XXII.
National Library of Medicine

INTRODUCTION

The year 1999 saw continuing leadership by the National Library of Medicine (NLM) in several areas of international work:

- furthering of global Internet connectivity;
- expansion of the DOCLINE program to include libraries in Africa, Internet connectivity, and access to information for malaria researchers in Africa; and
- the first meeting of international partners after the Board of Regents' approval of the long-range plan for international programs.

Future directions of NLM's international programs received substantial attention as a new long-range plan was approved by the NLM Board of Regents and plans for implementation began.

Internet communications connectivity and access to information resources by malaria research scientists in Africa is part of the Multilateral Initiative on Malaria (MIM)—a major multilateral initiative undertaken in collaboration with the National Institute of Allergy and Infectious Diseases (NIAID); the Fogarty International Center; and the Office of the Director, National Institutes of Health (NIH).

Other international activities were carried out with individual countries and governmental and nongovernmental organizations. Information management training was provided to colleagues from abroad, numerous professional visitors were received from around the world, and publications were exchanged with libraries in other countries.

HIGHLIGHTS OF RECENT SCIENTIFIC ADVANCES RESULTING FROM INTERNATIONAL ACTIVITIES

Long-range Planning

The increasing globalization of knowledge has made it clear that the domestic and international functions of NLM are not separable. A network of International MEDLARS Centers has grown over the years to 20 members, and the scope of their work must reflect changing needs. In 1998, the Library published "A Global Vision for the National Library of Medicine," a supplement to the long-range plan that charted an international course for the institution in the coming years. NLM has added selected international libraries to DOCLINE and Loansome Doc, to facilitate access to documents for international MEDLINE users. DOCLINE is NLM's automated interlibrary loan request and referral system. Its purpose is to provide document delivery service to health professionals by rapidly routing interlibrary loan requests among libraries in the National Network of Libraries of Medicine. Loansome Doc is a feature of PubMed and Internet Grateful Med that enables users to order documents found in MEDLINE. It is available to users in the United States and any foreign country. From PubMed or Internet Grateful Med, a user can have articles from a list of retrieved citations sent to a library that will supply full-text documents.

In December 1998, an invitational meeting of international partners was convened at NLM, Bethesda, Maryland, to discuss programs in areas of high priority, such as document delivery, connectivity, infrastructure, and the special needs of developing countries. A follow-up meeting was convened in Taipei, Taiwan, in May 1999, with representatives of the Asian International Centers, to discuss new opportunities for collaboration that focuses on the special needs of that region. A parallel meeting will be held in Cologne, Germany, in November 1999, with representatives of the European International Centers and others.

Toward the goal of promoting the development of a global health information infrastructure, NLM established the program plans described here.

Connectivity and Communications

In the area of connectivity and communications, NLM has the following goals:

- to develop a capability to work in a few carefully selected areas of need in the world where there are recent, severe health emergencies and to collaborate with efforts of other domestic and international organizations to set up targeted, carefully defined efforts (e.g., NLM participation in MIM);
- to broaden and enhance NLM's efforts to improve Internet connectivity and communications in sub-Saharan Africa; and
- to expand high bandwidth connectivity testing internationally and include protocols for connections with very high speed backbone network service, in addition to the current Internet.

Document Delivery

NLM will assist the development of effective document delivery mechanisms for international MEDLINE users by the following actions:

- promote regional networks in areas that lack effective mechanisms for document delivery;
- work with international libraries to improve access to copies of specific articles for international MEDLINE users;
- make low-cost technology for image transfer (e.g., DocView) available to international libraries and institutions, to facilitate rapid and economical delivery of documents from NLM and other U.S. libraries; and
- increase representation in MEDLINE for foreign journals containing useful global information, including reports on local and regional health problems.

Institutional Relationships

NLM will use the following strategies to promote productive institutional relationships:

- investigate the feasibility of exploiting current information technology to assist developing countries in accessing the world's sources of health care knowledge;

■ explore ways to encourage collaborative arrangements between U.S. and foreign institutions to promote sharing of resources and staff training; and

■ emphasize international partnerships in this hemisphere, for example, provision of surveillance, emergency disaster relief, and toxicological and environmental health information.

Training

NLM will continue to investigate new options for providing informatics training in geographic areas that lack training programs.

Internet Connectivity at Malaria Research Sites in Africa

"Communication with Atlanta [Georgia] and the rest of the world has improved tremendously. The importance of this cannot be overestimated. Contacts between scientists, between students and their professors and with our counterparts at CDC [Centers for Disease Prevention and Control], [and] contacts with companies and other institutes are a lot easier now. The system definitely is used—literature searches, visits to malaria-related Web sites—but the main use is e-mail [electronic mail]." These are the words of a researcher and statistician for CDC, at Kenya Medical Research Institute (KEMRI), Kisian, Kenya.

