MEDICAL LIBRARY ASSOCIATION

ORAL HISTORY COMMITTEE

INTERVIEW

WITH

DONALD A.B. LINDBERG

Interview conducted by Linda A. Watson, AHIP, FMLA

October 31, 2014

Edited by
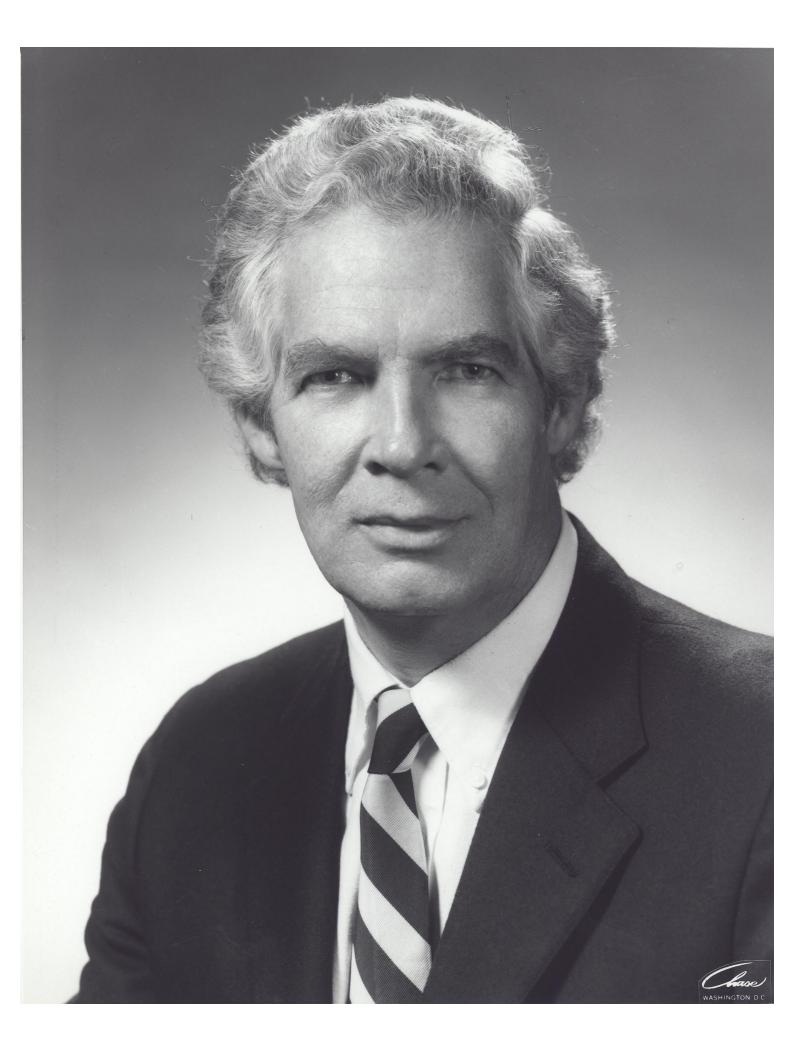Carolyn E. Lipscomb, AHIP, FMLA
Project Director
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Consent Form for Oral History Interview (2002 version)

This confirms my understanding and agreement with the Medical Library Association (MLA) concerning my participation in an oral history interview as a part of MLA's Oral History Program.

1. I agree to be interviewed by __Linda A. Watson_____
on __October 31, 2014_____. I understand that my interview will be recorded and that a transcript and edited version of my interview will later be created. I understand that I will be given an opportunity to review and edit the edited transcript before its release.

2. I hereby grant and assign all right, title, and interest to any and all recordings and transcripts of my interview including copyright [and all rights subsumed thereunder] to MLA. I will be given a copy of the edited transcript for my personal use. I understand that the transfer of these rights to MLA confers no obligations on MLA to promote, market, or otherwise make publicly available copies of the interview.

3. One or more edited and/or condensed versions of the interview, approved by me, may be disseminated by MLA, as it deems appropriate.

4. I understand that the original, unedited recording of my interview and the original unedited transcript will be maintained in the MLA archives at the National Library of Medicine, or at such other place as MLA may reasonably designate, and may be made available to researchers who have demonstrated that they have appropriate qualifications. I further understand that the original unedited recording and/or the original unedited transcript will be made available with the following restrictions (Check one):

     __X__No restrictions

     _____The following specified portions of the interview will not be made available to anyone until _____.

__Donald A.B. Lindberg_____   _Linda A. Watson_____
Name of Interviewee   Name of MLA Interviewer(s)

_____   _____
Signature   Signature

Date_10/31/2014_____   Date_10/31/14_____

                                      Date_2/26/16_____

Accepted by:_____
     MLA EXECUTIVE DIRECTOR

Biographical Statement

Donald A.B. Lindberg, MD, was interviewed shortly before his retirement as director of the National Library of Medicine, the world's largest biomedical library, a position he held for over thirty years from 1984-2015. He led the library in pioneering the application of computer and communications technology to biomedical research, health care, and the delivery of health information.

Lindberg graduated from Amherst College and Columbia University College of Physicians and Surgeons, where he met his wife Mary Lindberg. Trained in pathology as a resident at Columbia-Presbyterian Medical Center, he joined the pathology faculty at the University of Missouri-Columbia. There he became involved in the field that would come to be known as medical informatics, developing the first computer-based clinical laboratory. He was the first president of the American Medical Informatics Association.

As NLM director, he spearheaded transformative programs, including direct access to MEDLINE through Grateful Med and free Internet access via PubMed, MedlinePlus for the public, PubMed Central's full-text archive, the Unified Medical Language System, the Visible Human Project, and ClinicalTrials.gov. He oversaw the establishment by Congress of the National Center for Biomedical Information, a focal point for access to molecular biology information and genetic sequence data.

He was equally concerned with delivering high quality health information to everyone and recognized the importance of including patients and consumers as well as health professionals. He emphasized outreach in expanding the scope of the National Network of Libraries of Medicine and established partnerships with minority serving institutions, Native American groups, and the public health community. The successful NLM Exhibition Program extended its reach through traveling exhibits to libraries throughout the country. The library also coordinated health information resources and technology for disaster preparedness, response, and recovery.

Lindberg led federal interagency programs in concurrent positions as founding director of the National Coordination Office for High Performance Computing and Communications in the President's Office of Science and Technology Policy and as U.S. coordinator for the G-7 Global Healthcare Applications Project.

Through his leadership, the programs and services of the National Library of Medicine have helped librarians provide access to health information and continue to reinvent themselves and develop new roles. The Medical Library Association recognized his contributions to the partnership of MLA and NLM by awarding him honorary membership in 2013. The MLA Donald A.B. Lindberg Research Fellowship funds research linking information services provided by librarians to improved health care and advances in biomedical research.

Medical Library Association Interview with Donald A.B. Lindberg

[141031-LindbergPt1]

LINDA WATSON: This is the Medical Library Association oral history interview with Dr. Donald Lindberg, director of the National Library of Medicine. Today is Friday, October 31, 2014. We are in Dr. Lindberg's office at the National Library of Medicine in Bethesda, Maryland. The interviewer is Linda Watson.

Don, I want to thank you for taking the time to do this interview for the Medical Library Association. I thought we could divide the interview into three parts: first, briefly, your early career and background in education—your pre-NLM professional career; second, your thirty-year career at NLM, which is the major part, obviously, and the importance of long-range planning to NLM's activities and your involvement with medical librarians and the Medical Library Association; and finally, some general comments and observations. That sound okay?

DONALD A.B. LINDBERG: Sounds okay, but we'll probably do better just conversing.

W: I'm sure. So can you tell me a little bit about your early background—where you were raised, your family, and your education through college?

L: Well, first of all, I have to say that I've made positive identification of Linda Watson because I took a picture off our refrigerator. It was a slightly younger Linda but easily identifiable. She was standing with Don Detmer and Mary Helen Detmer in kind of a library-looking place. And I guess I was there. Mary [Lindberg] no doubt was there as well. But we didn't remember the circumstance and you did. What was it?

W: It was the dedication of a reading room that the Detmers helped us find the money to renovate, and we named it after Dr. Detmer. So it became the Detmer room. And it housed the Kerr White collection, so it was a very special place for us.

L: I'm sure it is a special place, and I'm sure that we were honored to be present when it was all happening.

W: Right, at the University of Virginia. It was a wonderful time there with Dr. Detmer.

L: Yes, I can see that. We actually met when you were at NLM, though. Isn't that right?

W: That's correct.

L: What did you do up here?

W: I started here in 1974, actually, as a contractor down on the C-level with all the serials. And my job was to re-catalog those serials from corporate main entry to title main entry back in those days, and then to shift the entire collection to make them

alphabetical—'Journal of the American Medical Association' rather than 'American Medical Association. Journal.' It was quite the task.

L: Yes.

W: From there I applied to be a library associate, and that's where I really started my National Library of Medicine career.

L: Oh, you were an associate. That's a wonderful program [Associate Fellowship Program].

W: Yes.

L: Yes, I think that's lovely. I was amazed to find that in full flower—almost full flower, anyway—when I came in 1984. I talked with Lois Ann Colaianni about doubling the size of it since it obviously was successful. There are all sorts of reasons for that not happening very quickly, but it happened very quickly once Betsy Humphreys took over the post. It doubled and it was a success in that mode. And she invented a whole second year, which also was very successful.

W: Yes. That, I think, was a real key, to get the library associates the first year training here at NLM, which was wonderful, but then to get them out into the field where the real world things were happening and they could see how NLM products and services affected all of us out in the field.

L: Well, sure, and the name of the game is to get a good job. We're fully aware of that. Every once in a while they're able to entice an exceptionally meritorious fellow to stay here, and now I know you're one of them. That's great. It confirms what a good policy it was.

W: Yes, thank you.

L: Actually, our current head of library operations, Joyce Backus, was a fellow.

W: Yes, many of us.

L: I keep thinking of her as a sort of second baseman, because shortly after she arrived there was a picnic. I don't know why we don't do that anymore. It was a lovely summer day and it was a picnic. I don't remember where. I guess over at Navy, maybe. And the pitcher on one side, I guess I thought it was my side, was Kent Smith, who was my deputy, but he liked pitching. And I think on the other side was Al Barnes. You probably remember him.

W: Oh, yes.

L: And so they desperately eyed each other and pitched their best. And it was really a wonderful day. But I remember being happy that Joyce was the 'newbie' showing up.

W: Great, yes. Softball is one of my passions. I played softball until about four years ago.

L: Did you really?

W: Yes.

L: So if you had been there that day what position would you have been playing?

W: I pitched and I played first and second base.

L: Wow, hot product.

W: So enough about me. This is your oral history interview. Maybe in ten years you can interview me for my oral history someday, but this is about you.

L: Well, about me, though—I like the library and I like the people who work here and I like MLA, as a matter of fact. The latter—something of a surprise—just because I didn't know it very well. But it's a wonderful organization. I've always enjoyed going to meetings. I always had a good sort of a feel for what they're trying to do and the way they conduct themselves. Just for example, MLA meetings, if you're going to give a talk, you know the projector is going to work. If the bulb burns out, it'll switch to a second bulb. The room will be the right size. You won't have everybody standing around the back wishing there was a seat or the reverse. That kind of stuff they do very, very well. You know, early morning meetings they may provide you with ice water.

W: Yes, there are a lot of early morning meetings, for sure. So when you first became library director here in 1984, had you worked much with medical librarians at all in Missouri or anywhere else?

L: Well, very happily in Missouri. There was a very nice librarian. I remember marching in one day—not hot under the collar or irate but just thinking I would tell them—here are important journals they didn't subscribe to and here are important books that he hadn't purchased. And instead of throwing me out, he said, "Oh, wonderful. So glad to hear from you. There's actually a library committee. You should be on the library committee."

W: So did you agree to be on the library committee?

L: Oh, yeah, sure. Ultimately they changed libraries. We physically moved from one place to another. And they did it the old way—hand-to-hand books, just a long line of people passing books—which is fun in itself. It was like some Midwest barn building. Of course, we were Midwest.

W: But you grew up in Brooklyn, right?

L: I grew up in Brooklyn, yes. That's pretty far away from the Midwest. But Brooklyn is a wonderful place. It sometimes gets a laugh out of a radio audience, but it was a great place. There was an opera in Brooklyn long before the Met in Manhattan. In fact, my dad always said that the biggest mistake Brooklyn ever made was allowing that bridge to be built. Well, actually, it's a beautiful bridge. I love the bridge. Also, we used to spend summers in Nova Scotia in Canada. I would say that Brooklyn, or the whole city, for a child in the summer is not ideal at all. There are beautiful beaches—at least there were, Jones Beach. It was sufficiently far out on the island and it didn't have any public transport, so that meant that it was fairly open, fairly private, I guess you would say. If you had a car you could drive there. Of course, like every boy in the United States, as soon as I could possibly manage to get my hands on a steering wheel, I had a car.

W: Of course.

L: An imaginary birthday, but a real car. So the summer usually we spent with my mother's family—my grandmother up in Nova Scotia, so I was fully prepared for life outside of New York. Up there, of course, they say, "Someone has moved." "Where has he moved?" "He moved out of town." Somewhere in the world—not New York.

W: But you went to school in Brooklyn for high school?

L: I did, Poly Prep. Polytechnic Preparatory Country Day School. Probably—well, easily, the four best years educationally for me ever, anywhere. Really wonderful place. And it was a wonderful time, those four years of—we call it 'high school' today. Even though they were followed, of course, by wonderful years at Amherst College and then [Columbia University] College of Physicians and Surgeons and medical school and then residency at Presbyterian Hospital. But the best four years were the prep school years.

W: The formative years, and you met people who are probably lifelong friends.

L: Yes, exactly. Absolutely. Although that was true at Amherst, also. It just hit me at the right time. I see kids now, I would say, looking as slummy as they possibly can manage. I mean, extra price for jeans that already were washed too many times and creased too many times, etc. I felt exactly the reverse. Here was an opportunity to wear a nice tweed jacket and a coat and tie and be dressed up. I thought that was wonderful.

W: What made you decide to go to medical school?

L: Yes. Well, every doctor has that same issue—why did you go into medicine. I guess the short story, from my point of view, is that I thought of medical school as human biology and I loved biology. I switched from an English major at Amherst to a biology major, so I had a good bit of both of that. But I knew, of course, that there's med school and a pre-med program and so forth. So I did the pre-med program at Amherst just in

case I would decide to go there. My boss actually wanted me to go to Rockefeller [Institute], a PhD program, so I sort of talked myself into a month-to-month contract in med school, because I don't know anyone that I could believe that would ever say that the four years of medical school were educationally wonderful, because they're absolutely totally terrible and, so far as I can see, remain terrible educationally.

W: Memorization and just stuffing your brain with information?

L: Yes, exactly—the reverse of understanding. It's just memorizing. Of course you have to do some of it, and the anatomy and the terminology must be learned. But it's not an inspiring process. Every once in a while in med school, there'd be what we said was 'egg in your beer.' That would be a few hours of physical diagnosis or talks with the senior faculty or something, anything about what we were doing. But on the other hand, P&S [Physicians and Surgeons] did give us, I guess I'd have to say, from the medical point of view, a good education and a good introduction to the field.

I remember, in respect to that, what would be the differences, because there was a big difference in ultimately graduating from medical school and path [pathology] residency and whatnot at Columbia-Presbyterian, and then choosing to go out to [the University of] Missouri[-Columbia], which was a new school. It had started just a year or so before I arrived [in 1960]; that is to say, it moved from a second-year school to a four-year school, having been sort of wiped out by the Flexner Report [1910], amongst many other schools. The Flexner Report said, yes, off to a pretty good start, but it's too small a town to support a major activity, and they were right, given the stuck-in-the-mud days. But anyways, so what was the difference? I would say that the kids are just as smart in School A as they are in School B. There's still a lot of competition—at least there was— to get into medical school. So smart kids aren't difficult to come by.

The real question—I worked on the National Board of Medical Examiners for quite a while, too, as a—I don't know what they call you, but you're on committees, and we were trying to get a computer-based exam going. But just to divert for a moment—what is the National Board of Medical Examiners really all about? Well, they have fallen prey then, and possibly still now, to the internist's favorite indoor occupation, which is pinning prizes on A+ students. And everyone wants to be an A+ student, they think, so their exams are designed to separate out the A+ students from the straight-A students from the, god forbid, A- students, which in reality is completely and utterly irrelevant. I mean, all of that work and all of that standardization, the best standardized tests that I've ever seen anywhere for a national board. But if you turned it around and said, what does the public actually think they're doing and what does the public actually want, well, what the public actually wants is—I've said that many, many times without any success that convinced me—what the public would actually like is a process that identifies phonies. You would read in the newspaper all the time, here's some old Navy corpsman who isn't an MD or even close to it and he's practicing. And, god, he's been doing it for five or six years and no one can tell the difference and his patients think he's lovely. Now I should turn it around and make it a female, but—I think it was the first way [laughter]. Because I think if National Board could identify someone like that, that would be socially useful, because

that's not right; they aren't safe. But to distinguish the A- from the A+ is totally, completely irrelevant to the patient, because it doesn't make any difference. What the patient would also like to know, and we, too, in medicine, we'd like to know that of these people sitting the exam, which one of them, man or woman, will actually get up at night and go see a patient, or even answer the phone. That's a tough thing to identify. We sort of say, well, we kind of can tell, but I don't know anyone who really can tell. That's what we'd like to know. That's what the patient would like.

W: So it sounds like even at P&S and when you were going through medical school there was this feeling that it wasn't preparing you for the right things.

L: Oh, no. And P&S is vastly satisfied with itself. It was the general feeling that everybody else was lagging behind. In fact they used the term 'LMD'—local medical doctors—which was actually, I guess, some benighted fellow, doddering or otherwise, out in the boroughs someplace, not in Manhattan, certainly, and not on the faculty, certainly.

One of the most interesting things I observed in that whole long period was just down the street—on I think it's called Fort Washington Avenue—was what was in those days called a deli, a very small shop that sold some food and newspapers and candies and maybe egg creams and stuff like that. Often I'd go with classmates to have a lunch there. And Izzy was the man who ran it, and his wife—and I'll have to think about her name. But anyway, they were both quite nice. But Izzy was an obvious acromegalyte. He had that disease [acromegaly]. One day we actually talked to Sarah—that was the wife's name—we talked to Sarah about Izzy, because he'd go in and out and so forth. In fact, he would go in and out of the neurological institute, which is logically where you'd get your pituitary tumor X-rayed so it didn't cause any more acromegaly. But anyways, so she said, "Well, there's nothing wrong with Izzy," and we said, "Well, that's not really true. There's this, that, and the other." And she said, "Well, he's getting old, so he's getting ugly." So neither of them had any appreciation at all of this life-threatening illness. And the fact that he's going in and out of the neurological institute was that—in fact—because he was delivering lunches. We assumed that he was being treated. Not so. So it got to be scary. Well, we have to get him treated, but on the other hand, will there be repercussions? Because he was seeing a doctor who was I guess fully qualified to be called an LMD—down the street, walk-up, you know, carrying an EKG machine, do those tests himself in the apartment. So will there be lawsuits and stuff like that? But it turned out quite the reverse, because Sarah and Izzy ended up being able to say, Izzy is being treated by the president's doctor at the institute. And radiation prevents it from getting any worse, anyway. But in the course of it they'd get hypertensive, eye changes. So that was literally in the shadow of Columbia-Presbyterian Hospital—literally down the street in the shadow. Terrible medicine. The worst you could imagine.

W: The haves and have-nots, which hasn't really changed too much these days, about the kind of medical care you can get.

L: Well, that's right, but it wasn't the case that they couldn't afford the care, because they were paying for care. I don't think anybody had insurance money in those days. And Presbyterian wouldn't have charged them anything anyway. In fact, he would have been seized upon as 'my' patient. "Man, I want you to see what I did for my patient." Everyone would have been vastly proud of themselves if they could possibly have gotten any more proud of themselves.

So it was educationally very worthwhile.

