

Free MEDLINE Access Worldwide

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Abstract. When Donald A.B. Lindberg M.D. was sworn in as Director of the National Library of Medicine (NLM) in 1984, MEDLINE, NLM's online database of citations and abstracts to biomedical journal articles, was searched primarily by librarians trained to use its command language interface. There were fees for searching, primarily to recover the cost of using commercial value-added telecommunications networks. Thirteen years later, in 1997, MEDLINE became free to anyone with an Internet connection and a Web browser. This chapter provides an insider's view of how Dr. Lindberg's vision and leadership - combined with new technology, astute handling of policy issues, and key help from political supporters and influential advocates - enabled a tremendous expansion in access to biomedical and health information for scientists, health professionals, patients, and the public.

Keywords. Donald A.B. Lindberg M.D., U.S. National Library of Medicine, MEDLINE

1. Introduction

On October 11, 1984, Donald A.B. Lindberg M.D. was sworn in as the Director of the U.S. National Library of Medicine (NLM). James Wyngaarden, M.D., Director, U.S. National Institutes of Health (NIH), noted the awesome responsibility of both acquiring and delivering information to those who need it, be they students, practitioners, or researchers. But responsibilities that would "seem like minuses to some would be seen as beckoning challenges to a man like Don." In closing, Dr. Wyngaarden said: "He is a dreamer, he can see the future, but as a decision-maker he is practical, service oriented, and these considerations will rule his judgement. I don't think it's too much for us to expect that he will take the Library into the second millennium that's only fifteen short years away" [1].

As it happened, Don led the institution with dignity well beyond that timeframe, driven by a clear vision of the biomedical information to be made accessible to the varied audiences in the health arena. In his remarks, Don noted that physicians will need up-to-date information as "journals on the shelf will become increasingly too remote for immediate patient care decisions, and the computer-based personal information station will become increasingly useful, comforting, perhaps essential" [1].

This vision was manifested in numerous programs and services Don created and nurtured. My exploration here follows the path that led to NLM's online index to articles in biomedical journals, MEDLINE, being available free on the web. It was a path that

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would require embracing new technology and formulating new policies, as well as overcoming numerous impediments along the way.

Speaking with a JAMA reporter before Don arrived at NLM, I (then NLM Deputy Director) predicted he would bring “perspective on information science that would be really unparalleled in the history of this institution” [2]. What I didn’t know at the time was how quickly I would experience that new perspective. Within a week, Don would challenge Dr. Harold Schoolman, NLM Deputy Director for Research and Education, and me to assemble our own office computers. What a change this was for me, but Don believed such a task would bullet-proof me from the computer guys in the future. While Don was a serious, driven, brilliant leader, whenever possible he enjoyed making work fun. I remember telling him early on that past leadership told me my job was to strictly keep the operation running, and not to waste time attending computer-related meetings. Don jokingly would say, “Smith moved from a boss who refused to let him go to a computer meeting....to one who made him build a damn computer” [3].

2. Long Range Plan

Don believed the NLM needed a long-range plan and was surprised no such plan existed when he arrived. While NLM was required to develop plans, they were done mostly as an afterthought, created in record time, and, once developed, were carefully placed on a bookshelf to gather the dust of time. Knowing NLM had done quite well for 148 years without a real plan, Don approached the subject with a good degree of humility. Yet he was convinced his vision of serving health professionals and the general public, not to mention what he saw as a changing role for medical libraries, needed the careful thoughts of others. In developing a planning strategy, initially we met with staff from the National Eye Institute at the NIH and examined their plan, which had been recently developed with external input. This helped in designing our plan’s eventual structure of five broad domains [4].

Under the direction of the NLM Board of Regents, the Library appointed panels of experts (some 150 of them) from outside the government to prepare the plan as a road map for NLM’s future. Don clearly wanted a bottom-up plan utilizing the views of the very types of people NLM aimed to serve. He opposed the often-traditional approach of top-down planning. He often would say top-down planning might be perfect for attacking the beaches of Normandy, but it was not very good for building the future of an institution like NLM. All five planning panels, in one way or another, envisioned providing access to medical information in new and innovative ways to serve the biomedical community and the general public - the free MEDLINE that was to come to pass certainly filled that bill.

