

**Milton Corn, MD**  
Narrator

**Dominique A. Tobbell, Ph.D.**  
Interviewer

**INSTITUTE FOR HEALTH INFORMATICS  
HISTORY PROJECT**

**UNIVERSITY OF MINNESOTA**

# **INSTITUTE FOR HEALTH INFORMATICS HISTORY PROJECT**

In 2015, the Institute for Health Informatics (IHI) celebrates the 50<sup>th</sup> anniversary of health informatics at the University of Minnesota. Early institutional markers serve as the formal beginnings of the emergent discipline of health informatics at the University of Minnesota, designating the University of Minnesota as one of the first academic institutions to support and subsequently anchor the development of the new discipline. In 1965, the National Institute of Health (NIH) Division of Research Resources awarded the University of Minnesota's College of Medical Sciences a grant to establish a Biomedical Data Processing Unit at the University. Two years later, the Hill Family Foundation awarded a ten-year grant to Professor Eugene Ackerman to initiate a graduate research and training program in Biomedical Computing. In 1968, the College of Medical Sciences established the Division of Health Computer Sciences, which would serve as the administrative home for the NIH research resources grant, housed within the Department of Laboratory Medicine. The Division provided interdisciplinary training to pre-doctoral and post-doctoral students applying health computer sciences technology to health services research. In 1974, the University of Minnesota was awarded the prestigious National Library of Medicine Grant for Training in Health Computer Sciences, which formally established the Graduate Program in Health Informatics at the University of Minnesota. The Division and its institutional successor, the Institute for Health Informatics (created in 2006), received continuous training grants from the National Library of Medicine until 2009. For fifty years, the University of Minnesota has been one of the preeminent health informatics institutions in the United States.

The Institute for Health Informatics History Project captures, analyzes, and records the history of health informatics at the University of Minnesota. Through oral history interviews, the Project preserves the personal stories of faculty members and National Library of Medicine administrators who were involved in the early history of the field and have keen insights into the history of health informatics at the University of Minnesota.

## **Biographical Sketch**

Milton Corn received his BS degree from Yale College and his MD degree from Yale Medical School. He completed his residency in internal medicine at Harvard University's Peter Bent Brigham Hospital, and a fellowship in hematology at Johns Hopkins University. Dr. Corn served as Professor of Medicine at Georgetown University School of Medicine, where he held a number of leadership positions, including Medical Director of Georgetown University Hospital and, during the 1980s, Dean of the School of Medicine. In 1990, Dr. Corn joined the National Library of Medicine as Director of the Extramural Programs Division. As director, Dr. Corn was responsible for all aspects of the NLM's grant programs, including the NLM Research Training Grant in Medical Informatics. In May 2009, Dr. Corn was appointed NLM Deputy Director for Research and Education. In this role, Dr. Corn serves as principal medical advisor on research and development and medical education priorities for NLM, and provides direction and advice on the full range of NLM's intramural and extramural research portfolio. [Adapted from [http://www.nlm.nih.gov/od/roster/milton\\_corn.html](http://www.nlm.nih.gov/od/roster/milton_corn.html)]

## **Interview Abstract**

Milton Corn begins the interview discussing the definition of health informatics and the early National Library of Medicine Research Training in Medical Informatics programs, including the University of Minnesota's training program. Dr. Corn describes his first introduction to medical informatics while serving as dean of Georgetown University School of Medicine and his decision to join the NLM in 1990. He describes at length the evolution of the NLM Research Training Program and the related history of the University of Minnesota's training program based on the evaluations the NLM performed of the training program every five years. He discusses the University of Minnesota and Mayo Clinic's efforts to establish a collaborative training program with Arizona State University. He also discusses the implications of Minnesota's decision not to fully pursue bioinformatics when the NLM shifted the focus of its training program in the 1990s. Dr. Corn goes on to discuss the development of the Clinical and Translational Science Awards and the influence of the awards on health informatics research.

**Interview with Doctor Milton Corn  
Deputy Director for Research and Education, National Library of Medicine**

**Interviewed by Dominique Tobbell, Oral Historian**

**Interviewed for the Academic Health Center, University of Minnesota  
Oral History Project**

**Interviewed in Doctor Corn's Office at the National Institutes of Health  
Bethesda, Maryland**

**Interviewed on September 4, 2014**

Milton Corn - MC

Dominique Tobbell - DT

MC: Did the word informatics actually have any semantic meaning for you before you went into this?