W: So is that where your passion for self-empowerment and patient education and understanding what your options are and all those kinds of things which you've obviously been able to push forward through your career might have originated?

L: I think it is. My wife ran the pediatric clinic. You see that there too. Mostly good mothers and some not. But the ones who are not would take oral medications and sell them down on Broadway. It was just the beginning of the "I'll buy anything that's a pill and swallow it and see what it does for me." But in this case it would be good medications—antibiotics. And we became so discouraged with that kind of process that we just finally—I mean, people, house staff—just made an informal policy that, by gosh, they're going to get injections. Whatever the hell it is, we're going to put it in the kids so we know they at least got that much.

W: You mentioned your wife, Mary. Can you tell me how you met? Because I know she's the love of your life and a big part of your career and a wonderful woman. Where did you meet?

L: Well, it was a marriage made in heaven. That's the whole story. Actually, she was running the pediatric treatment room at Presbyterian Hospital, and I showed up as a student—brash but not unaware of a pretty girl, which she sure was. And it turned out she actually had an engagement ring on, which I didn't pay, I guess, suitable enough attention to. So I asked if she'd like to come to the Amherst-Williams football game in a couple of weeks, and she informed me that that wasn't going to be possible and flashed the ring and so forth.   So I said, "Well,"—trying to recover as best I could—"I'll ask you again." And she'd have to tell her part of it. But by then she wasn't engaged and we did go to the Amherst-Williams football game. And I got to introduce her to my teacher up there, Oscar Schotté, who's an embryologist, and get the nod from Oscar. We proceeded to not have a lengthy engagement. I guess that first date was October 28th and we got married later, on June 8 [1957]. But she's a very good nurse.

One thing that still amazes me is we gave a lot of penicillin then. We didn't have a whole lot of choices. But everyone says that a certain percentage of kids react badly to penicillin and go on and have a terrible, life-threatening reaction and so forth. She never had that happen. I don't know if there's something in the way you give it or not, but she was giving a heck a lot of penicillin shots in a day, certainly twenty, thirty, forty, and never had that occur.

We had a lot of strange things happen, though. One time... I don't think I can remember the strange name. Of course, New York was a mixture of different ethnic names, but this was a funny name. It was sort of semi-Spanish but then with a Polish ending. Anyway, what would happen is that they would see patients in the order in which they arrived, and of course somebody would write down the name. And then when your turn came, they would say the name, and then you'd bring the child in and get a shot or get pumped out or blood pressure taken or whatever they needed to do. And this name was called and the person seen in order, but it was a mother that just wanted the child seen for something, for anything. They'd take whatever shot was associated with that name and then get out of there. So at the end of the day was the true mother with the true child not having been seen, and Mary asked her, "Ma'am, what is the name?" and it was this name that she'd already been called and seen. So I guess that's part of what you're asking me—should somebody take some sort of pity on patients. Yes. I mean, if the treatment that you get in a clinic is so bad that you'll do anything to get your kid something and get out of there, even though it's the wrong child, the wrong treatment, the wrong diagnosis, the wrong everything, that isn't a good system.

W: So you finished your pathology—chose pathology, did a pathology residence at Columbia. So how did you get to Missouri from there? That's a big switch from New York to Missouri.

L: Well, see, Amherst was the transition. At Amherst was falling in love with biology. I liked English as well, but my favorite English teacher got recruited by Harvard and so left me slightly looser, I suppose. And I discovered experimental embryology. This marvelous guy. The best teacher of my life by far was Oscar Schotté. Lovely, lovely guy. I guess what I learned at Amherst was two things, both of which were surprises. One, I would say, is the thrill of discovery. It's pretty fantastic. How many [times] in your life to go and do an experiment and discover something that nobody in the whole world knew? And then you can write it down and publish it and then everyone can know it. Well, that's the process that I found very striking. And how many steps in it and how long you had to wait. We would go out and collect... We did experimental work on newts, studying how they could regenerate limbs—that was the essence of it, although they can regenerate other things, and we used other organisms. But that was our classic experiment. And we would go out in the pond and get the newts.

W: Start to finish, huh?

L: Whole animal biology, yeah. And the experiments were, of course, I guess you'd say maybe now, on your honor. But you were conducting the experiment. You were writing down what you were doing. You were doing what you said you were going to do, and so forth, in contrast to what we're seeing now, which is so-called 'unreproduceable results.' And the drug houses are complaining about the publication. Good journals of preclinical results or basic chemistry and biology that for some reason or another don't hold up, so they're either falsely reported or falsely done or over-interpreted or whatever. Anyway, such a possibility couldn't be imagined in a Schotté lab. People sometimes say about someone he's a mensch. Well, this guy was a mensch, for sure. So by Friday afternoon,

like four, four-thirty, you want to definitely be in the lab talking with Prof, we called him—Schotté. So that was the time to go into the cold room and get the schnapps [laughter].

W: Okay. Happy hour, huh?

L: Switched to philosophy time [laughter]. Yes, it was that kind of a lab. And then it's fair to ask anything. You can ask him, "Why are you doing biology? What was life under the czar in Russia like?" That produced a lot of interesting stuff. Some tears in his eyes, of course, as well.

So Amherst was a wonderful place for me. Therefore, doing biology one way or another was definitely in the cards. You were entitled to believe that you are a biologist, having majored in that at Amherst College. You knew, in all honesty you were not doing—your own levels of competence in education were pretty minimal. You could say to yourself, "I am a biologist." And I don't know if in English they would have you say, "Well, I am a poet," but probably they would. It was that kind of school, but it was a good one.

So then the question was, well, okay, but will you [go to medical school]? It was clear there's a big division. And the question would be… Of course, one admired doctors. Sometimes there would be the fathers and friends and so forth. But it's a bit of a mystery in medical school why anyone ever got in the field, but usually it's a very casual understanding of what the field is really about. Almost no medical student I've ever encountered would have the slightest idea that two hundred doctors are practicing inside CIA, or that there's all the specialties in the world that you can have, etc. But on that level, I knew that I admired what these people did, and I knew that it was pretty hard to turn back. You could do the medical school, but in those days no one ever came back. These older students applying, now it's taken as a good thing. But it wasn't taken as a good thing then at all. So anyway, I made a decision to at least qualify by taking pre-med courses.

You might say, well, you got some advantage with the courses, but at Amherst, actually, the price you paid there is that you did not get to take the science for non-scientists course, which, strangely enough, was called evolution. Totally wonderful course. And my roommates were non-scientists. They were historians and lawyers. So they would tell me. The evolution course sounded to me absolutely glorious. Embryology and geology and everything. But you couldn't do that and also do blasted biochemistry, which we figured we had to do. Or maybe it was just called chemistry. I'm not sure. Chemistry, I guess it would be. And physics and so forth. But physics was kind of fun. In those days, in that kind of school, the top faculty, which is the senior faculty, taught the introductory courses.

W: Ah, not so much anymore. Yes.

L: No. It was not taught by foreign graduate students; it was taught by a full prof. And in the case of physics, I actually learned math modeling. I understand it to this day from freshman physics at Amherst. Ah, well, maybe I should have kept on doing that stuff.

W: So you went to Missouri, though. Did you teach? Having had a good mentor as a teacher, did you have a chance to teach in the way you had to mentor at Missouri?

L: Yes, I think so. Of course I'm going to have a lab, and I'm always going to have students in the lab. I always did. Now, whether they liked it or not—I think they liked it. We had fun, anyway. But I've always had students in any lab I've ever had. I think that's easily done and fun.

W: And was it in Missouri that you really became introduced to computers and their potential power, or had you encountered computers ahead of that time?

L: No, I had not. I was vastly ignorant of math. In fact, once I got into it, I discussed with Mary, who, of course, had seen me through the end of medical school and all the residency in pathology, and telling her that I was considering a PhD in math— [laughter]—she was sort of thinking, "Oh, well..." But that's a different story. But by the time I was seriously considering finding a PhD in math someplace... There wasn't any PhD in computer science. That didn't even exist. The words didn't exist. But I did talk with mathematicians quite a bit, and basically I found that they couldn't do stuff that I couldn't do. So I was thinking, well, I guess I'm not just going to settle down and now I can do the stuff I want to do, some of which was kind of simple. I could give you—I think it would be an understandable example. But there's a normal distribution of things and the so-called bell-shaped curve, but it has its own mathematical attributes. So could you make a two-dimensional bell-shaped curve? That's a 3-D object. Could you make an n-dimensional bell-shaped curve? We have analyzers that do forty tests at once. Well, can you construct a forty-dimensional normal distribution? And I would say in those days, the answer was, hell, no. But of course now it is possible, because you can waste some computer power. I guess there were more profound questions to ask than that. But did, they couldn't do what I was trying to do, which was basically to automate medical decision-making. Well, first, quality control in a clinical laboratory and then, from that, medical decision-making.

But even the lab thing, at Missouri I actually had the first computer-based clinical laboratory ever. And people came from really all over the world to see it. It became sufficiently burdensome that we just made a rule that Thursday is for visitors. And they've got to write ahead and I'm not going to see them until they've been toured through this and that and seen the slide show and all that kind of thing. And then by Thursday afternoon, okay, fine, we'll meet. But there were lots. One year there were forty-five people from forty-five labs, because by then—I guess another way of saying it is that maybe what I was doing was obvious.

W: But as I understand from reading Joan Ash's interview with you back in 2005, which went into quite a bit of detail about your lab there at Missouri, it seems like you were, even then, very much a collaborator—

[Editor's note: At the Helm of the World's Largest Biomedical Library: 2005 Interviews with Donald A.B. Lindberg (Conversations with Medical Informatics Pioneers: An Oral History Collection.]

L: Oh, sure.

W: —that you knew that the medical and the lab and the computer scientists had to work together to come up with solutions. Is that...?

L: Oh, yeah, absolutely. Partly that was either inspired by or supported by Vern Wilson, who was the dean of the medical school. Wonderful guy. What we undertook to do together—I guess what he was undertaking, from his point of view, he was raising the question, could this state med school give first-class care to everybody? In other words, could it treat everyone as if they were on the private side of Columbia-Presbyterian, which would be Harkness Pavilion. And I thought, wonderful, let's do it. Let's try it anyway. And so part of that was an experiment that he and I thought we were conducting, which was, is there a role for the digital computer in medicine? Is there something it can do that's useful? Now, of course, it was already doing accounting and billing and stuff like that, but something medical. And it was a bit of an open question. So he sort of put his dime on this young guy in path, and I wanted to do labs, and he thought, well, that sounds okay. Try that. And then we tried to expand ourselves to support medical decision-making, say in the specialty clinics, endocrinology, thyroid, pediatrics—stuff like that. All of it was vast fun—vast fun. The gear did definitely limit what we could do. We were sort of aware of that, but we had no idea of the extent to which all that would vanish as a problem. What we thought of as a big computer, I guess, in retrospect, was a tiny computer. But, of course, we had no sense of that.

W: So was this work that you did with your computerized lab what brought you to the attention of NLM and the Board of Scientific Counselors and how you got connected with NLM in the first place?

L: Well, I would put it the other way. It's what permitted me to discover NLM, because there isn't any place that's more faithful to computing in medicine than NLM, so even in those days they had...

W: Those were the '60s then, right? Sixties and '70s?

L: Yes, we went to Missouri in '60. I was promoting two kinds of research works with NIH [National Institutes of Health]. I wanted funding from NIH for two things. One was this mathematical model of electrolyte physiology. I'll characterize it that way; we can come back and talk more. So that was a new idea. And secondly, I was trying to get research funding for this computer-based clinical lab system, which, I guess we started it

probably—actually, it was in a strange place. We started it in microbiology, because I particularly liked running that laboratory. But how to get those reports—how to use the computer to improve the nature and the speed and accuracy and whatnot of those reports. So what you're imagining there is we're culturing things from patients, and then are doctors interested in the results? Well, yes, of course they are. And what is the typical question? The typical question is, to what antibiotic is this infection sensitive? And of course you therefore got an isolate of some sort from the patient, and then you're exposing it to different kinds of antibiotics and making some pronouncement about it. But, of course, the in vivo/in vitro correlation was reasonably poor.

To take an example, salmonella typhosa, the causal organism for salmonellosis—typhoid let's say. The bug is sensitive to just about everything on the plate, but we know that if you don't treat it with the right antibiotic, you're never going to eliminate it. So therefore, the in vivo, the way it will work out in the human being versus what it looks like in the lab—you had to honor the studies in the lab, but you have to override those with some clinical judgment. And chloramphenicol would have been in those days the drug that would kill typhoid—that's what we should give the patient—although it had some dangers; whereas it might be actually destroyed in the plate by something as common as penicillin, but that would never actually get to the organism. So there was an interesting thing—the combination of technology and medical judgment.

But at the time I came there, the lab was presided over by Miss Lorah. Wonderful lady. Master's degree in microbiology. She'd run this kind of stuff for decades. Was absolutely grand. We had a med tech program, so young techs, most of which were women, all called her "Auntie Martha"—Martha Lorah. So she was great. And that was good for me, because I didn't have to teach her how to flame loops and stuff like that. But since there it was a relatively high-volume lab, I would say basically as her interpretations we had translated by a variety of students, and even assistants. I would say generally, you couldn't spell 'staphylococcus aureus' the same way two days running. I was disappointed by that, because if you can't do that, then why should anyone believe all these R-resistant and S-sensitive things that followed?

W: So the quality control issues were...

L: Quality control was key. And then the volume. All of this was not far after the end of World War II and the country was really building up. There were new medical schools. There was new everything. There was new volume. There was Blue Cross Blue Shield—it was that kind of insurance. So there was a day, I remember, when they hadn't actually completely reported all of the results of the previous day. I think that was in chemistry, where machines were getting automated but the people not. And I remember pulling the phones off the wall, because the phone, of course, kept ringing. I mean, "Why did you have Miss Brown...?" And it was driving everybody nuts. I just pulled the phones right off the wall so they didn't ring anymore. Okay, now let's get back to the work. Let's just get it all cranked out. We're not going to leave today.

Anyway, I then went to see the chairman of the department about what are we going to do about getting some people who can actually get this thing done. But it was clear that the automation did have something to contribute. So getting it spelled right, getting it delivered—and in this case I wanted to deliver it electronically up to the fourth, fifth, sixth floor, wherever the doctors were, not carried in slips, because they were three- or four-part slips. Even that was somewhat interesting because it turned out that we were spending a huge amount of money just with these multi-part slips. I've forgotten the brand now, but...

W: So were you able to get a research grant from NIH to help support your automation and your quality control efforts?

L: I did, yes.

W: Okay, and then became familiar with the National Library of Medicine and some of the people here? Because you were on the Board of Scientific Counselors, I think, early on, right?

L: Yes, I was. Well, I never could get anybody anywhere to really understand this math model. It was maybe the best thing I've ever done, but we never could get funding for it, so we proceeded. I worked with a mathematician at RAND, Ed DeLand. He had a faculty position at UCLA but was really a RAND Corporation worker. Wonderful, brilliant guy. So we worked just on our own dime for some years to perfect it, but study sections just couldn't grasp it. They believed they already understood everything necessary about serum electrolytes, because they had a simpleminded little formula that helped a clinician to prescribe IV salt replacement. But that approach did not reflect any understanding of what actually was shaping those electrolytes. I was trying to model the underlying biochemistry, which has still not been done. The problem is as ripe today as it was fifty years ago. But anyway...

So NIH became very, very enthusiastic about the grant to automate clinical laboratories. They could understand that. And they site-visited. And that was interesting to me, too, because I found that we always greatly favored if they would site-visit Missouri. Because they started out with a general impression that it must be nobody in nowheresville, and then, of course, you would find that it was actually a pretty nice medical center, and it was full of very, very good people, and it was headed up by a dean with very modern ideas. And if you scratched around, you might even find some Lindberg youngster doing good work. So we always came out ahead. And, as I said, they were enthusiastic about it.

By then, actually, I had—it was a fun thing—I'd fallen in with IBM and a device that they had, which was called the densely coded matrix keyboard. But you pushed the button, and it meant different things depending on what overlay was on it and whether it was hematology or chemistry or microbiology or whatever. So I pulled a little bit of a stunt. I think it was a fair stunt. Firstly, the site visit ended up in the dean's office at least for part of the time, and he gave permission to do that, of course. But that was

unusual—to have site visits. And then I told him that I was going to use this new device from IBM, but I didn't have permission from IBM to announce it for them. So it was there under the sheet [laughter]. This was, of course, inspired directly by Melvin Belli. Wanted to discuss what we were going to do with it. And, of course, the dean was very supportive of it. And it was a fun thing because the site visitors were Octo Barnett, who was a Harvard guy, and Jordan Baruch, who was a brilliant engineer working in the Boston area. He was part of Bolt, Beranek and Newman [BBN Technologies]. He was one of the founders of Bolt, Beranek and Newman. And a lovely gal from the University of Indiana—I think an internist, but a swell person. And by then, Jordan and Octo knew each other pretty well, so they would basically be horsing around and kidding each other and embarrassing each other and saying outrageous things. So the chairman of pathology sort of called me aside halfway through the day, and he said, "Don, the behavior of these people is absolutely outrageous. I'm going to call NIH and..." I said, "Fred, please don't. I'm going to get the grant [laughter]."

W: They're having fun.

L: They're having fun. But they understood what I was doing. No one else was doing it and they should have awarded it and they did. But it was a little bit of smoke and mirrors, but it was fun.

W: So eventually NLM came calling, right, when you were at Missouri?

L: Well, eventually they came calling that I should go to run Lister Hill [National Center for Biomedical Communications]. I didn't do that.

W: So why weren't you interested in the Lister Hill position when that came open?

L: I just liked Missouri.

W: Oh, okay, you weren't ready to leave Missouri yet.

L: Yes. So Marty Cummings, my predecessor [as NLM director], a very fine guy who I subsequently had a lot of time with—but he came charging up to Mary at some kind of a meeting—and I don't remember whether it was a path meeting or a library meeting or something—and he said, "So you're the reason Don Lindberg won't leave Columbia, Missouri!" And she's quick on her feet, and she said to him, "Dr. Cummings, Don Lindberg will leave Columbia, Missouri, whenever he wants to." So she put him down.

W: Good for her.

L: But anyway, the next time was actually to replace him. I was surprised there to find out that NIH can, when it wants to, recruit like a university. You can't argue, [do] too much bargaining about salaries. They've sort of messed that up pretty badly. But I was getting calls from all over the country from people I respected, in and out of government, saying, "Now, wait a minute, you've got to look into this. This is important. You should

do it." And that persuaded me that it had an academic flavor to it. And, of course, the people I had met in government were good people, particularly at NLM. So all of that finally worked out fine. But I would say that, to me, the surprise coming here was not NLM. I knew it reasonably well by then. I liked it and admired it. The real surprise was NIH.

W: How so?

L: Well, it was good. It had sort of quality work in all the institutes—so research quality in depth. There'd be two or three or four persons doing a good thing. And I hadn't expected that. So, for instance, in the Dental Institute [National Institute of Dental Research], I thought, well, as a dental institute, I guess they teach you how to drill teeth and put in fillings and so forth, but no, they actually were teaching how to study biochemistry. They were doing the same as the other institutes, but they were following good scientific ideas through to their logical conclusion. So that was a big surprise.

W: So rather than a government bureaucracy, which you think of, institutes in Washington, it's a campus. It's a research and—

L: Physically a campus, yeah. But it has an environment that—at least what used to be in the past, anyway, collegial in the sense that department A isn't taking the money from department B. You were free to work together as…

W: Right, team science, really, basically, yeah.