This spirit and vision were exemplified in Don’s early Congressional testimony in 1986 when he stated: “The coming years will see dramatic changes in the nature and quantity of information required for providing quality medical care. The magnitude of our continuing investment in biomedical research guarantees this. If we are to reap the maximum benefit from this investment, the Library must be prepared to disseminate the results of this research to all who can benefit from them” [5]. This view was well received by numerous authorization and appropriation committees on the Hill and was advocated strongly by two distinguished friends of NLM: Michael E. DeBaakey M.D., eminent surgeon and a prime mover of the 1956 legislation which transformed the Armed Forces

Medical Library into NLM, and Congressman Paul G. Rogers, widely known as “Mr. Health” and an ardent supporter of health information for the public.

3. Information – Commodity or Public Good

As Don Lindberg took the reins of NLM, the information society Daniel Bell had predicted was clearly in full force [6]. Along with it the debate grew even larger on whether information should be regarded as a commodity to be bought and sold, or whether it should be treated as a public good that confers benefits on all of society. Don was well aware of the past battles NLM had encountered over its MEDLARS information retrieval system and soon would become even more familiar with the battle over the pricing of its online services. He quickly realized that the NLM Board of Regents and NLM’s own statutory authority which permitted NLM, with the advice of the Board, to offer its services without charge as a public service or upon a loan, exchange or charge basis, could shield the Library from much of the confrontation with the private sector.

In his initial meeting with the NLM Board of Regents, as Director-Designate, in May 1984, the Board of Regents approved the report of its Pricing Subcommittee, prepared in response to a recommendation from the Department of Health and Human Services (HHS). The Board, recognizing the reality of the public/private pressures, thought it was proper for the biomedical community to share with NLM the cost of online services. The NLM would, via appropriated funds, cover the generation costs of building the databases, and the actual users would pay the full cost of accessing the system. There would be no differential pricing by type of user (e.g., commercial, educational). Foreign users, who did not pay the U.S. taxes which covered the generation costs, would pay a surcharge [7].

This position was supported by the Medical Library Association (MLA) and Association of Academic Health Science Library Directors (MLA/AAHSL Legislative Task Force), which regularly met with Congressional committee staff members. These visits had the clear benefit of reminding folks on Capitol Hill the important role medical libraries play in the biomedical information enterprise. Don would often say that you need to keep reminding the public not to forget librarians for they make the information pipeline work. As he put it, “The water flows in the pipe and you forget that someone actually built a reservoir somewhere” [3].

4. Success Requires Multiple Fronts

The Sesquicentennial (150th) Anniversary of NLM in 1986 provided an opportunity to spread the word on the products and services of NLM, and Don was anxious to publicize their value. As he said: “In the past it seems that the NLM has almost been seeking obscurity. A little publicity is appropriate” [8].

When U.S. Representative Paul Rogers stepped forward in early 1986 and formed the Friends of the National Library of Medicine (FNLM) as a 501(c)(3) organization, it was clear a major effort was launched to promote, publicize and support the Library’s goals of collecting and organizing scientific information and making it more widely accessible to researchers, health-care practitioners, and the general public. Congressman

Rogers persuaded Jack Whitehead, founder of the Whitehead Institute at MIT, to become the Friends' first Chairman, and soon thereafter a major event was held in December of 1986 with numerous U.S. Senators and some 20 Nobel laureates in attendance. Weeks earlier, Barbara Culliton, a distinguished journalist from *Science*, had asked me a number of penetrating questions about the formation of the Friends. In her December 1986 *Science* article, "Friends' Dance for Library of Medicine," Culliton said "It was the first time anyone can remember that a traditional charity ball has been held for an agency of the federal government" [8]. The FNLM, formed early in Don's tenure, clearly had defied conventional wisdom that such organizations were prohibited from supporting activities of federal agencies

Meanwhile, Lois DeBakey Ph.D., who initiated the Board of Regents outreach efforts in 1984-86, and Dr. Michael DeBakey, who later chaired the Board's Outreach Subcommittee, made significant inroads in reaching the popular press. Ann Landers and Paul Harvey, to mention two prominent media figures, praised the NLM in their writings and on the air. The DeBakey efforts in the early 1990s would catch the eye of Congress when a MEDLINE search, namely "numb chin," was shown on the popular TV show ER. Don didn't miss a chance to mention this before Chairman Porter's Appropriation Committee, pointing out that MEDLINE's searches are geared for public consumption. Don, showing his whimsical manner, told Congressman Porter: "We try to make our systems understand ordinary speech, such as 'numb chin,' and to make the equivalents to the Greco-Roman expressions that medical people and librarians favor" [9]. This exposure to NLM and its purpose to serve the public good did much to blunt the continued efforts by lobbyists to argue that NLM's products were commodities that the private sector alone should disseminate.