DT: Only to the extent that I was a biochemistry major at college and I'd taken bioinformatics...

MC: Oh, *bioinformatics*.

DT: ...which I know is different. [chuckles]

MC: That has a rather clear operational definition.

DT: Right. That's one of the things that I'm learning along the way. My sense of it is, it's a lot about the gathering and collection and analysis of large bodies of data and, in the case of health informatics, around health data. But it could be in many different areas of health, not just medical, but public health, epidemiological data, data around healthcare provisions, the best way to treat patients. It can take many forms. It's still something that I'm trying to get a grasp on.

MC: Well, it hasn't been clarified, which is why I ask you. You can write about it without defining it, which is what everybody does. If I understood you correctly, you thought it involved analyzing the data?

DT: But is it just collection?

MC: Or collecting the data?

DT: Yes.

MC: This has not much to do with what you're doing here. I know that in the early history of the field, and to some extent still now if you actually attend informatics meetings and listen to what they're doing, not what they say, they were toolmakers. They made software, and there was considerable, I think, disagreement about whether actually analyzing the data, in other words doing the science rather than the engineering, was still informatics.

My own view is that tool making was historically important. Informaticians still make a lot of tools, such as decision support software. But someone who actually puts decision support in place, studies it, sees if it actually helps the patient and so on, is also doing informatics.

But we don't need to settle that here. I just thought it might help you in talking to people to try to get a feel for their mental model of the field. Is it making tools for other people to use or do they actually do something with information themselves?

DT: I'm actually really glad you brought that up. That has come through in the historical documents that I've read and in the people that I've interviewed at Minnesota so far. They have certainly been involved in making some of the informatics tools.

MC: Toolmakers.

DT: Yes. It's clear from the origins of the field that it is interdisciplinary and you have a mix of health professionals, basic scientists, and engineers originally who began the field. So you have that mix of backgrounds. I'm glad that you brought it up, and I'm glad that it hasn't been resolved. So there's a reason why I haven't quite grasped what exactly it is.

[laughter]

MC: It's been very slippery and there's not a great deal of agreement about it. I'm not sure I would agree with you about engineers and computer science forming the field if you're talking about health informatics, which is what Connie [W. Delaney] is interested in.

DT: Right.

MC: Our belief was that it was formed by doctors with hobbies, M.D.s. It's no longer dominated by physicians. Before my time—if you can believe that there was such a time...

[chuckles]

MC: Taking a look at the early training programs—all of the trainees were physicians. That was true at Minnesota, as well, probably not so much now, but then. I think,

basically, they wanted to apply computers to healthcare. Their original professional organization, which actually started here in Washington [D.C.] at George Washington University, was a precursor to AMIA [American Medical Informatics Association]—SCAMSI, Society for Computer Applications in Medicine. So tool making is almost inherent in the original concept with it. I think many of the early programs did take many, not exclusively but many—this was not our requirement; this was historical evolution—physicians who were interested in transcending what they'd been taught and applying this new tool to medicine. I think it was responsible for a lot of the success of the programs at Minnesota and elsewhere and, eventually, became stultifying and a bit of a barrier.

That certainly was true at Minnesota and at many of our other programs, because the question came up which Minnesota may have settled now, but hadn't, when we were site-visiting, is a question to which there is no good answer yet: is a physician with all of this training and all the time that's been put in, who then gets enough extra university training to get a master's degree, is this person now a scientist? Clinical training—I'm a physician myself—has its own bars to surmount but they really don't involve the scientific method the same way that a Ph.D. must.

Minnesota, in its training program—I'm not talking about what it was actually doing—had variable success in wrestling with that particular problem based on what our reviewers thought and what we ourselves thought as we came every five years and took a look. I think you know enough about this to know that we're not historians of the Minnesota informatics program, because the nature of the grants is that there's a competition every five years. So while we get reports in the interim, there's really not a good look. We're not enemies of the universities. If we give them a grant to do something, we know that they're going to do it. We always had high respect for Laë Gatewood, anyhow. So it was only at the renewal time that there was a rather exhaustive look. I think the first grant was probably before my time here, I think in the early 1980s.