NLM continues to lead MIM's Communications Working Group (CWG), which was begun in 1997. The objectives are to create new collaborations and partnerships, to support African scientists, and to increase the ability of malaria researchers to connect with one another and with sources of information, through full access to the Internet and the resources of the World Wide Web.

The initial meeting of the MIM CWG was held at NLM, in Bethesda, Maryland, in January 1998. In attendance were malaria research scientists, health information professionals, telecommunications experts, and representatives of the major agencies that fund MIM programs and activities. In keeping with the underlying goal of supporting a broad spectrum of basic and operational needs in malaria research, the investigators requested communications and connectivity capabilities sufficient to provide, at a minimum, robust and reliable e-mail; links among research sites; access to the full text of journal articles; database searching; exchange of large files and mapping data; and timely access to electronic information resources worldwide.

In July 1999, Redwing Satellite Solutions, Ltd. (United Kingdom), and NLM's technical consultant successfully installed VSAT (very small aperture terminal) ground stations at two research sites in Kenya—CDC and KEMRI, in Kisian, and the Wellcome Trust and KEMRI, in Kilifi. This system is composed of VSAT stations, a geostationary satellite, and a downlink in the United Kingdom.

The NLM team is working to add three sites: one in Nairobi, funded by Walter Reed Army Institute of Research, Washington, D.C., and two in Ghana—at Noguchi Institute, in Accra, and at Navrongo Health Research Center. The sites in Ghana, which are engaged in the testing of a malaria vaccine, will be funded jointly by NIAID (NIH), the Naval Medical Research Center, and the U.S. Agency for International Development (USAID). When these sites come on line, the overall bandwidth will increase to 128 kilobytes/second and monthly charges will be reduced to $2,100 per month per site.

Redwing Satellite Solutions, Ltd., has given NLM a group rate for purchase of bandwidth for the MIM sites and is treating the group of sites as one customer. The group arrangement has advantages. The rate per site would increase considerably if each entity were to buy satellite service on its own. In addition, the consortium approach allows for flexibility in adjusting bandwidth to fit the needs of the individual sites.

NLM continues to support site visits and assessments, and oversees all implementation and ongoing monitoring of the system. Related issues of user training, in-country licensure of technology, and allowances for future technological advances, such as predicted worldwide availability of low-cost commercial satellite systems, are all part of an implementation plan developed by the MIM CWG in fiscal year 1999.

The plan recommends immediate use of affordable technologies to provide high-speed and reliable information and communication links. The goal is to achieve timely improvement in the ability of scientists to collaborate in research and to disseminate their findings. Recommended technologies are VSAT, which uses a geostationary satellite and an earth station, and microwave, which uses radio waves. Microwave equipment is less expensive but is limited to line-of-sight transmission. The MIM sites that request a radio or VSAT link must gain permission from the relevant in-country authority.

International DOCLINE Libraries

Under a new project of NLM and the medical library of the University of Zimbabwe, Harare, malaria researchers in Central, Eastern, and Southern Africa can request documents and journal articles on malaria, through the medical libraries at the University of Zimbabwe and the South African Medical Research Council. Their requests will be filled as quickly as possible, either locally or at NLM, by Internet, e-mail, fax, or airmail. This service will be provided free as part of a pilot program at NLM, funded by the MIM CWG.

Target countries for the University of Zimbabwe medical library are Kenya, Malawi, Tanzania, Uganda, Zambia, and Zimbabwe. Target countries for the medical library of the South African Medical Research Council are Angola, Botswana, Mozambique, Namibia, South Africa, and Swaziland.

This new service is intended to serve malaria researchers with a range of technological capabilities. Those with Internet access to the Web can search MEDLINE via NLM's free PubMed service (http://www.nlm.nih.gov). During an online search, investigators can select journal references relating to malaria research and then request these references electronically by using the Loansome Doc feature of PubMed. For some journals, the full text of references can be obtained directly on line (e.g., *British Medical Journal*).

DocView, a free software application developed by the Communications Engineering Branch of NLM, is available to malaria researchers who use e-mail for document delivery but do not have software for viewing document images. DocView enables end users of libraries and information services to view, zoom, shrink, scroll, pan, rotate, and print bit-mapped image documents received via e-mail.

Documents can also be sent by fax or airmail to researchers, especially those who have no reliable e-mail connection or who prefer paper copies of documents.