5. Technology Advances Spur Progress on Multiple Fronts

The NLM 1986 Sesquicentennial anniversary also was the beginning of major advances on the technology front at the Library. Don's goal of putting more medical information at the fingertips of the nation's health professionals was actively pursued. To the delight of vendors, NLM offered its MEDLINE database to companies distributing information on video discs. One of the earliest players in this CD-ROM field was Cambridge Scientific Abstracts, which was soon followed by 20 or more other companies. Pritchard and Weightman in the UK, seeming a bit over-exuberant, stated, "The excitement generated by the advent of MEDLINE....on CD-ROM disks, had been equaled perhaps only by that which had greeted the introduction of MEDLARS some 20 years earlier" [10].

Don, who seemed to always be a step ahead of other innovators, had already set his sights on a more impactful product, namely the development of a user-friendly search software that would come to be known as 'Grateful Med', a system that was designed for untrained searchers and would run on personal computers [11]. The developmental task required enabling the package to 'shake hands' with NLM's complex ELHILL retrieval system for MEDLINE. In essence, with Grateful Med, people were not required to learn command language to search MEDLINE. Although some laughed at the clever name, Dr. Lindberg, after considering multiple names submitted by staff, simply said "it is just too good to pass up" [12]. Dr. Edward A. Feigenbaum at the 1987 Board of Regents meeting summed up this new "intelligent agent" by saying "the long-term path of computer science is from "how" to "what." We used to have to tell a machine how to

do something; now we can tell it what we want done. ... GRATEFUL MED is but the first ministep on that very long path" [13]

The Congress was pleased, health professionals found it useful, and the private sector offered only sporadic opposition. All was well, so it seemed - well not quite. As Betsy L. Humphreys, then NLM Associate Director for Library Operations, succinctly put it: "When I arrived at the National Library of Medicine in 1973, one of the first things I learned was that health sciences librarians are not always pleased with NLM. Most would agree that NLM's leadership and its services have been highly beneficial to the field, but this does not prevent specific NLM actions - or lack of action - from annoying or infuriating some health sciences librarians" [14]. Well, Grateful Med's introduction was one of those times where hospital librarians in particular felt threatened, and Don and I felt we had walked straight into a bee's nest. But the concern lessened as librarians found that Grateful Med and other new technologies provided an opportunity to directly train and assist health professionals and to develop new and innovative outreach programs for the medical community and the general public. Grateful Med certainly made searching easier for doctors, but as Don often said, doctors are not going to be anywhere near as good searchers as medical librarians.

6. The Internet Arrives in Full Force

One bright Friday morning in 1992, Don unexpectedly received a phone call to immediately report to the White House by noon. Somewhat alarmed, he stormed into my office and said in a loud voice "What the hell have you done? They are hauling me down to the damn White House" [15,p.38]. We sat down together and reviewed everything that had transpired that week which might have been viewed as slightly over the edge. Fortunately, when Don returned from downtown, he was smiling and reported that all was well. He had just been appointed to direct the National Coordination Office for the multi-agency High Performance Computing and Communications Office (HPCC), concurrently with directing NLM. He quickly became a major voice for biomedicine as the Next Generation Internet (NGI) began to emerge and empower numerous efforts at NLM [16].

The Internet had been geared initially to areas such as physics research and computer science, but Don's HPCC efforts put the focus clearly on medicine as well. Testifying about HPCC on the Hill, Don was explaining to Senator William Frist M.D. about MEDLINE when the Senator interrupted him and said: "Wait a minute, a day never happened that I didn't do MEDLINE searching when at Vanderbilt" [15,p.56]. Kathy Cravedi, Deputy Director of the NLM Office of Communications and Public Liaison, quickly suggested to Don that he invite the Senator to demonstrate Internet Grateful Med (IGM). So, an FNLM event in June of 1996 featuring Senator Frist was planned which Don felt might essentially secure the endorsement of Congress for MEDLINE on the Internet. The FNLM Conference on Health-Care Applications of the Information Superhighway presented the perfect opportunity to feature Senator Frist performing a search as part of the launch of Internet Grateful Med (IGM). Dr. DeBakey, Chairman of the Board of Regents, also participated on stage - nothing like two surgeons teaming up to promote a new NLM service. At the conference, Senator Frist summed it up this way: "MEDLINE can be critical for doctors in reaching the correct diagnosis and developing a sound treatment plan, resulting in lives saved, limbs spared, and disease prevented, unnecessary treatment avoided and hospitalization reduced" [17]. Reflecting later on the