DT: Nineteen eighty-four.

MC: Then, there was another in 1987 and, then, in five-year intervals thereafter, until it finished. I think the last one was 2002.

DT: I thought it was 2005. Then, there was a no-cost extension in 2009. I think the 2005 was denied.

MC: Actually, it's 2007 that was denied, technically.

DT: Okay.

MC: 2005, we came by because we were making a grand tour of all our programs in the middle of the cycle. We had not done that before. It was to get a status report at other than five-year intervals. So we visited every single one of the programs, including Minnesota—my one and only trip to Minneapolis. It's a lovely city.

DT: It is.

MC: That was not in association with a competition when we came in 2005. I think Laël Gatewood was still the PI [principal investigator] then. Doctor [Donald P.] Connelly was the actual PI when the renewal application came in a year and a half later. The visit was just to get a feel for what the programs were actually doing before we wrote the requirements for the next competition.

We've always been concerned about becoming habit bound or overly conservative ourselves. We also needed to be aware of what was being taught because we've never specified a curriculum. The curriculum was always generated by each of the programs and they're different. We've kept tabs on it, and we've looked for common elements, but we never thought that it was the position of the NIH or the Federal Government to set the educational curriculum for informatics...I think we did not do so for church and state reasons, but also because the field is so fluid. It's so hard to define that it would be like prematurely setting standards. But, obviously, we needed to know what was being taught. It was amazing *to me* that there was not that much tendency to reach a common core. My prediction had been in the early 1990s that the various curricula would converge to a large extent, and they did somewhat. There were some basics that had to be taught just as I imagine your biochemistry program couldn't have been *radically* different from biochemistry programs... Where were you? In California?

DT: No, this was in England at the University of Manchester.

MC: Manchester... Well, in Manchester or California, biochemistry is biochemistry.

DT: Yes. [chuckles]

MC: You're not talking about British history versus California's. It's chemistry.

They converged to some extent. We never were entirely sure that the products of these programs would have passed, for example, a certifying exam that was national, along the lines, say, of specialists in medicine who do that. That's not necessarily bad at all. After training, people become domain experts, and if they're smart enough, initially, they become very good. Curricula comparison was an important incentive for the 2005 site visits.

However, I don't mean to just ramble on. You must have some specific questions.

DT: Oh, I do. This is informative.

I'd like to actually find out a little bit more about your background in informatics. As I understand it, you were educated at Yale Medical School.

MC: Yes.

DT: I don't know what year you were training there.

MC: It was about the time the British came and burned Washington.

[laughter]

DT: So no informatics then.

MC: There was no informatics then when I was at Yale. Then, later on, there was no informatics at Harvard when I went up to Harvard afterwards.

The only connection I had with informatics is an interesting one, but not of interest to you. One of the, by now, gurus, doyens of informatics is a man named [G.] Octo Barnett at Mass General [Massachusetts General Hospital] at Harvard. Octo and I were best friends forever at Harvard. Octo, at that time, was an honest doctor who wanted to go ahead when he finished his internal medicine training to become a cardiologist. By that time, I'd left and gone on to Hopkins [Johns Hopkins University]. But he stayed in the Harvard system. He suddenly got bitten by the computer bug, and he became a pioneer in computing. I think you could not talk to anybody in informatics, or Connie or Doctor Connelly or Laël who doesn't know Octo... It's like saying, "Do you know Bill Clinton?"

[chuckles]

MC: That was my only connection. There was no informatics.

My own interest in it came when I was the dean of the medical school at Georgetown. I had long been interested in trying to actually improve education methods. I had no feud with lectures. I know that people sneer at them now. They are pretty efficient, but with computers, we probably ought to do better. Then, if you ever saw any kids playing with a video game, you saw that it took their attention. Hours would pass as they'd spend time on them. So I thought that maybe there was some potential for a new way of transferring information to people. I worked with the person who turned me on to this, the librarian Naomi Broering at Georgetown Medical Center. She was a pioneer. She thought computers would help manage information for her. The clinicians cared for none of it then and probably not a great deal now. But it was because of that, the potential for education that I became interested, and I would say of all the things in the intervening years that computers have been able to do, education has been the least successful area. I'm not talking about distance learning stuff. I'm talking about a major breakthrough. It may still come. But today I'm sure that the students at Minneapolis, like the students at Yale or at Harvard or Stanford, they sit and someone talks to them.