L: It's in theory team science, yeah. But the general attitude about federal labs was the one that you were sort of pointing to. I remember Jim Shannon [NIH director, 1955-1968], of course, one of the saints here in named buildings and statues and whatnot, but Shannon was a human being, I can testify to. In fact, he was a professor of medicine at Columbia-Presbyterian, Columbia University [New York University], in New York, and he ran one of the giant chronic disease facilities [editor's note: at NYU's Goldwater Memorial Hospital; he later went to Squibb Institute for Medical Research]. But he also somehow or another was favorable to the Markle Foundation, which—I was given an award by the Markle Foundation, and maybe he was instructing us or lecturing or something. Maybe he was just enjoying the place. But it turned out that a pretty good place to talk to him was being at the next bar stool. And I was on such a bar stool when I asked him, "Dr. Shannon, when you left Presbyterian, did you go and see Professor Loeb?"—Robert Loeb was the head of medicine; very distinguished and fine guy. And he gave me this black Irish smile and says, "Surely I did." I said, "Well, what did he tell you?" He said, "Jim, if you leave Presbyterian and go to this place, you'll never be heard of again."

W: Meaning NIH?

L: Yes. So I was thinking, well, isn't that interesting. Because what that meant to him is, well, firstly, you're leaving New York, which is a cardinal sin in itself. And then

you're going to the South, which I thought of as Maryland, which is certainly a terrible error. And then you're going to go to a government lab, which is clearly preposterous. So no one will ever hear of Jim Shannon again.

W: He proved them wrong, didn't he?

L: Yes, he proved them wrong. So he told it all with a smile, because he knew it was all rot. He had good judgment when he came here. But, of course, the world remade itself somewhat in his image. He got a lot of help, but NIH needed a lot of help.

W: Well, as you know, my husband, Bill Cooper, and I were both here in 1984 when you arrived, so I'd be interested in what your first impressions were when you first stepped in as the director. You were familiar with NLM, of course, already, but now you're the boss. And what did you think of some of the people and the programs and the services? What did you have in your mind?

L: Well, I liked all of the people I had already met, and I liked all the new ones I hadn't yet met. But I found one thing to be particularly amazing. There's this tunnel. There are two buildings—the old building and the new building, so to speak; the library and the Lister Hill Center. And at the end of the tunnel going from the library into the Lister Hill Center is a guard. Lots of questions why, but anyway, there's a guard—presumably to keep the priceless things from being stolen somehow or another, or—I don't know; they always look in boxes, so I guess someday they're going to find a bloody head or something and blow the whistle.

But actually, what wasn't physically there might as well have been—a great big sign going from the real library into the Lister Hill saying in big Roman caps, "Research this way. Otherwise, back where you came." And so Lister Hill was proud of being the research end of things, and I don't know what they thought was on the other side, but on the other side everybody knew they were being systemically excluded from what was called research, which you probably never, ever understand—'you,' nameless person. And I thought, this is terrible. This is absolutely screwy. I mean, we had hardly enough talent if we used all of our talent together to try and do some stuff. So I guess you would say research teams is what I had in mind. But I definitely remember talking with Lois Ann Colaianni and what were her expectations, what would she like, and she essentially said she thought that the librarians could do some research. And I said, "Lady, if I come here, they're going to get ample opportunity to do research. That I can guarantee you."

W: I think that wasn't unique to the National Library of Medicine. I think that was pretty common at the time in libraries out in universities, even—that librarians didn't have a good sense that they could do research. And I think that's changed, obviously, for the good, and NLM has obviously made some huge advances with that collaboration.

L: Yes. Well, one of the starting points was Unified Medical Language System [UMLS]. All that really involved was to make what was already quite a lot of machinable text, to make the medical stuff understandable in it. It seemed to me

perfectly ridiculous that one patient would be looking for cardiology and someone would otherwise be looking for heart surgery. They're not on the same list.

W: Right, exactly.

L: And the computer by then, no one had to convince me how stupid they were. But on the other hand, if you gave them a little bit of help—like heart and cardiac are the same damn thing—what the librarians would call a synonym, or even what the English majors at Amherst would call a synonym—and get started and do it. Hack [Harold] Schoolman, incidentally, was a big help on this. And Betsy, of course, was the person "without whom."

W: Betsy Humphreys would have—was wonderful.

L: Oh, she understood right away.

W: Absolutely.

L: She became the—I don't know what you'd say—sheet anchor or something, everything essential.

W: I heard a story about when you first arrived on how you introduced your two deputy directors at the time, Kent Smith and Harold Schoolman, to computers. Can you tell that story?

L: Yes. It didn't seem to me at the time that it was anything too strange. But I had had at home a DEC computer—LSI-11, it was called. All these things fit into a context. But the LSI-11 was sort of a commercial version of what had been basically a LINC computer. But anyway, I had that at home. It was kind of big and clumsy, but, still, I loved it. And then IBM began this project to develop a little computer. And they had parallel efforts, but anyway, they ended up with one particular one and I loved it. And I assembled it and used it, and I bought one for my son, who was just starting college and gave it to him. Whereas in my office, we had two distinguished guys, the deputy Kent Smith and the deputy for [research and] education, Hack Schoolman. I don't remember what they were using. Someone—I think it might even have been a predecessor at Lister Hill had advised the library to buy these Wang processors, which I thought was a terrible idea. I mean, they were lovely machines, but all they would do was text processing for making letters. Inside was a decent computer, but you couldn't get to it.
So anyway, I thought, well, I think these are wonderful. I'd like you all to benefit from them, but the best way to benefit is, it comes in a box, you open the box, it has instructions, you put them together. You take the parts together and at the end of that you've got a computer. So Hack Schoolman is totally unflappable. I don't remember what he said, but no doubt something suave. But what he in fact did was lay out a weekend, calling Maria in to read the instruction book.

W: Maria was his wife, yeah.

L: She was his wife. And Kent Smith did exactly the same thing. Actually, for years, Hack actually installed the A: drive and the B: drive in the opposite places.

W: He always liked to be different.

L: It continued to work. He could've switched it, but he didn't bother. Whereas Kent put it together and was rather proud at the end, which was my intent. So he later told me about it. I wasn't trying to be difficult; I just thought they ought to have the benefit. And Kent said, "You know, I have gone from a boss who refused to let me go to a computer meeting, telling me, 'God damn it, get here and do some work,' to a boss who says, 'I want you to build this damn computer.'" But the advantage of building it—and that I didn't foresee—was that the computer guys couldn't pull the wool over his eyes. They were very keen on going up to the balcony, the executive suites, and telling a bunch of nonsense about compilers and processors and blah blah blah.

W: All the jargon, yeah.

L: All the jargon. And by god, at the end of this putting an IBM little thing together, there's no magic. It's all parts. I think in those days you probably didn't even have to solder anything. I had made jillions of electronic audio stuff from a Heathkit. It was no magic to me, either. I soldered all these silly little pieces together, and that's what's an amplifier. So I thought it was very worthwhile, and Smith understood it. And he didn't take any guff from those computer guys after that.

W: So it seems to me that this is all a part of your idea to demystify computers, in this case for your administrators, but it also kind of foresees you wanting to demystify access to information for health professionals and eventually patients, too. So there's no secrets here; there's just skill and interface and all those kinds of things to get to the information that you can use.

L: Exactly right.

W: So it sounds like that was a really good beginning.

L: And, of course, the other amazing thing is the computers can kind of store stuff. Let's say you type the thing in and it goes around its circuits and it finally gets to a little tape drive. By gosh, it's there when you come back to it.

W: Mm-hmm. You don't have to remember.

L: You don't have to remember. And that was totally compatible with Vern Wilson, the dean at Missouri. His view was that the whole problem in medicine—and this is something of an oversimplification—but his view was that the whole problem in medicine was overspecialization, and people were specializing because then they could have a narrower segment of knowledge to have to memorize, whereas the computer

presumably could memorize everything and you could have access to everything. So he was a very, very advanced thinker. Wonderful guy. Also, he had two other attributes that were key for a leader. He was smart, and he could remember. So if you had a discussion with him on Thursday, by next Tuesday he actually remembered what he told you and what he promised [laughter].

W: That's very helpful.

L: Even if it was a budget…

W: So switching gears a little bit, so UMLS was one of the first projects that you undertook here. And at the time you arrived, NLM funding for the IAIMS program, borne from the Matheson Report, was already under way. What were your thoughts about the IAIMS program—Integrated Academic Information Management Systems? What were your thoughts about that at the time?

L: Well, it was called the Matheson Report, and I was at every meeting that it ever had. [Editor's note: "Academic Information in the Academic Health Sciences Center: Roles for the Library in Information Management" by Nina W. Matheson and John A. D. Cooper was published in 1982. Lindberg was a member of the study advisory committee while at Missouri.] They had lots of people in these committees and it included me. In fact, I remember at one of the last meetings, we asked ourselves if anything was missing from these wonderful words we put down on paper, and I said, "Yes, I'll tell you a word that's missing—network. There's no mention of networks and networking in this whole damn thing." Well, it turned out in retrospect that <u>was</u> the innovation.

W: Absolutely. Networks.

L: So they were a long ways from hitting the center of the target.

W: Right. But NLM really had a lot of—

L: Well, she came from NLM also, of course. But Marjorie Wilson, I guess, was plowing that field ahead of Nina, even. So she had invested a lot of her energy. And she was an associate director, I think, of NLM. And it was curious because as the IAIMS thing sort of spun out and people competed and so forth, [University of] Maryland [at Baltimore] actually turned out to be one of the first four [to receive NLM IAIMS funding]. Marjorie was there was there I think as associate dean or something like that by then. There was a lot of sputtering, and I was trying to find out, what's this all about. Well, it turns out that in this IAIMS program was written some kind of dollar limit or some part of it that Maryland wanted to do, and she was mad as a wet hen about how we were excluding her and limiting her and so forth. And Hack Schoolman and I looked into it and, hell, she had written the limitation [laughter].

W: Memories are short when you're on the other end.

L: Yes. It was interesting.

W: IAIMS was wonderful, I think, for librarians, particularly because it got them involved in institutional planning, which was what it was all about—

L: Absolutely.

W: —and had a seat at the table in many institutions, which was wonderful for those of us who competed for those.

L: You know, it had another curiosity, too. It was the only program that I've ever been associated with in any way, shape, or form in which I got letters saying, "Well, we didn't get any money out of this, but the stuff you put us through was really worthwhile. I'm glad we did it." So the analyses that led up to an IAIMS application were themselves a very interesting, worthwhile exercise. Those two ladies both contributed greatly to that.

W: Right. Exactly.

L: Know your institution and know your goals.

W: But it's not easy.

L: It isn't. Nor painless.

W: That's exactly right. And some of them weren't sustainable because of politics or—it wasn't the technology, necessarily; it was the personalities and politics.

L: Absolutely. But networking isn't all electronic, either.

W: No, it's not. So one of the first things you did at NLM was institute long-range planning—the first of several long-range plans which have really guided your actions. Can you tell me why it was so important to you to have the kind of planning that you initiated?

L: Well, I was amazed that there was no long-range plan. Because mostly, institutions I'd had anything to do with did have long-range plans, and this one had none. On the other hand, one way I sometimes say it is that it had done very well for 148 years without me, and I felt that at the time. Somehow or another—maybe it's the British 'muddle through' or something—but they had made very good decisions, extremely good decisions. So I didn't at all disagree with where they were, nor did I come to NLM to change a thing. I thought it was wonderful to begin with. But on the other hand, you could see that the winds were blowing. Stuff is going to change. Things are going to change. I thought it needed the guidance of a long-range plan. And people kind of went along with the general idea. There were some long-range plans, actually, at NIH. I think Heart Lung [National Heart, Lung, and Blood Institute] may have had a statutory

requirement for a long-range plan, but I think—in fact, if I'm not mistaken—contractors wrote it, and they bound it and put it on the shelf.

W: Right, and nobody ever looked at it again.

L: Right. I mean, they got rid of the obligation. At least that was the interpretation I took to it. The [National] Eye Institute, on the other hand, was one of the new people. It was the first new one of many to come. I didn't know that either. But I knew that if you tell an ophthalmologist that says, "I want to have an eye institute at NIH," if you tell them that neurology will take care of you, that's fightin' words. You're telling surgeons that the internists will look after them. They know that's not true. So the Eye Institute got founded through its own lobbying and determination and so forth, and it's done a wonderful job as well. But they also were in advance in long-range planning. To them it was different from what we did. But they had a kind of a matrix of the kind of scientific questions they thought should be investigated re ophthalmology, and then the number of grants that had been awarded—number of dollars, number of grants selected, number of places—in that matrix. So what they ended up with was a matrix of these questions to be investigated and the number of things to be in the slot. So they looked at it every quarter, every six months—something like that. And I thought, that's very, very interesting—how you achieved it and then the form that it took. So they helped us. We asked them for their help and they gave us their help.

But we didn't imitate it; we didn't make a Chinese copy. But we did undertake that type of reasoning. So we wanted to divide up the areas of work. See, for them, they could have dozens of these questions, appropriately. For us, I wanted something more handleable, some handful of areas to work in. Like, collection would be one thing and so forth. But we spent quite a lot of time dividing it all up into a certain number of things. We ended up with five. You can win and lose friends even on such a simple matter— what are the five categories you want to use. But anyway, we did find them. The question about how to configure the rest of it, to me, was very, very straightforward.

I was fully familiar with top-down planning. That's idiotic, in general. I guess it's a way to invade Normandy Beach and so forth to run World War II, but it's not the way to plan for an institution. So we all at NLM that I worked with had the idea that the planning should be done from the bottom up. In other words, start out with the people you're trying to serve and find out from them what would actually help and what's possible, even. Because some things you want to do and don't know how to do. So we clearly were doing a bottom-up plan, for better or worse. I think it was better. So that brought us into contact with doctors and patient groups and basic science groups and Medical Library Association groups—all manner of wonderful people. Probably 150, 160, something like that number of people, in long-range planning. All wonderful. And so they found it interesting, too. Here's a group of kind of similarly minded but different background people that made it fun. So all this stuff is no good if it isn't fun, it seems to me. If you're just doing this as a chore, geez, that's not going to go far.

W: So what were some of the major achievements that came out of that first plan that you did?

L: Just about everything important.

W: Quite a successful plan, then.

L: It was a very successful plan. Well, of course, it endorsed the Unified Medical Language System. We were priming the fire there. But it also identified other things. So for example, one of the things it identified is that all of the best computer work—we patted ourselves on the back about how we were part of the pack doing the best computer work, but it was actually all text and some numbers. And the long-range planning group raised the question that some day, somewhere, somehow, computers will be good enough that they could do pictures. Isn't that interesting? So we swore that, okay, when the time comes, we're going to do pictures. Well—[laughter]—the computer hardware got better faster than anyone thought, so we were able to ask ourselves in medicine what's essential. And at the heart of it is anatomy—pictures of anatomy. So the Visible Human [Project] became that project. Dan Masys and Mike Ackerman ran that and saw the end of it even. But that came right out of the long-range plan.

UMLS [also] came out of the long-range plan. One day we were talking about... Well, of course, the library stuff of a citation, that implies a certain organization, doesn't it, author and pages and number of the journal and stuff like that. But it had already happened that the computer programs that support that type of file, which is a big and important file—MEDLINE—MEDLARS [Medical Literature Analysis and Retrieval System], I guess, we might have said—are totally different from stuff for chemistry. So for toxicology, they had already kind of split off, because they needed their own kind of computer systems. The two were just totally different. So we had the idea of some kind of nontextual but complex and important kind of stuff. But I felt, well, gosh, if the only example we have is toxicology, this chemical stuff, that seems a little odd. What would a good computer scientist do? And the answer is always generalize, go a level higher. So we took it a level higher to be nontextual, complex files.

And in discussing those kinds of things one day, I asked a guy a question—one of the people on our planning committee—"Tell me, where is all this sequence stuff you guys, you genetics people, are doing." And of course, I had worked with [Joshua] Lederberg and Stanford people, so I had a partial understanding of it, but I didn't truly understand how it fit into any kind of big picture. And so the person I had asked it of, a chemist, actually, from Stanford, as I recall, said, "Oh, well, you want molecular biology 101." "Well," I said, "okay. I guess so. Let's do it." So we put down our coffee cups and also our pipes—[laughter]—

W: Back in those days, yes.

L: Back in those days.

W: You could smoke inside.

L: And then went into the boardroom. And he took up the chalk and got it on his coat and all that and gave a lecture about what are the sequences, what's DNA, and what's this other stuff, and the nomenclature. I remember at one point asking, "Well, why do you call that gene that name?" He says, "I don't know. It makes no sense at all." It was totally arbitrary, in fact. There was a bit of a competition for how imaginative could your names actually be. But by and large, the Drosophila people were the most imaginative [laughter]. So anyway, at the end of this presentation—Lederberg was one of the people in that meeting—and Rich Roberts as well, although he had not yet gotten his Nobel Prize, he was obviously a pretty sharp guy—and everybody looked around kind of dumbfounded, and somebody said—maybe even I—"Well, hell, it's a library problem" which indeed it was.

So we decided, by golly, we need to do something about that, but it's probably a big effort. UMLS, I knew it was a twenty-year effort, which started it. But this thing, we didn't know how long it was going to be, but we knew it was big. But it wasn't going to be a corner of one of these programs. So the thing got written up in various informal ways here, and then, working with [U.S. Representative] Claude Pepper, it became legislation that created the National Center for Biotechnology Information [NCBI] [in 1988]. There were a number of intermediate steps, but that's how it actually happened, literally.

W: Exactly.

L: So I think that was a good thing.

W: And this was paralleling, certainly, the Human Genome Project, so there was a really good partnership there with the science that was happening and then the ability to develop a database to manage some of that information, right?

L: Yes. The Genome had a separate line of thought, but... A guy named Walter Goad, actually, at Los Alamos Lab—Goad was a biologist, I believe—and he had already started a file of the gene fragments, the nucleotides that make up the DNA. But all of this was very hard-won information. I mean, people were doing this all over the country, including at NIH, but it was before automation. It was a very, very slow process. But anyway, Goad had started this file, which he called GenBank. He was a very good person and Los Alamos was a good place, but they don't work the same way as we do. They don't work on schedules. The work creating that file was actually supported by NIH—three groups, the National Library of Medicine, NIGMS [National Institute of General Medical Sciences], and, I think, NSF [National Science Foundation]. We would pool the money and give it to them, and then there would be a meeting once a year or two six-month meetings or something like that. And they would be behind on everything. We would be told, "Well, it's all right." But it got more and more important. So with the creation of this new thing, at least off the wings of the stage, the acceptability of being always late was less and less happy. And Ruth Kirschstein was on that committee. I

suppose that she was representing NIGMS at the time. Ultimately she'd end up being the deputy director and acting director of NIH as well. But she and I saw it the same way: that this was kind of foolishness. If NIH is going to pay for it, for god's sake, why isn't it at NIH to begin with, and Lipman had been a friend known to her. So we decided, well, let's just pull the money and see if David can do it better. He could.

W: Right. So David Lipman became the director of the NCBI, and it's an enormous success, huge growth, right?

L: It has been, yeah. But one time I remember we had both gone out to Los Alamos to sort of check up on things, and I came back and I said to him, "David, it's really a funny place. No one wears a watch." Of course, there are a lot of reasons for that. But he said, "Don, are you kidding? They don't even have calendars [laughter]."

W: They work at their own pace, huh?

L: Yes. So he was persuaded to take it over and has done a very good job.

W: He's done a great job. So switching gears a little bit, then, how did the Regional Medical Library [RML] Program, which later became the National Network of Libraries of Medicine [NN/LM], figure into your planning?

L: Well, it had already existed, of course, so all I had to do was just see it and realize the importance of it. But truthfully, by the time I came, it was withering, just for lack of money. The number of regions—it was originally called Regional Medical Library—so the number of regions in the U.S., I guess, was established by an arbitrary process. But the federal reason, I think, are around ten or eleven—something like that. So these RMLs had been reduced down to maybe five or something like that. [Editor's note: The number of regions was reduced from eleven to seven in 1982/83.]

W: I think it was seven or eight, it seems to me.

L: Yes, at one time it was seven or eight, and then I think it was headed down from that. So basically it was running out of money. I don't think that Cummings and the people here were unenthusiastic about it, but I think they were just dividing a fixed amount of money and smaller and smaller donations. But I thought of it as an important thing. And trying to learn about it, I met with the directors, however many they were in number, and I decided one time that I would send them an email, because that was sort of a thrill to begin with. Four out of five people wouldn't know what to do with an email, so it was a little bit of a test. Try to train you to pay attention. And I sent them an email that said, "I think it's possible I might be able to find a couple million dollars extra to put into the RML program. If I could, what do you want to do?" And do you know that I couldn't get an answer?

