Services Division, and in 1981 she was appointed Deputy Chief, TSD.

Eve-Marie Lacroix was appointed Chief, Reference Services Division, LO, in March 1985 Ms Lacroix was former Head, Information Services, Canada Institute for Scientific and Technical Information (CISTI), where she was responsible for developing and maintaining CISTI's national computerized information systems and services.

Roy F Rada, M.D., was appointed Head, Medical Subject Headings (MeSH) Section/Editor of *Index Medicus* in September 1985. Dr Rada had previously served as a Research Medical Officer in the Computer Science Branch, Lister Hill National Center for Biomedical Communications.

Henry W. Riecken, Ph.D., was appointed as a Special Expert in December 1984, and has been Acting Associate Director for Planning and Evaluation Dr. Riecken is a former Professor of Behavioral Sciences at the University of Pennsylvania School of Medicine.

Philip M Teigen, Ph.D , was appointed Deputy Chief, History of Medicine Division, LO, in October 1984 Dr Teigen was formerly an Assistant Professor in the Department of Humanities and Social Studies in Medicine at

McGill University, Montreal, Canada

William G Cooper, Ph D, resigned from his position of Associate Director for Extramural Programs effective October 1985 Dr Cooper joined the staff of NLM in 1979 In December 1980, he was appointed Associate Director for Planning In addition to this responsibility, he served as Acting Deputy Director for Research and Education, from October 1981 to June 1982, with responsibility for administering the programs of the Lister Hill National Center for Biomedical Communications In October, 1982, Dr Cooper assumed responsibilities as Acting Associate Director for Extramural Programs and was named permanent Associate Director in March 1984

Calvin H Plimpton, M D, resigned from his position of Special Assistant for International Programs in November 1984 He held this position since October 1983 Dr Plimpton resigned to become the President of the American University of Beirut, Lebanon

Jacque-Lynne Schulman resigned from her position of Head, Circulation and Control Section, Reference Services Division (RSD), in October 1985 Ms Schulman had been with NLM since September 1983 and had previously served as the Assistant Section Head of the Reference Section, RSD

Linda A Watson resigned from her position of Head, Audiovisual Resources Section, Reference Services Division, in October 1985 Ms Watson came to NLM in August 1975 In May 1980 she was appointed Chief, Materials Utilization Branch, National Medical Audiovisual Center (NMAC) With the reorganization of NMAC in October 1982, the Branch was transferred to the Division of Library Operations and retitled Audiovisual Resources Section Ms Watson has been appointed Director

of Information Services, Houston Academy of Medicine

Awards

Henry M Kissman, Ph D, Associate Director for Specialized Information Services, received the NIH Director's Award 'for his foresight and leadership in developing and improving the availability of critical toxicological information for the biomedical community

NIH Merit Awards were presented to

John E Anderson, Director, Information Systems, "for his skillful management of the MEDLARS III development and exceptional direction of NLM's computer and communications systems"

Frances M Howard, Extramural Programs, 'for her dedication and meritorious contributions to the National Library of Medicine and the National Institutes of Health

Mamie O Toler, Division of Library Operations, 'exceptional contributions to maintaining the responsiveness of the NLM collection to the needs of the biomedical community"

Jacqueline Van de Kamp, Division of Library Operations ' for outstanding instruction on MeSH and indexing procedures and assistance to health professionals and librarians in training classes"

The NLM Director's Award was presented to Karin K Colton, Committee Management Assistant, Division of Extramural Programs, "in recognition of her outstanding performance of the many faceted duties involved in the management of the external advisory committees and Boards of the National Library of Medicine

Equal Employment Opportunity

The purpose of the NLM EEO program is to provide equal employment opportunity for all employees regardless of race, religion, sex, national origin, color, age, or handicap. Our institutional responsibility for accomplishing these objectives is specified within our Affirmative Action Plan.

The NLM EEO Open Meeting was one of the highlights of this year's activities. The meeting, attended by more than 150 NLM employees, was hosted by a panel composed of the NLM Associate Directors, the Executive Officer, Personnel Officer, EEO Officer, and the Chairperson of the EEO Committee. In addition to hearing presentations on maternity and paternity leave guidelines and organizational statistics related to EEO, those attending had the opportunity to participate in an active question and answer session with panel members on EEO issues.