[chuckles]

MC: Not so?



DT: I lecture and use Power Point and that's it.

MC: Yes, as do I.

We made some attempts to try the video game route. But, you know, there's something about do-something-quick-for-a-heart attack that is not the same as a first-person shooter where you are blowing away *Halo* villains or someone in *BioShock Infinite*. You don't have the options to put all that excitement in there in an educational program. I think the Army was successful, that Army training program. But that's a shooter. They get a whole bunch of teenagers, boys mostly, and blow away bad guys and, then, they join the Army and get blown away is what it amounts to.

Anyhow, that's my entry into informatics, and I've certainly had a lot of contact with it, but I don't believe that I would label myself an informatician. I know a good bit about it now after all these years, but I think to masquerade as someone who has actually gone through a program, written a whole bunch of software, and so on would be false.

DT: When did you leave Georgetown and move to the NLM [National Library of Medicine]?

MC: While I was doing this work, I'd had some contacts with [Donald A.B.] Don Lindberg, the director here. I actually ran across a breakthrough that knocked my socks off. He had somebody working here, William Harless, who without much support from anybody hit on an idea that I thought *really* was terrific. He would let you watch, basically, a movie or a videocast or something and at any time during this, if you didn't probe too deeply, you could talk to the people that were acting, and they would turn and talk to you and answer your questions.

DT: Hmmm.

MC: I thought not only was this a very interesting way to learn, to ask the patient or ask the nurse, but I thought it was an interesting way to examine what students knew. You probably could get different information than from a multiple-choice test. What happened to this earth shaking thing? It was technically too difficult to scale up. If you restricted your questions to just the things that the program had been prepped for and, then, trained your voice, you could make a go of it. Bill Harless just recently died. He spent many, many years trying to make it fulfill the promise that I describe to you. But I think it's beyond computers at the present time, because computers don't recognize speech well. He used it for other things. The CIA [Central Intelligence Agency], for example, found that it was a very good way to teach a language. He showed me some of those. If you walk into a Spanish restaurant and you're learning Spanish, if you didn't have a reasonable degree of precision in your pronunciation, the waiter would say, "*No comprendo*," and you didn't get to eat anything.

[laughter]

MC: If your pronunciation got close enough, you got your empanada, your taco, or whatever you wanted. So for that, it was good. But for use at a higher level of abstraction, he never could make a go of it without using added text choices.

Because of that, I became familiar with Lindberg, and he knew I was genuinely interested in trying to apply it to new realms and so on.

When I left the dean's office... Ex-deans are treated with sort of a great respect like somebody's great grandfather.

DT: [chuckles]

MC: So you can do whatever you want. Everyone was very nice. But I'd done all those things, direct a training program and so on... So Don called and said, "Why don't you come here and run the grant program and see if you can jazz that up a little bit? All we're doing now is we're building electronic record tools," which was true. I thought, well, why not a change in career. That's more than you wanted to know, but that was the story on that.

DT: That's great. On the website, it said that you moved here in 1990. Is that about right?

MC: That's right.

DT: You weren't just focusing on informatics then. That was all the training programs?

MC: Everything. My actual administrative job was the grant program. The grant program here has a number of items in its portfolio. The single biggest item is the training grants. They're expensive. I think to this day, from 1990 to now 2014—that's a long time—Don and I both believed that that's our single most important grant expenditure, not the research. The research is very important as well, but we think the training of people to *do* the research is the key thing. We've persisted in that despite the evolution on the NIH campus of some support for other programs that do do some computational training.

However, in terms of understanding Minnesota, I will say that we evolved our training programs a great deal as we saw informatics evolve. You understand this is through the lens of the every five-year review.

DT: Yes.

MC: I'm not a judge of the Minnesota program.

DT: Sure.