importance of this event Don said: "You know this Internet is no longer just a political slogan - it's the best communication system this poor old planet has ever seen" [18]. IGM had increased individuals' ability to gain access to MEDLINE data without having to purchase and install copies of GM software.

7. Two Visionaries Meet on the Superhighway

On January 20, 1993 Al Gore was sworn in as the 45th vice president of the United States. As far back as the 1970s as a Congressman from Tennessee he was exploring and promoting the value of high-speed telecommunications. There was the Supercomputer National Study Act of 1986, later followed by the 1991 Gore-crafted High Performance Computing Act which demonstrated the potential advantages the Internet could offer. As Bob Kahn and Vint Cerf - the Fathers of the Internet - expressed it: "Al Gore was the first political leader to recognize the importance of the Internet and to promote and support its development" [19]. Gore coined the phrase 'digital highway,' harking back to his father's efforts in developing the nation's National Highway System while serving as a Senator during the Eisenhower administration. As Chapman and Rotenberg said in their paper "The National Information Infrastructure: A Public Interest Opportunity," a highway metaphor gives the national information infrastructure a concreteness, to employ a pun, that otherwise escapes many technologically unsophisticated listeners when they hear about multi-billion-dollar investments in computer networks [20].

In an editorial in 1995, Lindberg and Humphreys posed the question of "How important will high-performance, ...and high-speed communications be for biomedical purposes" [21]. We know now it turned out to be ubiquitous, but at the early stages the challenge was to simply obtain the necessary internet connections for institutions and the general public and demonstrate their use. With Don at the helm of HPCC, and with Gore's perspective on high-speed communications, the two visionaries were in frequent contact, and together their efforts would enhance health care. Importantly health science libraries would be a major part of the future equation.

In the mid-1990s, U.S. President Bill Clinton stated he was going to "reinvent government." The idea was to make the government less expensive, more efficient and to shift it from complacency to empowerment. Vice-President Gore was designated by the President to manage the National Performance Review (NPR). NIH had virtually no interest in this effort, but NLM decided that by being designated a "Reinvention Laboratory" perhaps it could make some lemonade out of this perceived lemon. While much of this was about streamlining operations, it also provided the Library an opportunity to secure some new legislative language allowing it to promote the use of computers and telecommunications by health professionals to enhance access to biomedical information for health care and research.

Don decided this was, of course, an ideal time to intensify our efforts to reinvent the Library's information systems. Our stated goal was to move to a more flexible, powerful, and maintainable computer system that would improve internal processing and provide innovative services to outside users. Many of the internal support systems were addressed by installing a commercial Integrated Library System (ILS) and building a new version of the DOCLINE system for interlibrary loan requests. Also, an effort to find a new retrieval system to replace ELHILL was intensified. NLM simply couldn't continue to maintain the old custom-built software and large mainframe system it had

relied upon for many years. Maintenance was a problem and flexibility was minimal under this legacy system.

Don was already exploring new avenues, and one option involved an interesting trip we took to the University of Massachusetts Health Science Center in Worcester, MA. Though a useful and promising visit, it turned out that the best solution to the NLM retrieval problem was right in its own backyard. David Lipman M.D., Director of NLM's National Center for Biotechnology Information (NCBI), and his talented staff had just developed the Entrez system for searching nucleotide sequences. A part of the Entrez retrieval system, soon to be known as PubMed, clearly had the capability of performing MEDLINE searches and developing important linkages. Don figured here was the final piece needed to offer MEDLINE free over the Internet. However, he emphasized that care would be required as NLM had, for many years, operated within directives and rules set forth by the Office of Management and Budget and the House and Senate Appropriations Committees. They had long required NLM policy to carefully balance the needs of both the private and the public sector.