W: Really?

L: Yes.

W: Wow, money on the table and no answer what to do with it.

L: No plan. No excitement. No forward momentum. But no plan. So that was amazing. But another good thing was training grants. I had had a training grant for some large number of years at Missouri.

W: And this was training in medical informatics, primarily?

L: Yes. We probably called it computers and medicine initially. Various modifications were made to that. But they were withering, too, from some larger number down to some smaller number, like four or five. And I thought that was—well, obviously that's totally insufficient if you're really trying to start a whole new profession in a big country. So there, too, I was trying to test, like, where are the levers, what can you do that can actually work. You can pray for rain, but when it comes, you don't want to drown, either. So I asked the directors of the training grants, again, the same sort of hypothetical question—if it were possible to produce n-million dollars extra, can you double the number of fellows. And every single one said, "No, of course not. Actually not. We're a scarce commodity. We work hard, only twenty-four hours a day," and so forth. So then I said, "I guess you will understand if we have to take some new places, some new programs, new institutions." "Yes, we understand that." So when we did get some extra money, we went after adding institutions, not just... Of course, it's re-competing. But we fully intended to add some institutions so we could double. And amazingly enough, fast-forward five or six years—we usually re-compete this every five years, so it probably was five years—I asked that same question once again and got the same answer. I said, "Well, then we've got to have more slots, more places." This is a hard thing to do. And it's understandable, because those training grants exist within a university structure and the elephant doesn't step up and do the tap dance. Universities are slow to move. And of course you're talking about the academic quality of the programs and graduate senates and physical things. Because I think I was just following NLM tradition, but I definitely had in mind that it's the job of universities to educate and do curriculas, not the job of NLM to tell them here's the syllabus, go teach it.

W: Was part of it that this new profession that was developing—medical informatics, as it became called, or health informatics—that people couldn't leave their current jobs to travel to another institution, and so, therefore, the recruitment was difficult for some of these programs, too?

L: Well, put it a different way, I would say nobody had achieved critical mass. For a while, Missouri and Harvard were the first programs as well, somewhat informal competitors. We used to say that Missouri is the Harvard on the Hinkson [Creek] [laughter], which it was, and it was a good school, but it wasn't Harvard. So Octo [Barnett at Harvard] and I would exchange lots of correspondence and sometimes applicants—you've got to have a slot, so that would work out okay.

So one principle was, are you going to redo this every five years, and I thought, yes, we should, because nobody complains, whoever got a grant, but he'd complain if somebody else got it but you think it's yours. So we stuck with the five-year thing. And of course there were changes at the margin. I mean, schools that look like super-super-hot stuff at one time. Einstein [College of Medicine], for example, with Josiah (Jay) Macy. Well, he died. So did it change us? Of course it changed.

W: So let's talk a little bit more about your relationship with librarians. Earlier in your tenure I think there were some rocky times, particularly with a new interface to MEDLINE—Grateful Med and all of that. Do you want to talk a little bit of that? Your ideas about…

L: Yes, I found I stepped into a bee's nest, because to me the most obvious thing in the world was, here are a bunch of doctors and they've got some kind of a computer in the office to do accounting. Let's convert it over: put some software down, load it, and turn that MEDLINE—Grateful Med is what it got called. [Editor's note: Grateful Med, personal computer-based, user-friendly software for accessing MEDLARS, was introduced to the health community in 1986.] That was, again, an NLM committee that picked the name. They gave me a list, and I picked that particular one off the list.

W: We all thought you were a Grateful Dead fan, which is where the name came from, huh?

L: Yes. Well, it was on the list. The other titles were pretty dull, but this one was a good one. And I was willing to take a chance that they were not going to sue us, and in fact they thought it was fun. But that went over particularly wonderfully in Europe. Mary and I were at those things. The youngsters thought, god, this bunch, these Americans, Christ, they're actually good.

But the American librarians didn't have that view, and particularly hospital librarians had a very narrow view. I would say the academic librarians—medical librarians— appreciated it very well. The hospital people felt threatened. They felt that the skill that they brought to the table and to their life and to their achievements was how to do searches. Someone needed an article on such and such piece, and the medical librarian would get it for him or her. And to some extent they were justified, because Thelma Charen, who really started all of this MEDLINE searching program—and I knew her; I worked with her. She was still around when I came. But they used to spend six weeks learning to do the incantations.

W: That's right.

L: You used the right kind of phraseology—

W: In my day it was three weeks. It was a three-week training program in the late '70s. Yes.

L: Well, that's still a lot.

W: It is.

L: I actually met doctors who went to the six-week thing, and I thought that was really amazing. So it wasn't so simple. I'm not saying it was simple. But Grateful Med surely attempted to make it simpler. So, yeah, they didn't like me at all, and I ended up doing a formal public debate at an MLA meeting with a kind of traditional library science fellow, older fellow. I thought he was pretty easy to take down, but I did work at it. And he had told the librarians—his famous incantation was, he told them, "If you go along with Lindberg, you're going to be 'hewers of wood and drawers of water'—biblical stuff. But I took the other view. [Editor's note: Lindberg and Herbert White of the School of Library and Information Science, Indiana University at Bloomington, debated the primary role of NLM in a Hospital Libraries Section session at the 1992 MLA Annual Meeting.] I guess it was a slight advantage to not be a medical librarian—because I'm also not an Ansel Adams-level photographer, but I'm a darn good amateur. And being a darn good amateur, you're taught by the professionals, and you respect them, admire them. In the same way, doctors are not going to be anywhere close to as good searchers as medical librarians, but they'll admire them.

W: Right. And it opened up for us academic librarians, which I was at the time—it opened up a lot of new possibilities for training—training the health professionals to do effective searches and to know when they've reached their limits and that they need extra help.

L: Yes. So I think it's still there.

W: Exactly.

L: But to not put that power available to a clinician, I would say, was sinful.

W: And around this time or a little bit later, wasn't it that the Internet came along and allowed you to offer free MEDLINE [in 1997], which was a huge benefit? I know it took the billing issues off of your plate, and it really democratized access to information. Isn't that right?

L: The Internet made all the difference in the world. You're right—we were involved in charging for it, which we really didn't like, and careful accounting, which was a bother and a lot of overheard. Yep, all of those things. But even beyond that, I would say we would have a help desk if you were having trouble installing Grateful Med or if something won't work and so forth. Fully 95% of those questions had to do with telecommunications, what the kids called "how's your bits?" In other words, I'm sending a bit that says, I want to send something. So I would say, okay, I received that. Now I'm going to start. Okay, I hear you. And after all this electronic rigmarole, one character would move down the wire.

W: It's hard to remember those days, isn't it? It's hard to even imagine those days.

L: Yes. We weren't fighting anything; we were just using commercial networks—TimeNet, Telenet. But the vast majority of troubles had to do with that stuff. It did not have to do with terminology in medicine or librarianship. So when that disappeared, that made all the difference in the world. I think we were spending—I don't know, twelve of every fourteen dollars on that kind of foolishness.

W: And you were able to actually publicize a lot of that new development with certainly Al Gore and with Bill Frist, I think was one of the first people to do a search like that with Grateful Med.

L: Oh, yeah, sure.

W: That was pretty exciting times.

L: It was fun.

W: It was very exciting.

L: Again, I think the best part of politicking is the fun. That's why it's so awful right now. No one seems to having much fun. There are archival things no one will really care what's happening in 2014. Basically, one party is fighting the other party to the death as opposed to making any progress at all. And it wasn't that way.

W: Exactly. So you know that the Medical Library Association and the Association of Academic Health Sciences Library Directors had an advocacy group [Joint MLA/AAHSL Legislative Task Force], and we came down to Washington once a year, twice a year, to talk to congressmen and the National Library of Medicine about your programs and others. Can you talk about how you felt that benefited NLM and maybe also some key experiences that you had with Congress that were memorable?

L: Yes. I think the advocacy of MLA is tremendously important and something we very much appreciate. But our role in it was to keep your organization fully informed about what we thought and wanted and needed and all that stuff, and after that it's up to them to have their own say and follow it or not follow it. But we appreciated their showing up, for sure. People do forget about libraries. You need to keep reminding them. Because when you do a good job, it just sort of works. The water flows in the pipe and you forgot that someone actually built a reservoir somewhere.

W: Do you have any memories of particular events or people in Congress that over your thirty years here that you want to talk about who were particularly beneficial? You mentioned Claude Pepper, obviously, and there were others. Any more recent ones?

L: I wish there were more Claude Peppers more recently. But the one thing that was kind of fun with him, I remember Kent Smith and I sort of burrowed in, because we

wanted there to be hearings. That's part of the process. You have a bill, you have hearings, people testify for and against it, MLA individuals and otherwise. And we just were having so much trouble getting that to happen for a number of a reasons. But Mr. [Henry] Waxman, actually, was—of course his heart was in the right place, but he was sort of the obstacle, because they didn't quite have time for this hearing. But Pepper was quite renowned. So if he'd pick up the phone, he'd say, "Give me Henry," and the answer would be, "Mr. Pepper, I'm here." So there was no question about that. And at that point, Pepper chaired the Rules Committee, which, again, is a very obscure function in federal government. They don't teach you about that in a civics course in high school. But the Rules Committees rules—in the House, anyway. And so a bill goes to the floor with the rules that the Rules Committee gives it, which may say there can be an amendment or no amendments or here's how many amendments or here's how many minutes can be debated or how many days or hours or whatever, or there's an amendment and it's mine. So it's an amazing thing. Anyway, that was his role. So what I remember most clearly—I've said it before—but we were gently protesting our worry about how things would go and not go and get the bill and get something happening. Meanwhile, of course, the genetics was getting more and more successful, so the need of it was ever greater. And he listened patiently and he finally said to me, "Doctor, I will introduce the bill in the House. Mr. Kennedy will introduce the bill in the Senate. And the bill will pass." [Said in imitation of Pepper; laughter]

W: NCBI, right?

L: Yes. And I thought, well, okay, I guess I get the picture now. But I don't know nowadays anyone can do it anymore. There are so many... will there be a comparable bill. It isn't working very well now. I don't know if what I said... and someone else would say, well, that's an example of good working and not working. But it was not. First of all, we were asking for an authorization bill—non-appropriation bill. So I wasn't trying to break any rules. I guess in a way I was, but... [James] Wyngaarden was endorsing me, too—the head of NIH. We weren't going behind anybody. We were all doing something for the good of the country. And I would guess it even was complicated then because, of course, Waxman was right—there's just a limited amount of time that the House can have hearings or not. But anyway, they did it all right and it all came out right.

And then Pepper actually came along and also endorsed an appropriation. Pretty small, a minor one, but a big help. So when that whole thing started, NCBI, I think we got maybe $8 million, something like that. But there were only two or three people. And we subsequently grew it up to 300 people all on NLM money. So no one was asked for anything more. We all took it out of... Of course it was a time when budgets were increasing, but we gave a lot of priority to NCBI. Ultimately we ended up at a point three years back where the only way that they could get enough money to hire enough people to keep up with the flood of the sequences was to ask other institutes to sort of chip in, which, they've been very faithful to that opportunity, both Dr. [Harold] Varmus and also Dr. [Francis] Collins. But, too bad to have to do that. Generally speaking, they've ended

up concluding okay on this particular issue, but in the future let's just put whatever it is that's needed into the NLM budget and don't go through this begging.

W: Right. Well, the growth and the success of NCBI really leads me to my next question, which is that you and Kent Smith, before he retired, worked really hard to expand the National Library of Medicine space to accommodate not only NCBI but the expanding collection and everything else. Can you talk a little bit about that project, which has been a difficult one?

L: Yes. Well, we made a good plan—formal architectural drawings and so forth—to make an expansion space that incorporates both the Lister Hill building and the current building and the underground connection. It actually allows, for the first time, cars to drive up and enter this complex—of course, only if it's built. But right at the moment, to get someone who's disabled up the steps to the great front doors—not possible. So we ended up saying right now, well, for you, take your crutches and wheelchair and all this stuff and go around to the loading dock and knock on the door, etc. Very unsatisfactory. I actually ended up doing one other thing—also not very good. But I found out that there are electric wheelchairs, so I got a couple of them. And one of them is positioned so that you can come in the parking garage—not that that's an imposing entrance, but at least it gets you on a level footing—and then you can use elevators. Little did I know that I would be one of the people using an electric wheelchair ultimately. That saw me through a fall, but fortunately I don't need it now.

W: So is this building plan on the books? Is it still a glimmer in your eye that's possible?

L: Oh, yeah, it's been approved by the Congress on three occasions, but that was back to 2003 and 2004. Since then you get the answer, "Don't you know there's a war on?" and in fact, there has been—continuously. Now, what's the top priority and what have we done? Were we just imagining that we needed more space? No, we were not. And subsequently, bit by bit, Dave Lipman has taken over a large part of Natcher [Building], across the road, a huge amount of it. And again, NIH has been generous in letting us do that. We also rent space at three different locations. And, of course, renting space in Montgomery County is not a good approach to saving money. It's good space, but it's expensive space, and getting more expensive as more and more people want space here. So it would make sense fiscally to build a building, but that money has not been found.

I would say NIH is probably not giving it a very high priority, but they do what they think is right, too. Basically they like labs. And I like labs, too, but in this case we need another kind of space just to do the work of NCBI and the other programs. SIS [Division of Specialized Information Services], for example, is basically toxicology. And is that ever more important? Well, yeah, it is, because we have these chemicals going into the river and shutting down town. Big question: What is that stuff? Actually, one of the toxicologists at our place was the first to actually know what it really was. And again, all of these things are sort of personal, but what it really was is a chemical invented and made by Eastman Kodak Company. So he knew the chemists from Eastman Kodak

Company and knew the studies that had been done. It isn't required that they be made public but they were done. So anyway, the toxicology and the chemistry is ever more important.

And that same lab, SIS, is the part that I've counted on to do two things that are ever more important. One is outreach to minority populations—help that, organize it, get it going. And the other is planning for disasters, or remediation thereof. So do we need space for them? Absolutely. Until then, we rent at Montgomery County.

W: So you mentioned a little bit about outreach. Going back to your 1989 planning report, "the DeBakey Outreach Report," as it's known, [*Improving Health Professionals' Access to Information*] had huge influence on medical librarians and RML. Can you talk about how this report just galvanized a missionary zeal for outreach, which really hadn't existed before so much?

L: Right. The vague idea of outreach is to help underserved persons or populations. But how do you translate that? Everyone says, well, yeah, sure, of course. But how do you translate that into actually doing something? And again, I think the logical way is to talk to those populations and find out what they think they need to begin with, but at least you're talking on the same wavelength.

We did that and ultimately decided that, at least from my point of view, the so-called Native American populations—which are the Indians, Native Hawaiians, and Native Alaskans, those are the native populations of our country—were tragically underserved in almost every way you could think of. I did a little bit of work years ago in the Indian School Hospital in Arizona on the reservations, in places where the major, major big step forward is a pipe coming out of the ground that gives you some water—not necessarily guaranteed pure, even. So anyway, we started efforts to do outreach to those three populations. There were predecessors of that, just looking at outreach to native populations. So a team assembled; the SIS people were a main part of it, also Library Operations. My view is that you don't want to division this as this is outreach—like, this is our charity arm or something. You want everybody in the library… trying to do the same thing, trying to do their part toward this difficult goal.

After a few years of these travels, we began to realize that our hearts are in the right place. And, of course, our minds are always fixed on information, so we tend to fly into some place and plop down a computer and terminal and do MEDLINE searches and stuff like that. But after a while, we began to listen as well as talk and discover that there's much to be learned in those societies from those people, in their own terms—like, what does health care mean to them and how do they accomplish it, and how do they manage their little long life without you?

And it turns out that given some patience, they're willing to tell you—although at least in one of the three cases it was more difficult. The Hawaiians were, to my surprise... I'd been to lots of Indian places, but I've never been in Hawaii or Alaska. And both turned out to be wonderful people, wonderful places. But the first take in Hawaii was very, very

negative. They essentially treated us as one more band of whites from the outside here to take advantage of them some way or another.

W: Because they didn't know you yet and they didn't trust you.

L: Yes, right, they sure didn't. And so they told me in a big public meeting that they had their secrets. They knew how to cure AIDS, for example, but don't expect them to tell me. So that was a very painful meeting, because it was very public, and we had intended to be nice. And so I ended up standing up and saying, "Wait a minute. Let me tell you something. Here's the NLM. Here's the way it works. Please don't tell me any secrets, because I don't have any secrets. Anything you tell me is available free forever to anybody. Any secrets you keep." And it did shut down conversation. There was a sort of radio silence. And I could see them thinking, "Well, this guy is a son of a bitch but at least he's honest." [Laughter] I just left.

W: But you subsequently, obviously—the exhibit downstairs at the National Library of Medicine here includes Hawaiian culture.

L: Oh, yeah. It took a year before I decided to go back and decided, well, I'll give them one more try, because I don't want to say it's Native populations other than Hawaii. But we've got to have better introduction than this.

W: Were the librarians and others in Hawaii able to help with that cultural difference? I know one of their librarians was on your Board of Regents, actually. She chaired it. Ginny Tanji. So was that a help to better understand or be better trusted by that population?

L: Yes, but there were other ways, other organizations. But we never went back to this event at a particular international pavilion at the University of Hawaii. It was exactly seemingly like the right place. But we never did that kind of a big public thing again. We just began to work. Native Hawaiians are not so plenteous, even in Hawaii. As you know, they've been treated very, very badly; I guess initially mostly killed off by viruses—childhood illnesses. But there are some villages that are pure and we started to work with them.

W: So for all of the pre-Lindberg history, NLM had focused its collections and services on health professionals.

L: Yes.

W: Certainly a big task—MEDLINE, the other services, health professionals. So why was it so important to you to add patients and consumers to NLM's direct constituency?

L: Because nobody else matters. The doctors are okay, but they're on their own. I don't have to really worry too much about their understanding of the literature anymore or needing to get it good services that grow up to do that. But the patients are still the most

important part. And the patients have changed radically from the time I started medicine. Now they're both more formally better educated, but their attitudes have changed quite a bit. They're ready to participate in decision making about how they and their family will be treated, what they want and need. So it's a different game entirely. But to me that's where the action is. So while we're continuing to support molecular biology, it's almost a different direction—in some ways almost looking the opposite way, from patient education to patient information, but we've got to do both.

W: So MedlinePlus [consumer health information] has obviously been a huge success.

L: It has been, yeah. That's truly a medical library product.

W: And the fact that it's also available in Spanish—MedlinePlus en Español—is very helpful. I use it for the classes that I teach in literacy, and it's very well received.

L: Well, the way to go—we're doing some research with a group of linguistic experts here in the library that actually started with Alexa McCray, people she hired. But I meet every couple of weeks with this group of younger people, including students—including even high school students—who can hold their own amongst professionals.

What we're looking at there are questions that patients, or at least somebody out there, asks of NLM, that they type into a terminal. "Dear NLM, please tell me..." And there are tens of thousands. We try to answer them. It costs a little bit of money to do it—on the grounds that the public requires it and needs it warrants it. But we would like to do the best job we possibly could in arming the medical—informatics—librarians who are going to answer them: make that answer come up fast on a computer, or maybe even eventually let the computer directly send the information to the inquirer. And that's very, very interesting, because we're now at a point that we couldn't have foreseen forty years ago at all, even thirty years ago—software that understands slang and lingo and abbreviations and funny talk and normal talk. No problem at all making it into a sentence or a question.

But it turns out—just to abbreviate what I've learned out of that—that the mystery's still in the medicine, because you end up often... So basically, the group I'm meeting with bring me problems—I mean, they're continuing to do very, very well on their own, so I'm essentially looking at places where there are difficulties. And generally that is some place where you understand the question, but you don't understand why they asked it.