MC: My impressions, through the haze of memory, of the Minnesota program were that they were *spot on* when they started with the zeitgeist, which was clinical information. They had something that they never lost which is really top people. Minnesota has never failed to have *very, very* good informaticians. I associate the program with Laël Gatewood from the beginning. But Stuart [M.] Speedie and Connelly, a number of other people, and I think the librarian were very good. Ellen Nagel was her name. Then, of course, getting Connie Delaney was a huge find. I think she's the first nurse to run this type of program. She's very well trained. She has a doctoral degree, I believe [Ph.D. Education Administration/Computer Applications]. Directors have always been more or less physicians with training or, sometimes, Ph.D.s in most of the programs, especially the bioinformatics programs. I think that no matter how we felt about the actual training program as it was described to us, we never flagged at admiring the quality of the people at the University of Minnesota. I'm not just saying that for the oral history. These were good people, and I think still are. They're very strong people, and they're respected in the informatics community, as well.

But, then, we evolved, and I think from our point of view, the Minnesota conception of the training program didn't evolve, perhaps, in quite the direction that we were looking for. To a large extent, I was present during much of this. The early informatics was clinical informatics and applied computers to clinical care broadly defined, records management, and so on. The early Minnesota programs were really superbly well adapted to that and in many ways richer than many of the others for several reasons. Perhaps, I'm wrong, but I associate an interest in public health more with Minnesota than with any other of our training programs. I think there was something called Community Health at one point that they did. That was breaking out from the bedside. There's much more to health than the doctor/patient/nurse relationship in an acute care hospital. I don't minimize that. Clearly, if you step outside as a citizen, you can see that. Minnesota was groundbreaking in that. I also thought that they took more seriously than any other program I can think of some interest in nursing informatics rather than the physician centric point of view that predominated. It was still physician centric at Minnesota, too, but the program was broader, I thought. So all those things were admirable about it.

I think a big change, at least from my point of view, occurred in the late 1980s when the genome project got started here and bioinformatics suddenly emerged. The management of that type of information loomed as a very large problem. I was impressed, as the director of the grant program, by something that I thought was a first, which was the importance of the computer for the genome project; it was not just a helpful assistant. The project couldn't have been done without the computer. I don't mean that the computer was that brilliant, but the sheer thousands of man-hours to do a sequence was not going to happen. So there was no question that here we had a major scientific achievement that required a computer partnership. It not only required it to be done but exploiting it without computers was not possible either. That was clear from the beginning when [David J.] Dave Lipman started with the NCBI [National Center for Biotechnology Information]. We began to wonder who was going to do this kind of computational research. The people trained to do the biochemistry and the biology had

not been trained to deal with vast amounts of information, especially of this sort. We thought that there would have to be bioinformaticians.

So, in the 1990s, we decided to broaden the training programs. We wanted to retain clinical informatics but to allow in bioinformatics as a partner. Now whether it was an equal partner or not, we would let history decide. We put a great deal of emphasis in the competitions beginning in the 1990s on implying that you'll get a lot more points during the review of your application if you're paying attention to the fact that information management for science is just as important as information management for clinical care. Some of the programs reacted very cleverly to that and others more clumsily. You know, if you're a French chef, you're not going to suddenly do wok cooking very well or vice versa, I guess.

We also put in a few other things we thought had been neglected, such as public health. We didn't give it the same emphasis that we had to the bioinformatics, but we included that, as well. We did try two other things. We encouraged the programs to see if they could get nurses and librarians to take some of this training, because those fields needed it, with not much success. We also encouraged a track in the training of what now would be called chief information officers. Not all of these things worked. In fact, none of the last three worked.

The thinking behind promoting training of information officers was that as the computers got more important in healthcare, say in hospital systems, they were actually being purchased, organized, and given their marching orders by the business people in the hospital and the administrators. Nothing wrong with that, of course, but obviously, the clinical people wanted some attention paid to what computer systems can do for patient care and so on. We thought it might be useful if some of the people who knew about the administration of systems would have a health informatics background. Most of the people actually doing that were people with MBAs from business schools who did OJT [on-the-job training]. Someone would say, "Get us a system," and they would do that. Our information officer training attempt was not a successful program nationally, but Minnesota tried with a track for administrators. It tried to do more for nursing informatics, as well. Is that true?

DT: It is true. They trained I think it was the first nurse informatician, Judith Graves. I think she trained Connie Delaney.