Don proceeded cautiously, remembering well a previous effort conducted by private sector lobbyists to insert damaging language to eliminate any federal agency control over public use of their databases into a bill to renew the Paperwork Reduction Act. Concerned about the provision, Don and I met with the relevant ranking committee members, Senator John Glenn (D-OH) and Senator Warren Rudman (R-NH). After our conversations, the latter, to our delight, took the unusual and unexpected step of invoking a "stop order" to the bill, which ultimately resulted in eliminating the restrictive language. In speaking with Tom Polgar, Rudman's Chief of Staff, he later explained the Senator's unique action, stating it was simply a testament to what you would call New England crotchety stubbornness.

Each year either during open hearings or in private meetings with appropriations staff NLM would be asked the following: (1) to report on its agreements to support differential pricing for foreign users of our services; (2) to indicate the amount of money we were returning to the U.S. Treasury from online MEDLINE services; and (3) to show the latest breakout of the various users of NLM's online services (i.e., biomedical researchers, health practitioners, medical libraries, the general public, and the pharmaceutical industry.) One concern with free MEDLINE was that without registrations NLM would no longer have accurate information about who its users were.

Don nonetheless felt free MEDLINE should be pursued with vigor. The experience with IGM had showed that this new method of telecommunication, when combined with the software innovation of the World Wide Web, had already reduced our actual costs of providing MEDLINE searching by approximately 80 to 90 percent. Given the clear objective to provide free MEDLINE, an internal NLM Pricing Committee examined the financial issue. The committee found costs could be drastically reduced by (1) eliminating the usage of commercial value-added networks; (2) stopping the registration of users; (3) ceasing the collection of fees, and (4) ending our management arrangement with the National Technical Information Service at the Department of Commerce. By moving to the Internet, the Committee concluded, it could reduce NLM's total costs from approximately \$18 million to a manageable \$4 million per year. [22]

From an administrative perspective it was clear that NLM could begin its transition plan to introduce free MEDLINE service for Web users, and to make, where necessary, subsidies to health professionals located in areas where there was no local Web access. The next challenge was to quickly garner additional political support, in particular from the Congress. Don got the ball rolling in his March 1997 testimony before Congressman

Porter's Appropriations Subcommittee, where he mentioned that NLM had a new MEDLINE-related service called PubMed. Smiling, he said "the name I attribute to my colleague Dr. David Lipman who has a fertile imagination." Don went on to alert the committee that: "We're actually now exploring whether it might be possible to offer PubMed without charge in the U.S. to those who use our inexpensive Internet connection service" [17].

8. A Notable Citizen Makes a Difference

It is common practice that in addition to formal Appropriations Subcommittee testimony from federal officials that public witnesses appear before the Subcommittee. The premise is that citizen testimony can provide significant additional input into the legislative process and also lend it additional legitimacy. To their credit, the Medical Library Association has provided important oral and written citizen testimony on behalf of NLM on numerous occasions.

On April 15, 1997, the FNLM, then chaired by former Congressman Paul Rogers, requested the Subcommittee to hear from the Chairman of the NLM Board of Regents, Dr. DeBakey. Congressman Dan Miller of Florida, chairing the Subcommittee that day, welcomed Dr. DeBakey by stating they were honored to hear from such a distinguished gentleman. Dr. DeBakey began his testimony praising the NIH and then related how he was involved as part of the Hoover Commission in recommending the establishment of the NLM and its inclusion as a part of NIH. DeBakey spoke of the wonders of the national information infrastructure and especially the Internet and the World Wide Web. That led to what he called the great opportunity, namely: "The Library could provide access to its vast MEDLINE database of references and abstracts to all U.S. citizens without charge on the World Wide Web." After commenting that an educated public is the bedrock of democracy, DeBakey proceeded to his second major point, emphasizing: "I believe that healthcare professionals and consumers should be able to tap into the most recent medical information, for that is a public good, not a commodity" [23].

The committee was clearly impressed to have heard from Dr. DeBakey, Don couldn't have been more pleased, and the theme of free MEDLINE as a public good now was clearly the path going forward.

9. The Vice-President and the Congress Make it all Official

In early June Don and Dr. DeBakey contacted Vice-President Gore to ascertain his possible interest in participating in a press briefing on the Hill to be hosted by Senator Arlen Specter (R-PA) and Senator Tom Harkin (D-IA), chair and ranking minority member of the Senate Appropriations Subcommittee. The request to Vice President Gore was for him to take part in the launching of PubMed, a system that would provide free access to MEDLINE to Americans and others around the world over the World Wide Web. The request was agreed to quickly for it matched perfectly with the vice president's efforts in promoting the importance of the nation's "digital highway" and with the president's initiative in "reinventing government." Both senators were instrumental in the success of the event, with their staff participating in its careful planning and execution.