Two employees received the NLM EEO Special Achievement Award this year: Ms. Jackie Mikail, Librarian and coordinator of the NLM Library Associates Program, Library Operations, and Ms. Louella Thomas, Technical Information Specialist, Library Operations.

Table 13
Staff, FY 1985 Full-Time Equivalents (FTEs)

Program	Full-Time Permanent	Other
Office of the Director	16	1
Office of Inquiries and Publications Management	5	1
Office of Administration	45	6
Office of Computer and Communications Systems	61	5
Extramural Programs	20	2
Lister Hill National Center for Biomedical Communications	76	9
Specialized Information Services	28	5
Library Operations	232	20
Total	483	49
Total FTE Usage	532	

Appendix 1: Staff Bibliography

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Appendix 3: Board of Regents

The NLM Board of Regents meets three times a year to consider Library issues and policies and make recommendations to the Secretary of Health and Human Services on matters affecting the Library

Appointed Members.

L Thompson Bowles, M D , Ph D (Chairman)
Dean for Academic Affairs
George Washington University

Edward N Brandt, Jr , M D , Ph D
Chancellor
University of Maryland at Baltimore

Lois E DeBakey, Ph D
Professor of Scientific Communications
Baylor College of Medicine

Russell L Fenwick
Senior Vice President
Bank of America

Albert E Gunn, M D
Medical Director
M D Anderson Hospital and Tumor Institute

John K Lopez
Executive Vice President
Medicalelectrographic Sciences

David O Moline, D D S
Asst Professor of Dentistry
University of Iowa

Ann K Randall, D L S
Chief Librarian
City College of CUNY

Grant V Rodkey, M D
Associate Clinical Professor of Surgery
Harvard Medical School

Eugene A Stead, Jr , M D
Professor Emeritus of Medicine
Duke University

Ex Officio Members

Librarian of Congress

Surgeon General
Public Health Service

Surgeon General
Department of the Air Force

Surgeon General
Department of the Army

Surgeon General
Department of the Navy

Chief Medical Director
Veterans Administration

Assistant Director for Biological, Behavioral, and
  Social Sciences
National Science Foundation

Director
National Agricultural Library

Dean
Uniformed Services University of the
  Health Sciences

Appendix 4: Board of Scientific Counselors

The Board of Scientific Counselors meets periodically to review and make recommendations on the Library's intramural research and development programs

Members

Morris F Collen, M D (Chairman)
Consultant
Permanente Medical Group

Arthur S Elstein, Ph D
Professor of Health Professions Education
University of Illinois at Chicago

Leonard D Fenninger, M D
Vice President
American Medical Association

Susan J Grobe, Ph D
Associate Professor of Nursing
University of Texas at Austin

Casimir A Kulikowski, Ph D
Professor of Computer Science
Rutgers University

Gwilym S Lodwick, M D
Department of Radiology
Massachusetts General Hospital

Mitchell W Spellman, M D
Dean for Medical Services
Harvard University Medical School

M Lucius Walker, Ph D
Dean, School of Engineering
Howard University

Appendix 5: Biomedical Library Review Committee

The Biomedical Library Review Committee meets three times a year to review applications for grants under the Medical Library Assistance Act

Members

Anthony R Aguirre
Director of Library
Philadelphia College of Physicians

Rachael K Anderson
Health Sciences Librarian
Columbia University

Marsden S Blois, Jr , M D , Ph D
Professor of Medical Information Science
University of California, San Francisco

C Michael Brooks, Ed D
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Univ of Alabama School Medicine

G Anthony Gorry, Ph D
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Baylor College of Medicine

Robert A Greenes, M D , Ph D
Department of Radiology
Brigham & Women's Hospital
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Lillian Haddock, M D
Dean for Academic Affairs
School of Medicine
University of Puerto Rico

Mary M Horres
Biomedical Librarian
Univ of Cal , San Diego

Donna P Johnson
Director, Resource Center
Abbott Northwestern Hospital
Minneapolis, Minn

Randolph A Miller, M D
Associate Professor of Medicine
University of Pittsburgh

Joyce A Mitchell, Ph D
Director Information Science Group
University of Missouri-Columbia

Miranda L Pao, Ph D
Asso Prof of Library Science
Case Western Reserve University

D Dax Taylor, M D
Vice President
National Board of Medical Examiners
Philadelphia

Homer R Warner, M D , Ph D (Chairman)
Dept of Medical Biophysics and Computing
Univ of Utah School of Medicine