MC: She trained Connie?

DT: Yes. She was at the University of Utah and ran the Nursing Informatics Center.

MC: Okay.

DT: They have, and they've consistently had nurses in their training program.

MC: I think that's wonderful. If you think about the whole point of this, which is to make sure that computer science is doing its share for healthcare, to say that it's restricted to physicians is absurd. You can't do clinical healthcare without the nurses. Hello!

[laughter]

MC: The information management people, the librarians...it's a whole bunch of people.

I don't know how much you're doing in public health now. It seemed to me there was Luddism on the part of public health schools. They thought they could publish indefinitely by working with Social Security tapes. I remember I was invited to speak at Hopkins [Johns Hopkins University] about informatics at the public health school. The dean was sophisticated about informatics as a concept. But as far as the rest of the faculty was concerned, when I was painting *Camelot* for them about what informatics could do, I felt as if I were IV Ambien. They had their tapes and that was good enough. Or so it seemed to me at the time.

DT: [chuckles]

MC: I think it's better now in public health. They've become more interested in data and big data management. I'm a bit surprised, considering the importance of data in public health, that the value of the machines wasn't self-evident...and all those stores of information!

DT: I think they were at Minnesota, again—you've already alluded to this—very strong in public health informatics, partly because the informatics originally began out of the School of Public Health. They were doing a lot of public health informatics. Informatics was being used in public health research projects from the beginning. Like Laël was involved in some of the epidemiological studies in the 1970s.

MC: Always, always, always.

DT: So I think that helps.

MC: She did some of that with European partnerships, too.

DT: Yes.

MC: She was a pioneer in that, too. She did a lot of things.

Then, perhaps, more pervasively or, perhaps, more perniciously, we started to sharpen up the point of the training. We became stricter about wanting to see research coming out of this program. So that simply giving a master's degree to a doctor of medicine became progressively less satisfying to us during the 1990s. I'm partially responsible for this. We became more concerned that there had to be people doing the investigation and that it was not the job of the National Institutes of Health to be training experts who could go in

an office and show people how to use computers. The country needed such people, but this training was the job of others, perhaps community colleges or whatever.

Something that has nothing to do with Minnesota, but we recently were involved in a possible formation of a training program with the military medical school, that in essence was a return to the old days. There is no question the military needs people who can get out there and show people how to use information systems. We agreed to cooperate with that program, although it was scrapped eventually because of military budget reasons. But the majority of the output would have been the old-fashioned informatician, a physician or nurse with a master's degree. The Army, Marines, and the [Navy] Seals don't need tens of thousands researchers. The universities can do that.

We did start to make a distinction and not all of our programs were able to adjust to our having moved the cheese.

If you do get a chance, talk to [Roger W.] Dahlen, our training program administrator for many years, crosscheck what I think with him. He knew all the programs. He must have been present at most of the reviews in the 1980s and the early 1990s and so on. My impression was that the people at Minnesota are intelligent and could read our application information well, but didn't know quite how they were going to do bioinformatics. They had this clinical stuff, better than most people, really. But bioinformatics? Also, and I mean *no* offense to Speedie or Connelly or Gatewood, but the research their trainees were doing was not of the same level that we were getting at some of our other schools. They did research, they had papers but.... Something that I personally did at each competition is look at the titles of all the trainee projects and compare them from school to school. Minnesota was not awful, but it just was not the same as what they were asking students at Stanford [University] or Yale to do. We had the impression that despite what they were saying on paper, that putting out very well-trained people who were excellent at service was still, perhaps, more the predominant focus than putting out informatics researchers. That's the way I remember it. You're free to disagree. Very likely, Laël would disagree with that or Doctor Connelly or some of the others.

While there was never a diminution in the quality of the faculty involved, we never did understand the combination with Arizona [State University, ASU]. It's possible that that might have worked, but our reviewers never did like that. I think that started in 2007.

DT: Something like that, yes.

MC: That was when Connelly was the PI.

DT: I thought it was Christopher [G.] Chute, that it was the Mayo...

MC: But Connelly did have ASU in there.