Fearing yet that some members of the private sector might object to free MEDLINE, an effort to include key people at the ceremony became crucial. To launch MEDLINE free on the Web was to, in effect, turn away from the long-standing agreements NLM had made over the years with Congressional members and of course the ever-present folks at the Office of Management and Budget. As Don amusingly commented: "They (the private sector) may attack me, but they're going to have to take out Varmus, Gore, Specter, and Harkin. I think I'm pretty bulletproof" [15,p.57].

On June 26, 1997, Vice President Al Gore was seated on Capitol Hill before a computer and performed the inaugural free search of MEDLINE. With these profound words he declared: "This development is going to do more than anything we've done in a long time to make people healthy." The vice president searched ear infections, flu shots, and other medical questions, all carried out in an entertaining manner with comic play-by-play with Dr. Lipman, Director of NCBI and leader of the developers of PubMed. All the dignitaries got into the act - Senator Specter: "The superhighway of medical information just became a freeway." Senator Harkin: "Today ER meets the Internet. Searching MEDLINE is going to be on the house." Don Lindberg: "The NLM's debut of free web-based searching could not be timelier" [24].

As expected, the print and electronic media covered the launch. The *New York Times*, the *Wall Street Journal*, the *Chicago Tribune*, the *Washington Post* and many more all praised the development. The *Post* said it simply in its headline: "Medical Research is Made Available to All." Numerous medical journals joined in celebrating free MEDLINE with statements such as: "That event may prove to be a symbolic watershed of 20th century American medicine" [25]. And "Free provision of this enormous resource is arguably the U.S.'s greatest contribution to modern healthcare" [26]. Shortly thereafter, Don would proudly tell Congressman Porter's Appropriations Committee that MEDLINE searching had dramatically increased from a going rate of seven million searches a year to 70 million, and the general public's percentage of searches had gone from almost zero to 30 percent.

On July 25, 1997, the House Subcommittee Report was released, and it provided the important Congressional endorsement of free MEDLINE. Working with the committee staff to finalize this important language was Mr. Bradie Metheny, a staunch NLM supporter and former Director of the Delegation for Basic Biomedical Research. Securing report language was essential, for aside from actual legislation, it is the closest mechanism for conveying clear Congressional intent. The language developed was unambiguous, stating:

The Committee supports NLM's decision to extend free MEDLINE access within the United States via the World Wide Web. The resulting access to high-quality health information will be an important step to improving public health and will build upon the national investment already made in telecommunications connectivity [27].

The vice president's endorsement and the Committee's report made it all official. Don's vision expressed at his swearing-in ceremony back in 1984 had become a reality. Citizens and the health professionals who served them were now able to access directly the most current and credible medical information available.

The worldwide impact was enormous. At the International Congress of Medical Librarianship in London in 2000, the first held after MEDLINE became free in 1997, the 1,417 attendees from 77 countries passed by acclamation a resolution thanking the

National Library of Medicine “for the enlightened generosity of your policy on access to Medline and other electronic resources via the Internet.” In communicating the resolution to Don, Tony McSean, the chair of the Congress, thanked “the U.S. government, the governance of the National Institutes of Health, and yourself personally for transforming at a stroke the quality of information that so many of us can offer to medical professionals and patients. The role of the NLM in the developing global health information system cannot be overstated” [28].

10. Conclusion

John Shaw Billings, M.D., director of NLM’s predecessors in the Department of the Army from 1867-1895, created MEDLINE’s precursor, *Index Medicus*, in 1879. A medical visionary himself, he said in 1913:

There is nothing really difficult if you only begin - some people contemplate a task until it looms so big, it seems impossible, but I just begin and it gets done somehow. There would be no coral islands if the first bug sat down and began to wonder how the job was to be done [29].

It was approximately 130 years later that Don Lindberg, a man with a vision and a common purpose, would assume the Directorship of the National Library of Medicine. He, too, had a passion and dedication to transform the accessibility of biomedical information to serve the needs of the nation. His determination, in spite of impediments along the journey, resulted in many achievements for NLM, none greater than free MEDLINE over the Internet. I was honored to have traveled that road with him for 20 years.

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