So a situation where you're in an examining room with a patient would never come up. You know why you're there; they know why you're there. It's intuitive. But if it's just typed on a terminal, however perfectly, you don't have the context. And we're still working on that. I could give you lots of different examples, but that's the bottom line.

Sometimes we have one advantage over other people who try to work in this field, because we know what the patient is looking at when they ask the question. There's a display. So if we compute and do all of our wonderful computational linguistics and then

we come back and we say, "Here's the display that answers your question," and that's the display they're looking at when they asked the question, what does that say? Well, it said, gosh, "We did something wrong here"—[laughter]—because there's still a question.

W: So still a lot of research questions to be answered.

L: Yes. But it's interesting that a lot of the questions are simple in the sense that 85% of the questions either name a disease or a drug. Well, that's a long way into it, isn't it, because that means that the patient has had some contact with a medical thing. They're a patient someplace and they're confused. So what do they want? Well, I think they want understanding. They don't want a reference. There's something they don't understand.

And I think all of us, if you end up seeing a doctor, if that's important to you, it doesn't have to necessarily be the 'big C' or something. Whatever it is, you're worried about it. That is not an ideal learning circumstance. So they'll tell you a lot of blah blah blah, but, well, wait a minute. Can I write that down or bring a friend? And usually it isn't written down and you didn't have a friend and you still don't know what the hell happened. Let me out of here, you know? Call me when my test gets done.

So from that point of view, it's easy to be sympathetic with a patient, with an inquirer, but if they tell you a name, it's not so impossibly difficult to come up with a proper answer. I don't mean that the computer is treating the patient. The computer may be improving the understanding of the patient. And there, too, I've always believed that this stuff about what level language is—you know, eighth grade or seventh grade—it's a bunch of nonsense. We've got all kinds of intelligent, PhD people who have no clue what's under their skin, and they don't teach that in physics or chemistry. So you could be capable of polysyllabic conversation, but if you don't know you've got two kidneys and someone wants to take one of them out, a great question arises.

So that's a lot of fun. If we just sledge our way out of this, it's not going to get solved and it's not going to be pleasant, it won't be fun. But some of this stuff is really quite amazing. And it definitely is fun to see high school kids. Of course, they're selected good. But to see high school kids really hit them out of the ballpark with this kind of a group...

[141031-LindbergPt2]

W: Okay, we are resuming our interview after a brief break. I wanted to talk a little bit about public access and the role that Harold Varmus and then David Lipman and the PubMed Central [free full-text archive of biomedical and life sciences journal literature] [National] Advisory Committee played. I was on that committee, and I remember it was really kind of a heady time and a challenging time. Do you have some thoughts about that?

L: Well, I think we ended up in the right place. Harold was very determined that he was not going to be upstaged—let alone overwhelmed—by publishers. And of course his

solution was to become a publisher [laughter]. Which he did. That turns out to be, certainly, a success. I mean, it was a success, because he and the people he picked for editorial boards were just five-star people. They had everything to offer. So it was a classy board, and the stuff they published. Well, I won't recite them all. But all the journals have been outstanding. I found them outstanding as print editions, actually. I must confess I still like the feel of a journal and the feel of a book, particularly leather-bound, but it doesn't have to be. So he proved the point right away. It turns out that even he and even using institutional reserves—corporate gifts and so forth—to subsidize costs, it's not possible to do everything. So at one time he told me that this argument that it's very difficult to get negative results published and that's why there's this bias and so forth, he said that he created a journal that would publish the negative results and subsidize the costs through these gifts that he had associated—and basically didn't get any takers. So you can't achieve everything. I remember there's a line in Shakespeare where a character says, "I can call monsters from the briny deep," and the other character says, "Ah, you can call them, but when you call them, will they come?" [Laughter] So he tried to call the negative results and couldn't get anyone to take it. But I would say that that's a success, and he's expended a lot of personal energy making it a success.

I like journals as well. I'm more interested in the form of them and the means of communicating with people. So I'm going to say I'm more interested in interactive journals—the idea that you can call up and see stuff and talk to it, and maybe if you want to re-analyze those data with your own statistics, that sort of a thing. Now, that particular part about the data and your own statistics is coming to the fore with the case of clinical trials. People are insisting that that's a very important thing to do. I'm less convinced on that particular point of revealing personal data. Right now we do a relatively good job of presenting group data, which is what the law requires, and documenting the means that you've used to make the decision—the statistical analyses and—

W: This is clinical trials stuff you're talking about?

L: Yes, clinical trials [ClinicalTrials.gov provides public access to information about current clinical research studies]. We don't give individual data or give an interpretation—again, according to the law that created it. But I think we haven't used what we have enough. So when somebody says, "Oh, it's no good, because I want to re-compute it all and I can show you where I came to a different conclusion," well, okay, maybe, but I'm not sure how often that will happen or any case where it matters. But it could be I'm wrong. But I would say the way to find out is to actively use what we already have.

As you know, the first analysis that Deborah Zarin was involved in, and I think also Jeff Drazen, showed that quite a few months out, nothing was published. And I think many, many months out, not more than about half gets published. So there to me is a mystery that could be investigated. I mean, if you ask anyone they'll tell you immediately, "Well, I know why," but they all know why differently. My original thought was that people were too damn lazy to write it up, and it might cover some percentage of them. Others have other ideas.

One of the things we discovered in creating ClinicalTrials.gov is that the legislation required us to ask the person doing the registration—so it's just registering, not results—"Have you made a legal commitment to anybody that controls the publication of the results?" And I personally thought that that's an insulting question for us to ask. That's a dreadful question. Why would anyone do such an awful thing? And it turned out that the first analysis revealed 47% of them had such a binding agreement, and it's gone up.

W: To a funder or something with that?

L: Yes, exactly. So investigating the actual nature of the thing—which the law doesn't require us to document, I don't believe; I think just the bare question, "Do you have an agreement?" And then following up with somebody. "Well, how did it actually work out? Did you reach a point where you wanted to publish? …Why is it the case that this stuff isn't getting published?" We finally actually convinced Dr. Varmus in a meeting with Deborah that that was in fact the case. And his immediate take was, "It's completely unacceptable that people would take NCI money, do the experiment, and not publish the results. We're going to do something about it." And I give him credit. It took him a year to turn the big ship around, but he has turned it around. So maybe we'll find out—perhaps.

W: Back to PubMed Central, certainly it has been important to the Medical Library Association, for one, for our being able to archive our entire *Bulletin* and *Journal of the Medical Library Association*, which many people have used to do research and to look up our history. So you must be proud of the role that NLM has taken in that endeavor.

L: Oh, yeah, it's another case where Dave Lipman just has done the job right from the start.

W: Mm-hmm, and having to navigate the issues with the publishers. It seems to have really worked out well.

L: But even so, just the simple matter of you as an NIH investigator are now required to turn this typescript, whatever it is, into a 'machinable' thing for us, a lot of people find that burdensome. And opinions differ as to how relatively easy or relatively hard it is. He's done his best to make it easy. I would think, in the end, the majority of that stuff will simply come from the publishers, because they have the facility to do it. There's no reason not to. Then you have total agreement on the status of the manuscript.

W: Exactly.

L: So I think the complaints will diminish.

W: Do you want to talk a little bit about the NLM Exhibition Program—"Changing the Face of Medicine," "Visible Proofs," "Frankenstein," "Native Voices"? And how much of that is your passions coming to the fore, working with your staff?

L: Well, quite a bit is mine, but I hope that I've never passed up a good idea that was someone else's good idea. But what struck me when I first came, there were then little exhibits in little see-through cases out in the lobby, and I was amazed at the high-class nature of the scholarship. They were very, very carefully done. Took many, many months and weeks of work on somebody's part, and nobody ever paid any attention to them. So I sort of got behind a policy that at least once a year we'll do one big exhibit, and we can do a couple small ones like this if you want, but at least let's do one big thing every once in a while. And then we started out with one that Esther Sternberg headed up, and it was called "Emotions and Health." She's a psychiatrist. Actually, she's now on the Board [of Regents] after all these many years, but has left NIH and has gone to University of Arizona in Tucson. But she had very much in her mind the interplay between various physical findings like endocrine and neurological and mentation. Scholar, in other words. And so she came up with a really wonderful exhibit. I can remember one of the highlights of that was planned in this very room at this very table. And of course, if you're looking at the history of psychiatry—which is what it amounts to if you say 'emotions' and 'health'—Freud is a pretty obvious touch point and was designed into the exhibit. And I had a meeting with the next person that they sent to represent the Institute [National Institute of Mental Health], who said that, essentially, we can't have this Freud stuff up there. We really want to put an emphasis on molecules and molecular biology and structures. And I had to say, man, are you kidding me? A history of medicine and a history of psychiatry without Freud? Impossible. Forget it. So he stayed in.

But one thing I remember, there's a surprisingly large amount of work to put on those exhibits. You think about the content and the intellectual part, but, even in those days, spelling was a problem. So, for instance, we'd have a label on an exhibit. You want labels; that helps the people coming through it. But they were done by sawing out letters. That's a nice 3-D effect, but god help you if you misspell something. You have to start all over again. So one thing, probably the most long-ranging conclusion we came to from Esther's exhibition was, the computer is going to make the signs, not the carpenter.

W: Well, one of the greatest things, I think, is not only the visibility that they have here at the National Library of Medicine and your beautiful space—which was freed up when the card catalog disappeared—but the traveling, the ability to condense the essence of an exhibit and allow it to travel around the country, which many of us in libraries took advantage of, and are still taking advantage of, so that more people can see it.

L: Yes, that's been a success. I worried about not being able to ship the whole thing. And the exhibit people here—actually center in History of Medicine, but they're professional exhibitors, as well—they assured me that it would work, if you take the essence of it and so forth. I remember once where there was still doubt in my mind. We were doing "Changing the Face of Medicine," maybe, no, I think it was electricity in medicine ["Frankenstein"]. And I noticed that it was going to a place called California State University, someplace. And I kind of challenged—like, okay, you made the deal. It's going to go there. I'm going to go to the opening to see what the heck is actually

going on. And it turned out that I was ignorant in many ways, but one of the ways is that California State 'blank' can be a heck of a big institution. I think this particular one was, I don't know, 20,000, 30,000 students—in Amherst terms, gigantic. And secondly, that they had planned the thing very, very carefully. I mean, it was a major event—so much so that the president of the university and the chairman of the board were on hand to have their say and offer their congratulations.   I think this one surely was involving the Frankenstein thing, so the chairman of the English department had undertaken the assignment to do an essay. Of course, the students are going to lap it up. It was very serious, very well taken. And it was to them an opportunity to discuss all of the good things that should be discussed in that—what was happening back in 1837 or whatever; what were they worrying about.

W: They were really great opportunities to bring campuses and other institutions together to have a discussion around the theme of the exhibit. It was really, really great. But what about some of the other History of Medicine programs and services, that particularly some people who don't have history [of medicine] in their own institutions as a big focus might not be aware of?

L: Well, I think the most striking thing about even the good shows and the good places is that every institution has stuff that they're particularly proud of, and so whatever we send is amplified, I guess I'd say, by what they're proud of. And that's wonderful to watch. So it's a different wonderment every place, but always quite interesting. So I'm strongly in favor of these exhibitions. I think they've done a lot of good. Initially, the reasoning is, help the public understand about science.

The Frankenstein thing came from my visiting a museum exhibition in Minneapolis that was designed by a person who makes pacemakers, amongst other things. So electricity was really the focus. But they did have a 3-D model of the monster and some spark generators. And it was a wonderful thing. They, of course, include children as well as adults.

W: Was that the Bakken [Museum]?

L: Yes. Very nice thing.

W: Fascinating museum.

L: And the curator there helped us to go beyond that, and the History of Medicine people, of course, are very good at the more generalized approach—what about the poet, what about the authors, what were the ideas and the times, and so forth. But if you follow that up, still I think the major response to my putting the thing together was Lindberg is doing a crazy thing once again. What in the world is he talking about, telling us about Frankenstein, for Christ's sake? Not that that would weaken my determination to do it. It didn't, but probably strengthened it.

But about two weeks before the show opened, what happened in the world? Dolly the [cloned] sheep. So, bingo, the director of NIH—in that case, Harold Varmus—was surrounded by people stuffing microphones under his eyes to get a comment on what does Dolly the sheep mean and so forth. Well, hell, it's exactly what we're talking about. What it's all about? Somebody's sick and deformed or something and should you help them and what should you do? Would you do something as insane as give a blood transfusion, which they certainly weren't doing back in those days. And where would you get the blood? Good god [laughter].

W: So there was an immediate connection with something in people's consciousness.

L: Sure. Making a creature. For heaven's sake, right out there in the lab with NIH money. So, yeah, all the same questions came up. Same as those days.

W: Fascinating. So another success.

L: Yes, oh, it was.

W: You stood your ground and another success.

L: Because of the very good people working on the thing. Also, it's a sound idea, of course. But it did start at the Bakken. And then the History of Medicine people added, I would say, a literary flavor to it.

W: Well, NLM's getting ready to launch its next planning process, and you jump-started that in May [14, 2014] with a symposium here, ["The National Library of Medicine, 1984-2014:] Voyaging to the Future." So what are your expectations and your hopes for that next voyage? You've always been a visionary. That's come to pass. And certainly in your work with NLM. So what is your vision? What do you see for this voyage for NLM?

L: Well, it's going to have to play itself out, because I think initially, back in '84, '85, if someone had said, "Oh, I'll tell you how it will all be," they would have been wrong, for sure, six different ways to Sunday. So anyone who would give a direct answer would be very foolish. But I would hope that if we stick to a bottom-up approach—namely, say who you want to help, get them to tell you where they want the help, and listen—we could get a long ways.

Part of the thing we're discovering in this Native Peoples exhibition is very well said by one old Apache healer—witch doctor, if you like. He's saying, "You know what? All the people who come to see me," he said, "my approach is, I listen to them. And if you listen carefully, they'll tell you what's wrong and they'll tell you what you've got to do to help them. So I don't have to be an expert in everything or even anything, but I've got to listen to them." Well, that lecture should be repeated about three times a day for every medical student in the bloody country, because it's so easy to get fascinated by what

you're going to do and what you know how to do and the lab measurements and all that. But the patient still will tell you if you let them—most cases.

So with that in mind, amongst the people who didn't help us—we didn't ask for help on the initial plan much in the way of patient groups. We didn't actively discourage them. We certainly didn't have medical student groups. Now I should think it would include nurses and maybe physician assistants as well—if we're interested. If we decide, okay, fine, then they are part of our population and part of our audience, then they ought to be part of the plan.

Where will cures come from? Well, I don't think anybody doubts that we're off on the century of genetics—that all of our concepts of basic disease are going to be totally redefined by what we learn about human genetics—and of course, human, as illuminated by all of those other studies in other animals. So that has got to play a big part. I guess all we can do is invite people and hope we've got the right ones and to listen carefully.

W: And make it fun.

L: Yes, make it fun.

W: Your planning has always been fun.

L: It should definitely be.

W: It's always been fun to come here and give our opinions. So how would you like to be remembered by the library and the broader health care and informatics communities? You've left a huge legacy here, obviously, and you've done so many things and you continue to do things.

L: I guess as a person that tried hard. At least that. I hit a few balls well. But you have to acknowledge that the world changes so rapidly that all of us are ignorant of some of the things we should have been doing. I had a lot to do to learn what genomics and genetics was all about, even though I actually was a teaching assistant in genetics back in Amherst days. We were giving out the wrong number of human genomes—human chromosomes, of course. But there's so much changing.

And I guess the thing I've come to observe that I would not have known without doing this government job is the intimate interplay between policy and science. Some things you just can't do without an explicit public policy, which you cannot get without a democratic process. So some stuff simply can't and won't be done without a policy action. So I would not have been as aware of that. Some of those policies worked smoothly, some not. For instance, we're seriously having trouble with this rulemaking procedure with respect to ClinicalTrials.gov. The law says do it and we are and we have, but it has been years delayed by the processes that are involved. And at least in the House of Representatives, they said to us, "Why in the world are you doing rulemaking? We don't want you doing rulemaking," to which the attorneys at NIH said, "Well, you

should have said that in the law." That made a big difference. And the rulemaking itself is—it's a good thing to have a process like that. It assures that the people know what's actually going on. But it does slow things up.

W: So what advice would you give to library and informatics people just entering the field today, especially new professionals, maybe some of us mid-career, about where things are going and how we should keep ourselves prepared, up-to-date, making a difference?

L: I've been amazed at the ability and flexibility of medical librarians—Mary as well. You're almost tempted to say they can do anything. But I certainly think that most can imagine doing anything, and most can imagine taking a swing at any ball they receive. So I think that is the right attitude. Nobody in the world can tell you what is the world going to be just like thirty, forty years from now. Sure it'll be different, but it'll still be very, very information intense. So any field that's not information intense is not going to be much. That comes down even to manual labor and automobile repairs. As you know, the parts are informatics themselves and the keeping up is informatics. And people nowadays are used to having two or three careers before they're done. So I think, recognizing that, that the medical library people are in the right field. Even though the field will change, you'll change and you'll be ahead if you have that proper attitude. So I think it's still a great field.

And I've been amazed at the ability of the people. One part of it, for instance, that they've responded to, I would say, ahead of the rest of the profession, is the recognition of disasters and planning for them, disaster recovery and prevention and so forth. Librarians seem to take that as a natural—"Oh, well, sure, I'll do that; that'd be interesting"—whereas, I would say, the medical people, we recall in horror. And the politicians are just false. Totally false.

W: Right. Well, I may have a biased view—I do have a biased view—that I think it's NLM's programs and services that have helped librarians be able to continue to reinvent themselves. Whether it was outreach, whether it's informationist concepts, whether it's patient care, disaster, you've given us the tools to be able to reinvent ourselves successfully.

L: I compliment you on Carla Funk, who has been absolutely marvelous, a leader of MLA [executive director, 1992-2015].

W: Yes.

L: We worked so smoothly and without a whole lot of folderol, and even written agreements just naturally supporting what we're trying to do, and we are having some pleasure in supporting what she's trying to accomplish and MLA is after. It has been a great pleasure and a wonderful partnership.

W: Do you remember your very first MLA meeting? I know it was in New York because I looked it up. Do you remember that? Were you intimidated by a new audience of constituents?

L: Yes. No, I was amazed at how sharp they were and also that the meetings were typically very well run. They don't go amuck. You don't find topics that are with too big an audience for the number of chairs or too many chairs for the audience. They don't do that. They're well run and good and interesting.

W: Yes. The Medical Library Association and NLM's partnership has been really a very valuable thing over the years. Do you want to talk about anything else or anyone else that we haven't mentioned yet that you want to get on record that you haven't had a chance to talk about?

L: No, I don't think so. I think you've covered a wide range.

W: Okay. So one last question, then. What's next for Don Lindberg? [Editor's note: Lindberg announced his retirement, effective March 31, 2015.] More adventures here? Taking time to enjoy your other interests, like photography? These beautiful photographs in your office.

L: Well, I definitely hope I haven't taken my last photograph. It turns out, of course, most of the years I've been doing wet photography—dark room, you know—and I've pretty much stopped. I've pretty much switched over to digital. But there's still a lot of creativity there left as well and I've enjoyed it, so I'll for sure keep that up.

I think we're probably going to sell the powerboat. We've enjoyed cruising and swimming and exploring and navigating and all those kinds of good things. Mary and I actually, many years ago, when we were just first married, took a power squadron course in Manhattan on how to operate a boat and how to do things safely. We had a wonderful time. We did it one night a week. And we'd go a little bit early, and we fell in with a pattern of having dinner with this older couple—they were like forty or something like that—forty years old.   And we stood in amazement that they were still able to stagger around [laughter]. But we also discovered that the guy lived in an apartment in New York. Must be a nice apartment. He was a wealthy guy. And he had bought a boat essentially with a check and received the keys to the boat and operated it for a year, and was horrified at what he'd heard in the power squadron about the unsafe procedures he'd been executing.