The marriage with Chute was good. He's well respected, and Mayo is respected, but we didn't think that there ever was much in the way of interchange between the two

programs. The students never moved much from one to the other. Perhaps, even more importantly, we did not think that either Minnesota or Mayo was actually going deeply into clinical data. We wondered if Chris Chute was being given any access to that Mayo record system as beautiful as it is. He got small samples to do his experiments on. It doesn't mean that students couldn't have been trained very well, but we didn't think they were going to have experience with large datasets... Informaticians were starting to work with larger amounts of data. Once you have a genome, you become interested in the phenome. In 2002, there was starting to be some questions about whether enough adaptation had been made by a previously solid program such as Minnesota's or whether it was just the same old stuff.

I think when the next competition came and Doctor Gatewood dropped out and Doctor Connelly's came,... (There is no lack of huge respect for Doctor Connelly. He has an interesting background. He's seen the world. He's also respected inside the American College of Medical Informatics and so on.) No one could figure out how that was going to work with Arizona. It sounded vaguely like there'd be distance learning and some use of telecommunications, but it really didn't look like integrated programs, that the students were meeting each other or would be having mentors from the other places. Our feeling at that time was that it wasn't that Minnesota as a medical center had lost its way, but that the program that was being offered to us for funding had lost its way. I remember thinking, and so did some of the other reviewers, that it had, perhaps, been presented prematurely. [chuckles]

Perhaps some of the Minnesota students did travel to Rochester. What is that, two hours, three hours?

DT: An hour and a half.

MC: Well, it's not that bad, but as far as we could tell, nobody had done it, not a single person. Arizona was known in the field to be an interesting but shaky work in progress. I think [Robert A.] Bob Greenes is still there. The problem was not weakness in Minnesota informatics necessarily, but weakness in the training program as it was being organized.

Then, when it came to Chris Chute that must have been around 2011. Is that it? It's only three years ago?

DT: It's recent, yes.

MC: Again, Chris is one of the most respected people in the field. That program was supposed to be Chris Chute, Arizona, also Mayo in Arizona, and Minnesota. We couldn't find any significant Minnesota participation. [chuckles]

MC: It looked like for Auld Lang Syne we'll stick old Minnesota in there. OK with us if they wanted to do it that way, but it just seemed so odd, because we had started with Minnesota. It had done all that wonderful stuff all those years and, now, was sort of an afterthought.

I think that Connie Delaney came in in the middle of 2005.

DT: Yes, 2005.

MC: She is so strong. And not only that, the most impressive part of that application—I'm saying out of memory now—was the nursing part. Connie, I think, had gotten a Mayo Clinic nurse to work with her and had, also a nurse I didn't know from Arizona, so it looked like the *nurses* really had something going. However, we couldn't fund a training program just on the nursing component. Obviously, something had happened internally at Minnesota in that Don Connelly replaced Laël. Someone had told me Laël was not well. In terms of the internal dynamics at the University, we knew nothing about it, and it played no part in our decisions. As much as we like Laël, Minnesota lost nothing by putting Don Connelly in there. He carried weight. But we just couldn't fund that application. If I remember, we had changed things at NIH [National Institutes of Health] at that time, and the application was not even scored. In other words, we made a preliminary assessment and those that we thought were in the bottom half were not even given a merit score. I think it was because of the apparent total separation of the three units and the inability of the program to describe how these barriers would be overcome. It's not enough to say, "We'll use the Internet." So as seen through these five-year openings of the door, you have my impressions about the Minnesota evolution. Since I'm operating mostly out of memory, it's possible that I've changed, altered, or perverted some of the things that actually did happen.

What was your own impression? You must have tried to find out what happened.

DT: One of the main reasons that Connie wanted me to interview you is to get some perspective on what happened, and what had changed, and why there had been this decline in, perhaps, what the University was achieving in health informatics for that period, and why they hadn't been successful in that final grant application, wanting to get your perspective on that because you had been on that 2005 site review and been seeing the applications.

MC: I've been on every one of the reviews.

DT: Seeing the internal documents and interviewing people who had been there and been there for so long, I think it's hard when you're in the middle of it to actually step out of it and see what explains this.

MC: It is hard.

DT: I think having your perspective is what's going to be so valuable and informative. It's certainly informative for me because I hadn't been able to get a sense of things based on just what I'd seen in the documents. I read all the grant applications and renewals.