Malaria researchers with access to the Web

are invited to access a new Web site of useful resources and links for malaria research that has been developed under the auspices of the MIM CWG (http://www.mimcom.net).

Global Internet Connectivity

In FY 99, NLM completed phase II of its end-to-end Internet connectivity testing and evaluation project. This project was intended to explore the methods and measurements needed to better understand the quality of Internet performance from the perspective of the end user. To do this, NLM used test methods that measure, for example, the size of the Internet transmission "pipe," the time for sending packets of information to the destination and back, the percentage of packets lost during transmission, and response time.

NLM collaborated with numerous domestic and international partners to test Internet pathways around the world. Overall, NLM monitored about 85 network paths to hosts (typically Web servers) in 29 countries and 14 time zones. Hosts were located in all major regions of the world: sub-Saharan Africa; Central, North, and South America; East, South, and Southeast Asia; Eastern and Western Europe; and the Middle East. The monitoring included locations in all G7 and G8 countries. NLM conducted symmetrical (two-way) and time zone testing with three partners, as part of the G7–G8 Internet connectivity initiative. These partners are the Western Universities Research Consortium at the University of Calgary, Alberta; OMNI (Online Medical Networked Information) at the University of Nottingham, England; and ForthNet SA, in Crete, Greece. In addition, NLM has conducted special testing of Internet pathways to sites in several sub-Saharan African countries and in Mexico and Russia.

Results of phase I of the Internet connectivity project were published in an article entitled "Evaluating Internet End-to-End Performance: Overview of Test Methodology and Results," in the *Journal of the American Medical Informatics Association* (November/December 1998). Results of phase II are being analyzed and prepared for publication.

SUMMARY OF INTERNATIONAL PROGRAMS AND ACTIVITIES

Activities With International and Multinational Organizations

International Council for Scientific and Technical Information

As a member institution of the International Council for Scientific and Technical Information, a component of the International Council of Scientific Unions, NLM collaborated with international journal publishers and database providers in a variety of technical projects and policy initiatives. These included definition of the electronic journal publication of the future and standards and technologies needed to preserve the digital archival record of science, technology, and medicine.

G7 Global Healthcare Applications Project

Health is 1 of 11 theme areas identified for study by President Bill Clinton and his counterparts in the G7 nations, to demonstrate the value of information technology in addressing social needs.

NLM is leading a project activity premised on the notion that many G7 Global Healthcare Applications projects depend in whole or in part on the availability of the Internet. As the preferred technical means for the exchange of biomedical information with and among the G7 nations and beyond, the Internet is a critical component of the emerging global health information infrastructure. NLM, in conjunction with G7 countries and other domestic and international partners, has successfully concluded an Internet testing study that improves understanding of Internet connectivity from the user's perspective and better informs users about selecting Internet services and solving problems in use of the Internet. NLM identified a need for objective and widely accepted methods of characterizing and diagnosing the quality and performance of Internet connections under various conditions (e.g., locations, distances, time periods, and data volumes). An important finding has emerged: local bottlenecks, rather than inadequate bandwidth on the international links, are the primary source of most congestion problems on the Internet. The results of this research were published in the *Journal of the American Medical Informatics Association*, as noted previously.

Multi-Language Anatomical Digital Database

NLM developed a second U.S.-led project, the Multi-Language Anatomical Digital Database. Germany, Italy, and Japan participate in this program, which takes advantage of the multilingual capabilities of the Unified Medical Language System and facilitates multilingual access to the future Visible Human Database. This database consists of images that are inherently word free and language neutral; thus, with the addition of multilingual anatomic labeling, these images can serve multilingual needs. The project serves as a test bed for a range of applications, including medical education, patient information, and telemedicine consultation. The multilingual capability is especially advantageous for international applications.

International Visitors

NLM continues to be a focal point for visitors of the international community from a variety of disciplines. Many of these visitors are responsible for medical, scientific, or technical information in their own countries. Visitors are officially received and briefed on relevant aspects of NLM operations and research. Visitors in FY 99 came from Australia, Belarus, Belgium, Brazil, Burma, Canada, Chile, China, Colombia, Croatia, Denmark, Egypt, England, Estonia, France, Georgia, Germany, Hong Kong, Hungary, India, Iran, Israel, Italy, Jamaica, Japan, Korea, Macedonia, Malawi, Malaysia, Mali, Mexico, the Netherlands, Nigeria, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tanzania, Thailand, Tunisia, Turkey, Turkmenistan, the United Kingdom, Vietnam, Zambia, Zimbabwe, and Taiwan.