Of course, both Mary and I had done boating before, but in the truthfulness of an early marriage, it actually turned out that mostly she was dating in boats in Boston and places like that, and mostly I was hauling on lines on boats on the Long Island Sound, but pretty much interested in the female companionship of the boats. So we decided that if we were really going to do boating, we better have some instruction.

W: So here's a question for you. In your boat, who's the captain?

L: I guess I am. I don't think Mary wants to be a captain.

W: Sounds like a lot of fun.

L: It is a lot of fun. And she can make a wonderful meal in any galley. I mean, just absolutely first class. So when we cruise we always call ahead and try to get a slip or whatever we have to get. And if it's a good restaurant, we'll go there, and if not, we don't care, because she can make the finest meal alive on the boat. So the boating has been a lot of fun. I don't regret any of it.

W: That's great. Anything else you'd like to say? It's been a wonderful opportunity to have a chat and just reminisce about some of the things you've accomplished in your career. I'm impressed by your spark of discovery. You mentioned that early on in the interview—about how you are always so thrilled to discover something new that no one has ever figured out before. It seems like NLM has been able to do that in different ways.

L: We have, but some of the fields we work in, like genetics, every week even they'll discover new particles, new elements, new ways that the genetic thing gets translated into a person, that it would be impossible to be bored by the progress of the next twenty years. I give a little lecture in genetics in one of our courses, and I always be sure to put on a slide of Jim Watson, who speaks about—it was some years ago—but he speaks about understanding the genome of E. coli, because that was something of a milestone, to know the entire genome of this microorganism that's so familiar to everyone. And he said that even so, that it would be perhaps fifty or sixty years before the study of things you could learn on E. coli became irrelevant. So you have the starting of a wonderful field, but no one in the world knows where it's going to end. And certainly anyone going into medical work, including medical library work, would be foolish to neglect that area.

But yet on the other side—on the patients and the families and the public side—how about making them able to benefit from this new information? Now, there, I think it's very clear that, once again, they're not actually calling for a recitation of facts; they're calling for improving understanding. Because it's very difficult to understand things at the moment.

Take another field, physics, which is not my field, but I've talked with a physicist who remembers the days when it was said, and believed, I guess, that only half a dozen people in the world understand the Einstein theories and so forth. And that's just a laugh. Now it's taught by graduate students. Relativity? Sure. Get my piece of chalk and I'll give it to you. So we'll get that blasé about the genome as well, but it's going to be a lot of time before it takes that superficial an understanding to be useful, and it ought to be a very fun ride.

W: Well, one final thought that I have is that you gave the 2014 Paul Evan Peters Memorial Lecture at CNI, the Coalition for Networked Information, which I think, personally, was one of the best talks I've ever heard you give.

L: Oh, good. Thank you.

W: I watched it on video on YouTube. I wanted to get that reference in for my librarian colleagues to hear. "Computers, Plans, and Campfires." A great talk. But it seemed you got very emotional at the end of that. Were you?

L: Well, I guess I was leaving a happy event. But I was ending up, I hope, on sort of a level of person and emotion.

W: It came through. And you were talking about the Native Americans and the healing and then the value of the National Library of Medicine, and the power of information, actually, that I think we all should be proud of. So with that, I want to thank you very much for the interview. That concludes the interview with Dr. Donald Lindberg, and it's been a pleasure. Thank you very much.

L: Linda, thanks so much for the opportunity. You did a great job.

W: Thank you.

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CURRICULUM VITAE
Donald Allan Bror Lindberg, M.D.

PRESENT POSITION
Director
National Library of Medicine
Bethesda, Maryland 20894

BORN	**MARRIED**	**CHILDREN**
September 21, 1933	Mary Musick	Donald Allan Bror Lindberg
		Christopher Charles Seeley Lindberg
		Jonathan Edwards Moyer Lindberg

EDUCATION
> Amherst College
> Amherst, Massachusetts
> A.B. Magna cum Laude • 1954

MEDICAL EDUCATION
> College of Physicians and Surgeons
> Columbia University
> New York, New York
> M.D. • 1958

GRADUATE MEDICAL EDUCATION

Research Assistant to Dr. O.E. Schotte Amherst College, Amherst, MA	1954-1955
Intern in Pathology, Columbia-Presbyterian Medical Center, New York, NY	1958-1959
Assistant in Pathology, Columbia University College of Physicians and Surgeons, New York, NY	1958-1960
Assistant Resident in Pathology, Columbia- Presbyterian Medical Center, New York, NY	1958-1960
Resident Physician in Pathology, University of Missouri School of Medicine, Columbia, MO	1960-1962

PROFESSIONAL APPOINTMENTS

Director, National Library of Medicine	1984-

Director, National Coordination Office for High Performance
    Computing and Communications, Office of Science and
    Technology Policy, Executive Office of the President
	1992-1995

U.S. National Coordinator for the G-7 Global Healthcare Applications Project, Global Information Infrastructure Initiative	1996-2000

UNIVERSITY ACADEMIC APPOINTMENTS

University of Virginia, Charlottesville, VA	1992-1998
Clinical Professor of Pathology	
University of Maryland School of Medicine, Baltimore, MD	1984-1998
Adjunct Professor of Pathology	
University of Missouri	
School of Medicine, Columbia, MO	
Director, Information Science Group	1971-1984
Professor of Pathology	1969-1984
Associate Professor of Pathology	1966-1969
Assistant Professor of Pathology	1963-1966
Instructor in Pathology	1962-1963
Professor and Chairman, Department of Information Science, School of Library and Information Science	1969-1971

UNIVERSITY PROFESSIONAL APPOINTMENTS

University of Missouri-Columbia, Columbia, MO

Chairman, Hospital Medical Records Committee	1982-1984
Chairman, University Assembly Lectures Committee	1982-1984
Member, School of Medicine Research Council	1977-1979
Director, Health Services Research Center and Health Care Technology Center	1976-1980
Staff, Vice-President for Academic Affairs	1970-1971
Chairman, Campus Computer Coordinating Committee	1968-1971
Staff, Executive Director for Health Affairs	1968-1970
Director, Missouri Regional Medical Program Information Systems	1967-1970
Director, Missouri Regional Automated Electro-cardiography System	1967-1969
Director, Medical Center Computer Program	1962-1970
Chairman, School of Medicine Research Development Committee	1962-1966
Director, Medical Center Diagnostic Microbiology Laboratory	1960-1963

SPECIALTY CERTIFICATION

American Board of Pathology	1963
Anatomic Pathology	
Clinical Pathology	

LICENSURE

New York — License #81509 • 9/22/58
Missouri — License #R2875 • 10/17/65
Maryland — License #D41925
Diplomate, National Board of Medical Examiners • License #54601 7/1/61

HONORS, AWARDS

Phi Beta Kappa	1953
Simpson Fellow of Amherst College	1954-1955
Markle Scholar in Academic Medicine	1964-1969
Distinguished Practitioner in Medicine Academies of Practice in Medicine	1983
Fellow, American College of Medical Informatics	1985
Member, Institute of Medicine National Academy of Sciences	1985
Member, Institute of Medicine Council	1991-1996
Silver Core Award, International Federation for Information Processing	1986
Surgeon General's Medallion, U.S. Public Health Service	1989

Nathan Davis Award for Outstanding Member of
  Executive Branch in Career Public Service
  American Medical Association
	1989

Walter C. Alvarez Memorial Award American Medical Writers Association	1989
Presidential Senior Executive Rank Award	1990
Founding Fellow, American Institute of Medical and Biological Engineering	1992
Outstanding Service Medal Uniformed Services University of the Health Sciences	1992
Federal Computer Week's Federal 100 Award	1993
Computers in Healthcare Pioneer Award Computers in Healthcare Publishers	1993
Outstanding Volunteer Service Award D.C. Superintendent of Schools	1995
The Association of Minority Health Professions Schools Commendation	1995
RCI High Performance Computing Industry Recognition Award	1995

U.S. National Commission on Libraries and Information Science Silver Award	1996
Council of Biology Editors Meritorious Award	1996
Presidential Rank Award of Meritorious Executive in the Senior Executive Service	1996
Fellow, American Association for the Advancement of Science	1996
Medical Library Association President's Award	1997
Morris F. Collen, M.D. Award of Excellence American College of Medical Informatics	1997
Johns Hopkins University School of Medicine Ranice W. Crosby Distinguished Achievement Award	1998
New York Academy of Medicine Information Frontier in Biomedicine and Health Award	1999
Association of the Alumni of the College of Physicians and Surgeons of Columbia University Special Recognition Award	2001
Cosmos Club Award	2001
Surgeon General's Medallion, U.S. Public Health Service	2002
New York Academy of Medicine Honorary Fellowship	2004
American Medical Women's Association Lila A. Wallis Women's Health Award	2005
U.S. Medicine Frank Brown Berry Prize	2005

Louis Round Wilson Prize for Lifetime Achievement
   Louis Round Wilson Academy
   University of North Carolina at Chapel Hill
   School of Information and Library Science
	2006

Fellow, American Academy of Arts & Sciences	2006
Research America Builders of Science Award	2011
Honorary Member, Medical Library Association	2013
Coalition for Networked Information • Paul Evans Peters Award	2014
Association for Pathology Informatics • Lifetime Achievement Award	2014

HONORARY DEGREES

Sc.D. (hon. caus.), Amherst College 　Amherst, Massachusetts	1979
Sc.D. (hon. caus.), State University of New York 　Health Science Center, Syracuse, New York	1987
LL.D. (hon. caus.), University of Missouri-Columbia 　Columbia, Missouri	1990
Sc.D. (hon caus.), University for Health Sciences, Medical Informatics 　and Technology, Innsbruck, Austria	2004
Sc.D. (hon caus.), Old Dominion University, Norfolk, Virginia	2009

PROFESSIONAL MEMBERSHIPS

College of American Pathologists
American Medical Informatics Association
American Clinical and Climatological Association
Washington Society for the History of Medicine
Cosmos Club

BOARD MEMBERSHIPS IN PROFESSIONAL SERVICE ORGANIZATIONS

Federal Liaison to the Health on the Net Foundation	1996-
Board of Directors, Medical Informatics and Technology 　Applications Consortium (MITAC)	1999-2004
Advisory Board, Open Society Institute	1997-1999
Advisory Board, Alexandria Digital Library	1996-1998
Board of Directors, American Medical Informatics Association	1992-1996
Advisory Council, Institute of Medicine	1991-1996
Advisory Council, International Hospice Institute	1990-1994
American Medical Informatics Association • President	1988-1991
Board of Annual Reviews	1989-1993
National Advisory Board of Science Journalism Center 　University of Missouri-Columbia School of Journalism	1987-1994
Executive Board, National Board of Medical Examiners	1987-1991
Hughston Sports Medicine Foundation Board	1986-1987

National Board of Medical Examiners	1984-1991
Board of Directors, Gorgas Memorial Institute	1984-1989
Board of Directors, American Association for Medical Systems and Informatics (AAMSI)	1982-1986
Board of Directors, Symposium on Computer Applications in Medical Care (SCAMC)	1981-1988
Salutis Unitas • American Vice President	1981-1988
Board of Directors, Society for Computer Medicine	1978-1982
Computer Science and Engineering Board, NAS	1971-1974

BOARD OR COMMITTEE MEMBERSHIPS IN GOVERNMENT ORGANIZATIONS

Health IT R&D Senior Steering Group, Networking and Information Technology Research and Development Subcommittee, Committee on Technology, Presidential National Science and Technology Council	2010-
Trans-NIH Working Group on Climate Change and Health	2008-
Trans-NIH Biomedical Informatics Coordinating Committee	2007-
NIH Working Group on Women in Biomedical Careers	2007-
NIH Bioinformatics and Computational Biology Roadmap Working Group	2003-
Library of Congress National Digital Strategy Advisory Board	2001-2006
NSF Disease Information Senior Coordinating Committee	2003-2004
National Science and Technology Council, Committee on Information and Communication R&D	1994-1995

National Science and Technology Council, Committee on
  Education and Training, Subcommittee on Research and
  Development in Education and Training
	1994-1996

Federal Coordinating Council for Science, Engineering and
  Technology (FCCSET) Committee on Physical, Mathematical
  and Engineering Sciences (CPMES)
	1992-1993

OSTP High Performance Computing and Communications Information Technology Subcommittee • Chairman	1992-1995

Board of Scientific Counselors, Lister Hill National Center for Biomedical Communications National Library of Medicine	1983-1984
Department of Defense Peer Review Group for TRIMIS (Triservice Medical Information System)	1979-1984
Biomedical Library Review Committee of the National Library of Medicine	1976-1980
NIH Computer Research and Biomathematics Study Section	1967-1971

COMMITTEE MEMBERSHIPS IN PROFESSIONAL SERVICE ORGANIZATIONS

Chair, Visiting Committee on the Use of Technology, National Academies	2000-2001
American Association for the Advancement of Science (AAAS) Scientific Program Committee	1993-1996
Intersociety Pathology Telecommunications Network Committee, College of American Pathologists and American Society of Clinical Pathologists	1984-1986
Publications Committee, American Association for Medical Systems and Informatics (AAMSI) • Chairman	1983-1984
Program Committee MEDINFO 83, Fourth World Conference on Medical Informatics, Amsterdam, The Netherlands American Association of Medical Systems and Informatics	August l983
Organizing Committee, MEDINFO 86 • Chairman	1982-1987
Working Group on Fundamental Skills Association of American Medical Colleges (AAMC)	1982-1983
Commission on Computer Policy and Coordination College of American Pathologists	1981-1984
U.S. Planning Committee for MEDINFO 86	1981-1982
Advisory Committee on Information in the Academic Health Sciences Center. Roles for the Library in Information Management, AAMC	1981-1982
Department of Computer Science Institutional Review Team University of Missouri-Columbia • Chairman	1980
U.S. Representative to IMIA (International Medical	1979-1984

Informatics Association) (formerly TC4 of the
International Federation for Information Processing
IFIP) Trustee, IMIA   1979-1984

Committee on Laboratory Animal Data, National   1979-1981
 Research Council, National Academy of Sciences and
 National Academy of Engineering • Chairman

Symposium on Medical Informatics, Versailles, France   1979
 Second Annual Conference of World Association for
 Medical Informatics (WAMI) • Co-Chairman

Advisory Committee on Research and Development   1978-1982
 National Board of Medical Examiners

Advisory Committee to Health Information Management   1978-1982
 Program, Stephens College, Columbia, Missouri

International Affairs Committee, Society for   1978-1982
 Computer Medicine

Symposium on Medical Informatics, Toulouse, France   1978
 First Annual Conference of World Association for
 Medical Informatics (WAMI) • Co-Chairman

Advisory Group, Area II Health Systems Agency   1977-1979

Committee on Laboratory Animal Data, National   1976-1978
 Research Council, National Academy of Sciences and
 National Academy of Engineering

International Affairs Committee, American Federation   1975-1984
 of Information Processing Societies

National Advisory Committee of Artificial Intelligence   1975-1984
 in Medicine (SUMEX-AIM), Stanford University
 Chairman

U.S. Representative to International Federation for   1975-1979
 Information Processing Societies (TC4) Committee for
 Health Care and Biomedical Research

U.S. Committee for MEDINFO 77. Second World   1976-1977
 Conference on Medical Informatics, Toronto,
 Canada, August 1977 • Chairman

Data Work Group of National Commission on   1975-1976
 Arthritis • Chairman

Joint Computer Based Examination Committee of the   1974-1981

National Board of Medical Examiners and
The American Board of Internal Medicine

Conference on the Computer as a Research Tool in the   1973-1974
  Life Sciences, Federation of American Societies for
Experimental Biology • Chairman

President's Advisory Committee on Computer Science   1972-1982
  Stanford University

Computer Based Examination Advisory Committee of the   1971-1974
  National Board of Medical Examiners • Chairman

Subcommittee on Data Processing of the College of   1970-1972
  American Pathologists Commission on Laboratory
Inspection and Accreditation

Committee on Computers in Laboratory Medicine, American   1967-1969
  Society of Clinical Pathologists • Chairman

EDITORSHIPS

Editorial Board, Journal of the American Medical Association   1991-

Editorial Board, Medicine of the Americas,   1998-2000
  Eisenhower Medical Center Foundation

Editorial Board, Medscape   1999-2001

Contributing Editor, Methods of Information in Medicine   1970-1983
Associate Editor

Managing Editor, Series: Lecture Notes in Medical Informatics
  Springer-Verlag, New York and Heidelberg   1978-1991

Editorial Board, Journal of Medical Systems   1976-1996

Editorial Board, Medical Informatics Journal   1976-1996

Chief Editor, Proceedings of Third Annual Spring Conference of American
  Association for Medical Systems and Informatics (AAMSI Congress 84),
San Francisco   May 21-23, 1984

Chief Editor, Proceedings of Second Annual Spring Conference of American
  Association for Medical Systems and Informatics (AAMSI Congress 83),
San Francisco   May 2-4, 1983

Chief Editor, Proceedings of First Annual Joint Conference of the American
  Medical Information Association (AMIA), San Francisco   May 2-5, 1982

Chief Editor, Proceedings of MEDINFO 80. Third World Conference on

NAMED LECTURESHIPS

Paul Evan Peters Memorial Lecture, Spring 2014 Coalition for Networked Information (CNI) Membership Meeting, St. Louis, Missouri 2014.

Stanley L. Robbins, M.D. Memorial Lecture, *Pathology Surviving in an Informatics World*, Brigham and Women's' Hospital, Harvard University, 2010

Overholser Memorial Lecture, *Modern Information Systems for Modern Medicine*, University of Missouri, 2008

Nicholas E. Davies Lectureship, *Health Information: the Good, the Bad and the Ugly*, Piedmont Hospital, Atlanta, GA 2007

NFAIS Annual Conference 2007 Miles Conrad Lecture, *Health Information: Thorough Fast Free and Honest is Not Enough*, Philadelphia, PA, 2007

13th Billy S. Guyton History of Medicine Lecture, *A Computer for Doctor Osler*, University of Mississippi Medical Center, Jackson, MS 2006

Antonija Prelec Memorial Lecture 2001, *The Use and Abuse of Digital Medical Information: a Public Policy Dilemma,* State University of New York Stony Brook, Stony Brook, NY, *2001*

Montgomery County General Hospital's 20th Annual Dr. McKendree Boyer Lecture, *Information Technology for 21st Century Medicine*, Olney, MD, 1999

Marsden Blois Memorial Lecture, *Information and Medicine Reconsidered,* University of California, San Francisco, CA, 1998

Leslie Nicholas Lecture, *Modern Medicine and the Modern Library*, College of Physicians of Philadelphia, 1998

Donald A.B. Lindberg Lecture, *Access to Information and Knowledge,* Univ of Pittsburgh, 1997

Highman Lectureship, *Medicine and the NII,* University of California, Davis, California, 1996

Lazarow Lectureship, *Where is Telemedicine in the NII,* University of Minnesota, Minneapolis, Minnesota 1995

16th Annual Reynolds Historical Lecture, *A Brief and Biased History of Regional Medical Programs,* The University of Alabama at Birmingham, 1995

Eugene P. Pendergrass New Horizons Lecture, Radiological Society of North America, Chicago, Illinois, 1994

Richard A. Polacsek Lecture, Johns Hopkins University, Baltimore, Maryland, 1993

The British Library Dainton Lecture, Royal Society, London, England, 1993

Rachel K. Anderson Lecture, Columbia University, New York, New York, 1992

William Warner Bishop Lecture, University of Michigan, Ann Arbor, Michigan, 1992

Lansdowne Lecture, University of Victoria, BC, 1989

Robert F. Metzdorf Lecture, University of Rochester Medical Center, 1989

Baba Memorial Lecture, Ohio State University, Columbus, Ohio, 1986

David Maddison Lecture, University of Newcastle, New South Wales, Australia, 1988

Estelle Brodman Lecture, Washington University School of Medicine, St. Louis, Missouri, 1987

Yuri Nakata Lecture, University of Illinois, Chicago, Illinois, 1986

Francis Delafield Lecture, Columbia University, New York, New York, 1971

INVITED LECTURES

American College of Radiology, *History of Medical Journals*, Big Sky, Montana, 2013

2013 Intersociety Summer Conference, *Innovations of Medical Publishing: National Library of Medicine,* Big Sky, Montana, 2013

Washington State University, *How Scientific Information is Disseminated and Used*, Pullman, Washington, 2013

15th International Congress on Circumpolar Health, *Native Peoples/Concepts of Health and Illness,*

Fairbanks, Alaska, 2012
VHA Office of Informatics and Analysis Library, *The 21st Century Library Resources & Services,*
    Arlington, Virginia, 2012
Coalition for Advanced Scientific Computation, *High Performance Computing and Communications*
    at 20 years: What a Ride!, Washington, DC, 2011
2010 Keeneland Conference on Public Health Systems and Services Research, University of
    Kentucky, *Public Health and Medical Informatics,* Lexington, Kentucky, 2010
Maplewood Park Place Community, *The Future is Here Now,* Bethesda, Maryland, 2010
American Clinical and Climatological Association, *My Flying Machine Was Out of Order,*
    Hot Springs, Virginia, 2009
American Clinical and Climatological Association, *The Second 125 Years of the ACCA: Shall We*
    Return to Our Roots? Ponte Vedra, Florida, 2008
International Conference on Behavioral Health & Traumatic Brain Injury, *NLM Information Systems*
    for the Public and Professionals, St. Joseph's Regional Medical Center, Paterson, NJ, 2008
CHIA State Convention & Exhibit, Keynote Address: *The Role of Health Information in the*
    Delivery of Health Care, San Jose, California, 2008
GenBank 25th Anniversary, *History of GenBank*, NIH, Bethesda, MD, 2008
AHLTA 2008, National Forum of the Defense Health Information System, Keynote Address:
    Cutting the Gordian Knot, Georgetown University, Wash., DC, 2008
Changing the Face of Medicine Traveling Exhibition, *Nuts and Bolts of the Traveling Exhibition,*
    University of Mississippi Medical Center, Jackson, MS, 2008
ISMPP – Special Education Meeting, New Federal Legislation for Clinical Trial Registration and
    Results Disclosure: Implications for Publication Planning Professionals & Biomedical
    Publications, *ClinicalTrials.gov: Keeping Pace with the New Legislation*, Ronald Reagan
    Building & International Trade Center, Wash., DC, 2008
Josiah Macy, Jr. Foundation, *Influence of the Internet on Continuing Education,* Bermuda, 2007
AMIA 2007 Annual Symposium, Panel: *What on the Horizon? National Policy and Informatics?*
    Chicago, Illinois, 2007
Health on the Net Foundation, Bordeaux, France, 2007
The Business of Government Hour Radio Show, 2007
University of Utah, Legacy of Life Scientific Achievement Conference, Keynote Address:
    Biomedical Informatics: Research Opportunities & Challenges, Salt Lake City, UT, 2006
University of Utah InfoFair, Keynote Lecture: *Access to Truthful and Relevant Scientific*
    Information, Salt Lake City, UT, 2006
HMS Center for Biomedical Informatics Grand Rounds Lecture, *Open Access Literature & Open*
    Access Database and More, Harvard Medical School, Boston, MA, 2006
Falmouth Forum Lecture Series, *Health Information: the Good, the Bad and the Ugly*, Marine
    Biological Laboratory, Woods Hole, MA, 2006
Lane Biomedical Library Centennial Symposium: *Biomedical Information and Knowledge*
    Management in the 21st Century, Keynote Lecture, Stanford University, Stanford, CA, 2006
ECURE 2006 Conference: Preservation and Access for Digital College and University Resources,
    Keynote Address: *Informatics, Scientific Research and Your Tax Dollars at Work*, Arizona State
    University, Tempe, AZ, 2006
University of Columbia, Biomedical Informatics Faculty Scientific Conference, *Medical Informatics*
    Then and Now, New York, NY, 2006
International Conference on Health Promotion, University of Tennessee, Atlanta, GA, 2006
TTI/Vanguard NextGens Technologies, *Future of Electronic Health Records*, Wash., DC, 2005
NIH Grand Rounds for Clinical Fellows, *A Computer for Dr. Osler*, NIH, Bethesda, MD, 2005
Pediatric Academic Societies' Annual Meeting, *ClinicalTrials.gov – For All and Open to All*,
    Washington, DC, 2005
Suburban Hospital Grand Rounds, *A Modern Computer for Modern Medicine*, Bethesda, MD, 2005
10th Anniversary Celebration of the Eskind Biomedical Library, *Transforming Healthcare through*
    Innovations in Informatics and Librarianship, Vanderbilt University, Nashville, TN, 2004
University for Health Sciences, Medical Informatics and Technology, *Research Opportunities and*
    *Challenges in 200*5, Innsbruck, Tyrol, Austria, 2004
Geisinger Health System, Medicine Grand Rounds Lecture, Geisinger Medical Center, Danville,
    Pennsylvania, 2004

Delaware Academy of Medicine, Inc., Keynote Address: *Digital Libraries and Analog Doctors*, Wilmington, Delaware, 2004

The National Academies, *Enhancing Global Informatics Infrastructure in Support of Health Care*, Washington, DC, 2004

Robert Wood Johnson Clinical Scholars Program Annual Meeting, *Biomedical Informatics: Scientific Promise and Policy Dilemma*, Ft. Lauderdale, Florida, 2003

International Conference on Health Promotion, *Informatics for Health Promotion*, University of Tennessee, Chattanooga, TN, 2003

University of Pittsburgh Medical Center Cancer Centers, *Pathology and Biomedical Informatics*, Pittsburgh, Pennsylvania, 2003

Special Libraries Association Annual Meeting, *Finding the Librarian Gene*, New York, NY, 2003

American Clinical and Climatological Association, *Biomedical Informatics: Previous Scientific Resources and Public Policy*, Williamsburg, Virginia, 2002

Macy Morehouse Conference on Primary Care, *Impact of Health Information and New Technology*, Atlanta, Georgia, 2002

Ohio Public Health Forum sponsored by Representatives Regula and Obey, *Modern Medicine, the Internet and You*, Kent State University, Canton, Ohio, 2002

Bioscience Information Technology First Annual Conference, Keynote Address: *Federal Strategies in the Application and Development of Bioinformatics*, McLean, VA, 2002

University of Health Informatics and Technology Opening Ceremony Lecture, *Medicine in the 21st Century: Global Problems, Global Solutions*, Innsbruck, Austria, 2002

Jack A. Austin Lecture Series, Teaching, Learning and Research with Technology, Tufts University, Boston, Massachusetts, 2002

Duke Endowment Trustees Lecture, *Information Technology & Healthcare: Unsolved Problems*, Charlotte, North Carolina, 2002

Cosmos Club Awardee Lecture, *Tales of Information and Medicine*, Washington, DC, 2001

Spry Foundation Conference, Web Progress and Future Challenges*, Keynote Lecture: *NLM's Vision: Health for Older Americans*, Natcher Center, Bethesda, Maryland, 2001

National Press Foundation Seminar on Biomedical Science, *Accessing Medical Information*, Washington, DC, 2000

The Academic Medicine and Managed Care Forum, Keynote Address: *Information to the Rescue*, Washington, DC, 2000

American Board of Internal Medicine Foundation Forum 2000: Restructuring Health Care, *Quality and Health Care: How will the growth in Information Technology Affect the Demand for and the Delivery of Health Care*, Mont Tremblant, Quebec, Canada, 2000

University of Pittsburgh Symposium: Medical Information: Security and Privacy in the Era of the Internet, Pittsburgh, Pennsylvania, 2000

Medical Technology Leadership Forum, *Next Generation Internet and Old Generation Doctors*, Indiana University, Bloomington, Indiana, 2000

National Research Council Second National Conference on Scientific and Technical Data, Making Health Information Available to the Public: The Federal Opportunity, National Academy of Sciences, Washington, DC, 2000

Eighth Cosmos Club Spring Symposium, The Power of Knowledge in the New Century, Washington, DC, 2000

The Brookings Institution: Seminar on Science and Technology Policy, Electronic Communication and Scientific Progress, Washington, D.C., 2000

Johns Hopkins University, Welch Medical Library 70th Anniversary, Keynote Lecture, 1999

University of Washington Health Sciences Libraries: The Health Information Challenge, Connecting People to Knowledge for Life, Seattle, WA 1999

The Krasnow Institute, *The Medical Library in Changing Times*, Fairfax, VA, 1999

Spry Foundation Conference, Older Adults, Health Information and the World Wide Web,

The Unique Role of Computers and the World Wide Web in Providing Health Information to Older Adults, Bethesda, Maryland, 1999

The Brookings Institution: Understanding the Science and Technology Enterprise: The Political and Economic Contexts, Scientific and Technological Knowledge: Communications and Use--Issues of Libraries, Journals, and Electronic Publishing, Washington, D.C., 1999

International Conference on Transferring Research to Practice in the Information Age, European Union Center and Center for Health Care Quality, University of Missouri, Columbia, MO, Transferring Research Through High Performance Computing, 1998

Chicago Society of Internal Medicine, *Medical Informatics - The National Perspective*, Chicago, IL, 1998

Scientific Colloquium in Celebration of Dr. Michael E. DeBakey's 50th Anniversary at Baylor College of Medicine, *The Role of Informatics,* Houston, Texas, 1998

National Center for Infectious Diseases, Centers for Disease Control and Prevention, *The Next Generation Medical Library*, Atlanta, Georgia, 1998

Cosmos Club Foundation, The John P. McGovern Award, Washington, D.C., 1998

HOST Summer Meeting: The Business of IT, Arlington, VA, 1998

Department of Energy and National Science Foundation, National Workshop on Advanced Scientific Computation, Washington, D.C., 1998

National Institute of Standards and Technology, Advanced Technology Program, Modern Computing and Modern Health Care, Gaithersburg, MD, 1998

Institute for Alternative Futures, Information Solutions for Health Systems Management, *Access to Information and Knowledge*, Washington, DC, 1998

Cosmos Club, Dramatic Changes Computers Have Brought to Medicine, Washington, DC, 1997

NASA Goddard Space Flight Center Scientific Colloquium, Greenbelt, MD, 1997

American Telemedicine Association Annual Meeting, Atlanta, Georgia, 1997

American Defense Preparedness Association/National Security Industrial Association, Medical Technology Conference and Exposition (MEDTEC 1997), Tysons Corner, VA, 1997

Friends of the National Library of Medicine (FNLM) Health Information Infrastructure (HII) Conference, Georgetown University, Washington, DC, 1997-1998

Northeast Group on Educational Affairs (NEGEA) Annual Program, Informatics Today and Tomorrow — Implications for Medical Educators, Georgetown University, Washington, DC, 1997

Society of Medical Administrators Annual Meeting**,** *Information Technology and Medicine,* San Juan, Puerto Rico, 1997

Supercomputing '96, *Information Technology and Healthcare,* Pittsburgh, PA, 1996

National Association of Health Data Organizations, Keynote Address*,* Washington, DC, 1996

Institute of Medicine Twenty-Sixth Annual Meeting, National Information Infrastructure*,* Washington, DC, 1996

University of Washington, *Computers and the Modern Medical School: A Happy Symbiosis,* Seattle, Washington, 1996

Sixth Biennial Regenstrief Conference, *Promises, Promises!,* University of Indiana, Indianapolis, Indiana, 1996

Information Technology in Health Care Conference, *Information Technology and Health Care,* University of Virginia, 1996

Charles R. Drew University, *Medicine in the Information Age: Implications for Libraries, Research and Education and Clinical Practice*

Council of Biology Editors Annual Meeting and Awards Ceremony, 1996 Meritorious

Award, Portland, Oregon

Friends of the National Library of Medicine (FNLM) Health Informatics Infrastructure (HII) Conference, *NLM on the Information Superhighway,* Georgetown University, Washington, DC, 1996

Advanced Digital Libraries 96, *Applying Knowledge in the Digital Landscape,* Library of Congress, Washington, DC, 1996

American Medical Student Association, *Medicine's Chance in an Electronic World,* Arlington, Virginia, 1996

Medical University of South Carolina, *Medicine Wagon on the Electronic Highway*, Charleston, South Carolina, 1996

British Medical Association 2nd International Conference on Medical Informatics, *The National Library of Medicine's Approach to Integrated Information Management,* London, England, 1995

American Medical Writers' Association (AMWA) Annual Meeting, *The National Library of Medicine: From HyperDOC to CyberBody,* Baltimore, MD, 1995

American Society of Internal Medicine (ASIM) Conference, *Information Superhighway: Where's the Medical Lane,* Washington, DC, 1995

Visualization Forum, Aspen Institute, Visualization, Medical Information and High Performance Libraries*,* Aspen, CO, 1995

International Conference on the Internet and the World Wide Web for Telematics in Health Care, *The Internet, the World Wide Web and Biomedicine,* Geneva, Switzerland, 1995

MedInfo 95, 8th World Congress on Medical Informatics, *High Performance Libraries,* Vancouver, British Columbia, Canada, 1995

National Institutes of Health (NIH), Clinical Center Grand Rounds, *Telemedicine: Where It's At!,* Bethesda, MD, 1995

National Advisory Council of the National Institute of Dental Research, *Health Sciences Applications on the National Information Infrastructure,* Bethesda, MD, 1995

College of American Pathologists Conference XXIX, New Approaches to Autopsy Information Management, Washington, DC, 1995

Conference on Advances in Digital Libraries, *Medical Issues in Digital Libraries,* Tysons Center, Virginia, 1995

7th International Congress on Medical Librarianship, *The Modern Library — Lost and Found,* Washington, DC, 1995

1995 Radiology Centennial Commemorative Conference, National Information Infrastructure: Implications for Teleradiology*,* Lister Hill Center, Bethesda, MD, 1995

Second International Conference on the Medical Aspects of Telemedicine, *The National Library of Medicine's Central Role in Clinical Communications,* Mayo Clinic, Rochester, Minnesota, 1995

Department of Veterans Affairs, Veterans Health Administration, *Future Direction of Healthcare Information,* Washington Information Systems Center, Silver Spring, MD, 1995

1995 AMA National Leadership Conference, *Informatics,* Washington, DC, 1995

American Association for Dental Research, *Health Sciences Applications in the NII,* San Antonio, Texas, 1995

Cosmos Club Lecture, *Medicine Wagon on the Electronic Highway*, Washington, DC 1995

Medicine Meets Virtual Reality III Conference, HPCC &Virtual Reality*,* San Diego, CA, 1995

Joint New York Medical College and NYNEX Symposium on Envisioning Telecommunication Technologies, Providing the Vision*,* New York Medical College, Valhalla, NY, 1994

Centennial Symposium of the William Pepper Laboratory, Information Management, University of Pennsylvania Medical School, Philadelphia, PA, 1994

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Computers in Medicine Seminar, Howard University College of Medicine, Washington, DC, 1994

American Medical Publishers' Association Board of Trustees, Chicago, Illinois, 1994

Supercomputing '94: The High Performance Computing & Communications (HPCC) Program: Technologies for the NII Panel, Convention Center, Washington, DC

105th Annual AAMC Meeting Focus Session: Academic Medical Centers and the Information Superhighway, Boston, Massachusetts, 1994

Institute on Federal Library Resources, Bethesda, Maryland, 1994

Computer Professionals for Social Responsibility Conference, Washington, DC, 1994

National Medical Honor Society, University of Missouri, Columbia, MO, 1994

High Performance Consortium, American Electronics Association, Washington, DC, 1994

Dedication of Vanderbilt University Medical Center Library, Vanderbilt University School of Medicine, Nashville, Tennessee, 1994

Ad Hoc Committee on Telemedicine, U.S. Capitol, Washington, DC, 1994

The Maryland Biotechnology Network Forum: HPC Revolution and Biotechnology, Bethesda, MD 1994

Library and Information Planning Meeting, National Biological Survey, National Fisheries Research Center, Kearneysville, West Virginia, 1994

Regional Medical Libraries Meeting, National Library of Medicine, Bethesda, MD, 1994

AMIA 17th Annual Symposium, SCAMC Closing Session: ACMI Debate and Distinguished Lecture, *Medical Computing, High and Low,* Washington, DC, 1993

Special Interest Group for Networked Information Discovery and Retrieval III (SIGNIDR Conference), Bethesda, Maryland, 1993

ARL/CAUSE/EDUCOM Coalition for Networked Information Task Force Fall Meeting, Washington, DC, 1993

20th Annual Toxicology Information Roundtable. National Library of Medicine, Bethesda, Maryland, 1993

ComputerLand Washington Summit: Tomorrow's Information Technology, Washington, DC, 1993

Congressional Research Service Seminar on Telemedicine: A Vehicle for Expanding Access to Health Care, Library of Congress, Washington, DC, 1993

Computer Science and Telecommunications Board, National Research Council, NRENaissance Study Group, Washington, DC, 1993

Montgomery County High Technology Council, 1993

High Performance Computing and Communications Consortium, American Electronics Association, Washington, DC, 1993

MEDLARS Center Opening, Jerusalem, Israel, 1993

Federal Aviation Administration, Washington, DC, 1993

American Institute of Medical and Biological Engineering Annual Meeting, Washington, DC, 1992-1993

American Association of Engineering Societies (AAES), Washington, DC, 1993

American Medical Association (AMA) Annual Meetings, 1986, 1987, 1993

University of Arizona, Dedication of the Arizona Health Sciences Library and Learning Resource Center, Tucson, Arizona, 1993

American College of Cardiologists, Bethesda, Maryland, 1992

RCI North American Annual Member Executive Conference, Washington, DC, 1992

Information Industry Association Meeting, Washington, DC, 1992-1993

University of Virginia, Department of Pathology, Health Sciences Center, Charlottesville, Virginia, 1992

Association of American Medical Colleges (AAMC), Washington, DC, 1992

Texas A&M University, College Station, Texas 1992
Ohio Society of Pathologists, Columbus, Ohio, 1992
University of Oregon, Dedication of the Biomedical Information Communications Center,
    Portland, Oregon, 1991
Bowman Gray School of Medicine, Bowman Gray 50th Anniversary, Wake Forest University,
    Winston-Salem, North Carolina, 1991
American Society for Information Science (ASIS), Washington, DC, 1991
University of Washington, Health Sciences Library, Seattle, Washington, 1991
AAMC Information Technology Symposium, Snowmass, Colorado, 1991-1996
AAMC Council of Deans, Tempe, Arizona, 1991
Medical Informatics 1991, Salt Lake City, Utah, 1991
University of Virginia, Claude Moore Health Sciences Library, 1991
University of Oklahoma, Dedication of Robert M. Bird Health Sciences Library, Oklahoma City,
    Oklahoma, 1991
Federal Library and Information Center Committee (FLICC) Forum, Washington,
    DC, 1986, 1991, 1993
American Association for the Advancement of Science (AAAS), Washington, DC, 1991
University of Cape Town, Cape Town, South Africa, 1991
Health Informatics for Southern Africa Congress, Cape Town, South Africa, 1991
White House Conference on Library Information Services, Bethesda, MD, 1990
Sanitatsakademie, Munich, Germany, 1990
SCAMel Consortium, Dallas, Texas, 1990
NFAIS Annual Conferences, Philadelphia, Pennsylvania, 1988, 1990
Marburg University, Marburg, Germany, 1990
University of Pittsburgh, Pittsburgh, Pennsylvania, 1990
Cornell University Medical College, Dedication of C.V. Starr Biomedical Information Center,
    New York, New York, 1990
University of Texas Southwestern Medical Center, Dallas, Texas, 1990
Johns Hopkins University, Montgomery County Center, Rockville, MD, 1990
College of American Pathologists, Kansas City, 1988; Washington, DC and Chicago, IL 1989
Stanford University, Stanford, California, 1980, 1989
Association of Research Libraries (ARL), Bethesda, Maryland, 1989
New York University Medical School, New York, New York, 1989
ACP Symposium, University of Pennsylvania, Philadelphia, Pennsylvania, 1989
Yale University School of Medicine, New Haven, Connecticut, 1989
Harvard University, Harvard Countway Library Rededication, Boston Massachusetts, 1989
University of Iowa, Health Science Library, Iowa City, Iowa, 1989
Library Association of China, Taipei, Taiwan, 1989
American Medical Association, Chicago, Illinois 1989
University of Newcastle, New South Wales, Australia, 1988
University of Wisconsin Hospital, Department of Medicine Grand Rounds, Madison, WI, 1988
Ameritech Foundation Lecture, University of Wisconsin, Madison, WI, 1988
National Board of Medical Examiners (NBME), Philadelphia, Pennsylvania, 1988
History of Medical Informatics Conference, Bethesda, Maryland, 1988
Howard Hughes Medical Institute (HHMI), Bethesda, Maryland, 1988
National Academy of Sciences, Computer Science Technology Board, 1988
Royal Netherlands Academy of Arts & Sciences Symposium, Amsterdam, the Netherlands, 198
American Medical Writers Association (AMWA), Bethesda, Maryland, 1987
European Federation for Medical Informatics International Congress, Rome, Italy, 1987
Association of American Medical Colleges (AAMC), Denver, Colorado, 1964;

Tucson, Arizona, 1987

National Institutes of Health (NIH), Clinical Center Grand Rounds, 1987

State University of New York, SUNY Health Science Center Syracuse, New York, 1987

George Washington University Medical Center, Department of Pathology, Washington, DC, 1987

Department of the Navy, Bethesda, Maryland, 1987

University of Utah, Salt Lake City, Utah, 1985, 1987

MEDLARS Center Opening, Beijing, China, 1987

National Science Foundation, Washington, DC, 1987

National Academy of Sciences, Institute of Medicine, Council on Health Care Technology, Washington, DC, 1987

University of Washington, Seattle, Washington, 1986

University of Maryland at Baltimore, 1986

University of Illinois at Chicago and Urbana-Champaign, 1981, 1986

University of Texas, Texas Medical Center, Dallas, Texas, 1986

State University of New York at Buffalo, Buffalo, New York, 1986

University of California, San Francisco, California, 1986

University of Southern California, Norris Medical Library, Los Angeles, California, 1986

Health Sciences Library Statewide Meeting, Philadelphia, Pennsylvania, 1986

Tufts University, Boston, Massachusetts, 1986

University of Texas Health Science Center, Dolph Briscoe Library Dedication, San Antonio, Texas, 1986

The Princeton Club, New York, New York, 1986

University of Southern California, Los Angeles, California, 1985

American Association of Medical Systems and Informatics (AAMSI) Congress, San Francisco, California, 1985

University of Missouri-Columbia, Grand Rounds, Department of Child Health, Columbia, Missouri, 1983

Missouri Institute of Psychiatry, St. Louis, Missouri, 1983

World Health Organization, Geneva, Switzerland, 1983

Ottawa Civic Hospital, George S. Williamson Health Sciences Library, Ottawa, Canada, 1983

Johns Hopkins University, Department of Biomedical Computing, Baltimore, Maryland, 1983

Missouri Society of Internal Medicine/ACP Meeting, University of Missouri, 1983

First Annual Conference of American Medical Informatics Association, San Francisco, California, 1982

Upjohn Company, Williamsburg, Virginia, 1982

National Health Policy Forum, Washington, DC, 1982

American Society of Clinical Pathologists and College of American Pathologists, Las Vegas, Nevada, 1981

Medical Information System Development Center, Tokyo, Japan, 1977, 1981

SCM Tenth Annual Meeting, San Diego, California, 1980

Stanford University, Artificial Intelligence in Medicine Workshop, Stanford, California, 1980

Society for Computers in Medicine, San Diego, California, 1980

Conference on Hospital Information Systems, Cape Town, South Africa, 1979

International Health Evaluation Association and Salutis Unitas, Stockholm, Sweden, 1979

Life Planning Center, Tokyo, Japan, 1977

IBM Research Center, Yorktown Heights, New York, 1975

Global Epidemiology Board, Washington, DC, 1975

National Library of Medicine, Bethesda, Maryland, 1974

American Health Congress, Chicago, Illinois, 1974

FASEB Conference, Aspen, Colorado, 1974

Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, DC, 1970, 1972, 1973
California Medical Association, San Francisco, California, 1972
Symposium on Hospital and Information Systems, Rio de Janeiro, 1971
University of Georgia, College of Business Administration, Athens, Georgia, 1971
Conference on Medical Information Systems, Health Sciences Research Center of the Kaiser-Permanente Medical Care Program, San Francisco, California, 1970
Tulane University, School of Public Health and Tropical Medicine, New Orleans, Louisiana, 1969
Institute for Planning and Rationalization of Health and Social Welfare Services, Stockholm, Sweden, 1969
Missouri State Medical Association, St. Louis, Missouri, 1969
American Association of Clinical Chemists, Denver, Colorado, 1969
New York State Medical Society Annual Meeting, New York, New York, 1969
Missouri State Medical Society Annual Meeting, Kansas City, Missouri, 1968
Lecture to Engineering Summer Conferences, University of Michigan, Ann Arbor, MI, 1966
AMA Conference, Chicago, Illinois, 1966
Kansas City Academy of Medicine Scientific Meeting, Kansas City, Kansas, 1966
Hill Foundation Clinic Directors, College of Medical Sciences, University of Minnesota, Minneapolis, Minnesota, 1965
Ontario Association of Pathologists, Toronto, Canada, 1965
California Society of Pathologists, El Segundo, California, 1965
University of Kansas Alumni Day, Kansas City, Kansas, 1965
University of Wisconsin Medical Center, Madison, Wisconsin, 1965
IBM Department of Education, Medical Research, Poughkeepsie New York, 1965
California College of Medicine, Palm Springs, California, 1964
Wesley Medical Center, Wichita, Kansas, 1964
American Society for Microbiology, Cleveland, Ohio, 1963
Missouri Society of Pathologists, Columbia, Missouri, 1963

MAJOR PRESENTATIONS
The National Library of Medicine 1984-2014: Voyaging to the Future, *Letting Users Set the Course: NLM and Long Range Planning*, 2014
Medical Library Association (MLA) Annual Meetings, *NLM Update,* 1985-2014
Marine Biological Laboratory, Medical Informatics Seminar, Woods Hole, MA, 1991-2013
FNLM/NLM/Research!America Workshop: Public Access to Clinical Trials, Lister Hill Center, Bethesda, MD, 2013
Health Disparities and Research Conference: Native People's Concepts of Health and Illness, Anchorage, Alaska, 2012
Health on the Net Foundation, Geneva, Switzerland, 2010
FNLM/NLM/AAAS Conference: Clinical Trials: Present Challenges and Future Opportunities, *Enhancing Clinical Trials to Improve Health Care,* NLM Lister Hill Center, Bethesda, MD 2011
FNLM/NLM Conference: The ePatient: Digital and Genomic Technologies for Personalized Health Care, NIH Natcher Center, Bethesda, MD, 2010
American Academy of Arts and Sciences Symposium, *The Library of the Future,* Mountain View, California, 2009
Health on the Net Foundation, Paris, France, 2009
FNLM/NLM Symposium on Personal Electronic Health Records: From Biomedical Research to People's Health, NIH Natcher Center, 2009
AMIA Annual Symposium, *Informatics Year in Review*, San Francisco, California, 2009

Go Local Launch, Oregon Health Sciences University Library, Portland, Oregon, 2009
Health on the Net Foundation, Williamsburg, Virginia, 2008
Student National Medical Association Annual Meeting, *I'm a Leader in Medicine,*
    New York, New York, 2008
Michael E. DeBakey Symposium for Texas High School Students, Edwin Hornberger Conference
    Center, Houston, Texas, 2007
Josiah Macy, Jr. Foundation, *Continuing Education in the Health Professions* Conference,
    Influence of the Internet on Continuing Education, Southampton, Bermuda, 2007
Go Local Launch, University of Minnesota, Minneapolis, Minnesota 2007
NIH TV Program, *Tomorrow's Medicine Today*, Montclair State University, Montclair,
    New Jersey, 2007
Congressional Steering Committee on Telehealth and Medical Informatics, Washington, DC, 2002
3rd Triennial World Asthma Conference, Chicago, Illinois, 2001
White House Commission on Complementary and Alternative Medicine, Wash., DC, 2001
National Asthma Education and Prevention Program, NHLBI, Reston, Virginia, 2001
IOM Health Care Services Board Meeting, NAS, Washington, DC, 2001
White House Commission on Complimentary and Alternative Medicine Policy Meeting,
    Washington, DC, 2001
CENDI-NLM Symposium "Evaluating Our Web Presence: Challenges, Metrics, Results",
    Bethesda, MD, 2001
NLM/PLA/MLA Conference "The Public Library and Consumer Health: Meeting
    Community Needs Through Resource Identification and Collaboration",
    Washington, DC, 2001
AAMC Information Technology Symposium, Snowmass, Colorado, 1991-2000
National Health Council, Voluntary Health Agencies, Washington, DC, 2000
The Third Lindberg Lecture on Biomedical Informatics, University of Pittsburgh, PA, 1999
AAMC 1999 Professional Development Conference, Putting Information to Work, Pittsburgh,
    PA, 1999
HII 99 Conference: Improving Health in a Digital World, Plenary IV - Emerging Technologies,
    Washington, D.C., 1999
G7/G8 SP-4 Global Forum, Opening Plenary: Global Health Care, Washington, D.C., 1999
CENDI, *NLM: Current Activities*, Bethesda, MD, 1999
Working Group on Biomedical Computing, Advisory Committee to the Director, NIH, *NLM
    Biomedical Computing Activities*, Bethesda, MD, 1999
Massachusetts Institute of Technology, Cambridge, MA, 1998
Virtual Head and Neck Anatomy Workshop, National Institutes of Health, 1998
AAMC Information Technology Seminar, Aspen, Colorado, 1993-98Presidential Advisory
    Committee on High Performance Computing and Communications,
    Information Technology, and the Next Generation Internet, Washington, DC, 1997
Advanced Digital Libraries Conference, Library of Congress, Washington, DC, 1997
Telemedicine Panel on U.S. International Activities, U.S. Capitol, Washington, DC, 1997
6th Global Meeting of the G7 National Coordinators, Global Healthcare Applications
    Project, Bethesda, MD, 1997
American Medical Informatics Association Spring Congress, Predicting the Impact of Telemedicine
    on Informatics and Information Services, 1996
Managed Care/Telemedicine Consensus Conference, convened by the Center for Public
    Service Communications in cooperation with the Friends of the National Library of
    Medicine, Georgetown University, Washington, DC, 1996
American Educational Research Association Annual Meeting (AERA) High Performance
    Computing and Human Problem Solving, New York, New York, 1996

American Association for the Advancement of Science Annual Meeting (AMSIE 96),
    Baltimore, Maryland, 1996
19th Annual Symposium on Computer Applications in Medical Care (SCAMC),
    New Orleans, Louisiana, 1995
Association for Academic Surgery Annual Meeting, Dearborn, MI, 1995
Choices and Challenges Forum, Quality of Life in the Electronic Village, Blacksburg, VA, 1995
Federation of American Research Networks Bits and Mortar: Building the National
    Infrastructure for Health Care Workshop, Washington, DC, 1994
Healthcare Informatics Telecom Network Live Satellite Teleconference: Advanced
    Computing and Communications: Realities Beyond the Promise, Washington, DC, 1994
McGill University Faculty Colloquium, McGill University Centre for Medical
    Education, Montreal, Canada, 1994
Applied Imagery Pattern Recognition (AIPR) Workshop, Cosmos Club, Washington, DC, 1994
HPCC Symposium: Improving Health Through Advanced Computing and Communication
    Applications, Smithsonian Institute, Washington, DC, 1994
IEEE-USA Technology Policy Council 1994 Annual Symposium, Tysons Corner, VA, 1994
1st Congress on Computing in Civil Engineering, American Society of Civil Engineer's
    Technology Council on Computer Practices, Washington, DC, 1994
Joint Medical Library Association (MLA) and National Coordination Office for High
    Performance Computing and Communications (NCO-HPCC) Symposium: The Future
    of Health Information Transfer; The Promise of HPCC, San Antonio, Texas, 1994
Briefing on Telemedicine: State and Federal Policy Issues, Ad Hoc Steering Committee
    on Telemedicine, U.S. Capitol, Washington, DC, 1994
Division of Research Grants Advisory Committee, NIH, Bethesda, MD, 1994
HPCC and the Information Superhighway - Cable TV Taping – 1994
The Ewing Report – Representative Thomas W. Ewing (Ill.) Live Satellite Broadcast Health Care
    Telecommunications, Washington, DC, 1994
Joint National Aeronautics and Space Administration (NASA)/Uniformed Services
    University of the Health Sciences (USUHS) International Telemedicine Conference,
    Bethesda, MD, 1994
ComNet Conference and Exhibition, Washington Convention Center, Washington, DC, 1994
Conference on High Performance Computing and Networking, George Washington
University School of Engineering and Applied Science, Reston, Virginia, 1993
American College of Medical Informatics Annual Meeting, SCAMC, Washington, DC, 1993
5th Education Foundation of the Data Processing Management Association Conference
    on Virtual Reality, Washington, DC, 1993
Advisory Board for the British Advisory Councils, British Embassy, Washington, DC
HPCCI Impact on Scientists and Engineers Summit for Scientific Computing and
    Automation: Accessing New Resources Washington, DC
American Hospital Systems Annual Meeting, Dallas, Texas, 1993
American Medical Association Fourth National Conference on CME Proficer/Industry
    Collaboration, Washington, DC, 1993
Twentieth Annual Conference of the American Nurses Association Council on
Continuing Education and Staff Development, Washington, DC, 1993
National Aeronautics and Space Administration Foreign Acquisitions Workshop,
    Washington, DC, 1993
Conference on Improving Medical Care: The Vision of High Performance Computing
    and Information Technology, 1993
Fifth Annual Federal Information Systems Conference, Electronic Industries Association,
    Washington, DC, 1993

International Medical Informatics Association, Working Conference on the Workstations
as Enabling Technologies for Computer-Based Patient Records, Washington, DC, 1993
3Com NII Roundtable, Health Care Solutions Panel, Washington, DC, 1993
Conference on Coordinating Federal Health Care: Progress and Promise. Co-Chaired
by the Federal Health Care Study Commission: Indian Health Service; Department of
Defense; Department of Veterans Affairs, Washington, DC, 1993
International Council for Scientific and Technical Information (ICSTI) Annual Meeting, 1993
IEEE Information Exchange Conference: Telecommunications as Part of the NII, Institute of
Electrical and Electronics Engineers, Inc., Washington, DC, 1993
Eleventh International EFMI Congress, MIE 93, IMIA, Jerusalem, Israel, 1993
3Com Expanding the Global Infrastructure Conference, Washington, DC, 1993
Commerce, Energy, NASA, NLM, Defense Information (CENDI) Annual Meeting,
Washington, DC, 1993
Grand Challenge Applications and Software Technologies Workshop, Joint Agency
(NASA/NSF/DOE/NIH/EPA/DARPA/NSA/NIST/NOAA) HPCC Conference,
Pittsburgh, Pennsylvania, 1993
Federal Information Resource Management (IRM) Council, Washington, DC, 1993
Computer Health Care Conference, Georgetown University Medical School,
Washington, DC, 1992
National Aeronautics and Space Administration Advisory Council, Washington, DC 1992
Symposium on Computer Applications in Medical Care (SCAMC), 1987-1991
College of American Pathologists, Future Technologies Committee, Kansas City, Kansas, 1988
TAPPI Paper Preservation Symposium, Washington, DC, 1988
Conference on Computer Applications in Radiology, Hilton Head Island, South Carolina, 1988
55th Meeting of the Advisory Committee to the Director, National Institutes of Health,
Bethesda, Maryland, 1987
CODATA Workshop on Nucleic Acid and Protein Sequencing Data, National Bureau of
Standards, Gaithersburg, Maryland, 1987
Friends of the National Library of Medicine (FNLM) Symposium, Washington, DC 1987-1995
MEDINFO '86, Washington, DC, 1987
University of Southern California 2nd Annual Symposium, Physicians and Computers,
Los Angeles, California, 1985
IEEE Centennial Briefing for the Media, Washington, DC, 1984
American College of Physicians (ACP) Meeting, Atlanta, Georgia, 1984
IMIA Working Conference on Information Science and Medical Education, Chamonix,
France, 1983
Rutgers University, AIM Workshop, New Brunswick, New Jersey, 1975, 1978, 1983
ACME Workshop, San Francisco, California, 1983
Missouri Oncology Hematology Conference, Lake of the Ozarks, Missouri, 1982
IMIA General Assembly, Melbourne, Australia, 1982
IMIA Working Conference on International Perspectives on Medical Informatics,
Melbourne, Australia, 1982
IMIA Working Conference on Communication Networks in Health Care, Stockholm, Sweden, 1982
Society for Computer Medicine (SCM) and Society for Advanced Medical
Systems (SAMS) Meeting, Washington, DC, 1981
Conference on Medical Information Systems, Champaign, Illinois, 1980
Illinois Conference on Medical Information Systems, Champaign, Illinois, 1979
Computers in Health Care Symposium, New Johannesburg Hospital, Johannesburg,
South Africa, 1979
Conference of World Association for Medical Informatics (WAMI), Versailles, France, 1979

MEDIS '78, Osaka, Japan, 1978

Workshop on Computer-Based Information Technology and Public Policy
    National Research Council, Woods Hole, Massachusetts, 1978

Institute of Medicine, Assembly of Engineering, Washington, DC, 1978

Task Force on the NLM Extramural Research Grant Program, Bethesda, Maryland, 1977

Conference on Medical Information Systems, Chicago, Illinois, 1975-1976

Symposium on Mathematics of Large-Scale Simulation, University of Vermont
    Burlington, Vermont, 1974

Workshop on Methods of Analysis and Principles of Instrumentation in the Clinical
    Laboratory, St. Louis, Missouri, 1974

Pathology Workshop, Tantara, Missouri, 1973

AMA Advisory Committee, Detroit, Michigan, 1973

Conference on Computer Usage in Clinical Research, Bethesda, Maryland, 1971

Symposium on Computer Systems in Medicine, Las Vegas, Nevada, 1971

Conference on the Diagnostic Process, University of Michigan, Ann Arbor, Michigan, 1970

San Diego Biomedical Symposium, San Diego, California, 1970

AMA Conference in Computer Assistance in Medicine, Washington, DC, 1969

Computer Assisted Food Management Conference, University of Missouri-Columbia, 1969

Educom Symposium on the Computer Utility, Manchester, New Hampshire, 1969

Specialized Institute on Continuing Education for Medical Record Consultants and Department
    Heads, St. Louis, Missouri, 1969

American College of Cardiology Conference, Washington, DC, 1969

Annual Conference of Engineering in Medicine and Biology, Boston, 1967; Houston, Texas, 1968

Conference on the Use of Computers in Medical Education, University of Oklahoma Medical
    Center, Oklahoma City, Oklahoma, 1968

Conference on the Use of Computers in Radiology, University of Chicago, Chicago, Illinois, 1966

IBM Medical Symposium, Poughkeepsie, New York, 1965

Fifth Interscience Conf on Antimicrobial Agents & Chemotherapy, Washington, DC, 1965

Regional Meeting of Regions VI and VI, Hospital and Medical Facilities, Department of Health,
    Education and Welfare, Chicago, Illinois, 1965

Southeastern Regional College of American Pathologists and North Carolina
    Pathology Society, University of North Carolina, Chapel Hill, NC, 1965

Second Annual University of Texas Symposium on Biomathematics and Computer
    Science in the Life Sciences, Houston, Texas, 1964

Biomedical Sciences Instrumentation Symposium of the Instrument Society of America,
    Los Angeles, California, 1963

American Society for Experimental Pathology, Atlantic City, New Jersey, 1963

IV Congress International Academy of Pathology, Zurich, Switzerland, 1962