MC: I'll bet you didn't read the request for applications. They'll burn your brain out.



DT: [laughter]

MC: Where we're at fault is our prose, which is constrained by NIH conventions. I think an important part of why Minnesota became increasingly less successful—even 1997 was not as successful as 1992 had been—was not necessarily that they were changing but that we were changing. We were trying to actually adapt to what was happening in the world as we saw it, that informatics was expanding to include bench science, public health, all these other things. From our point of view, Minnesota was less successful than some of the others in making these changes. Having said that, it may be that we were too obscure in describing how we were changing. Some read our descriptions and got it, because, obviously, we had some wonderful applications, and we did fund them, and there were many new programs. And, too, perhaps, Minnesota was a bit obtuse in not recognizing that we meant it when we said the world was changing. When we encourage you to do bioinformatics, we're not saying, "Just in case you feel like it."

DT: [chuckles] We mean it! Please do it!

MC: The formal request for applications is, in fact somewhat difficult to read. Having spent most of my life in universities, I know that what some PIs are really hoping for is somebody in the group will have read it and will tell you what it really means. Others parse every sentence, and these PIs are likely to be *extremely* responsive. We did end up with some programs that were *pure* bioinformatics. A fine application in the University of California system did nothing but that.

Now, if you like ironies, some of the Minnesota problems occurred during the doubling of the budget at NIH, so our failure to fund was not because of budget pressures. That doubling was in about 1997 to 2002 and energized us into being more aggressive about changing things, because we could expand.

As the first decade of this century came on, I changed my mind again about what the training ought to emphasize, not that I think any less of bioinformatics but for other reasons. The birth of general interest in computation at the National Institutes of Health can be dated to about 1999. It has taken root in varying degrees of strength at the Institutes but almost entirely on the bioinformatics or computational biology modeling side, systems biology, and so on. As we got into that decade, I became concerned that *no* one except NLM was now focusing on clinical side of healthcare, because *nobody* here on the campus cared much about healthcare delivery informatics, other than as a source of data for research. I mean, they do as citizens or as people who have mothers, but not in terms of where they put their funds. So to some extent, we offloaded some bioinformatics since others were now doing it, and we started to put more money back into clinical informatics, but not the same old convention, not more tools. We put it more into translational research, bench to the bedside, research informatics, large volume stuff, big data. We may be wrong in some of our judgments on what has become important, but I think it's better to shift as you see the country's needs than it is to just sit there inertly.

DT: [chuckles]

MC: Anyhow, that's about it, Dominique, on Minnesota. Actually, something that you can do as an historian is contrast what I said with the perception of others.

How long has Stuart [Speedie] been there now?

DT: I'm interviewing him next week, actually. I think he arrived in the mid 1990s [correctly, 1996].

MC: So he's been there a long time.

DT: Yes, he's been there a good while.

MC: I think that would be lovely to get his perception.

DT: Yes.

MC: Or Laël's.

DT: I've interviewed her.

MC: You've already interviewed Laël?

DT: Yes. She had so many insights. I'll be interviewing Chris Chute in a couple weeks time. I've interviewed Don Connelly.

MC: I'll read your paper when it comes out. They might say, "We couldn't tell what NLM was trying to do," or "It was impossible..." or "It was arbitrary," or "The reviewers were unsympathetic."

DT: One point that I should add is that what they confronted were a lot of institutional obstacles. This impacted their ability to adapt to the goals, the changes, the evolution of the training grant, to some extent. This is a question that I'll have to go back and ask regarding bioinformatics. They could not get any institutional funding to get new tenure lines. They could not hire any new faculty. That's changed in the last ten years, but, certainly, through the 1980s and early 1990s...

MC: They couldn't get it.

DT: ...they couldn't get it.

MC: We noticed that, too, as a matter of fact. Both in 1997 and a little bit in the Chute one, the number of Minnesota faculty actually involved in this was dwindling. Even many of the courses weren't courses run by informatics people. They were latching onto

other's courses, the engineering, computer science courses, and so on. But that wasn't unique to Minnesota. We noticed it in other sites, as well.

As bioinformatics got started, in some places, it fused with the clinical informatics. But in many places, perhaps the majority, it split into a different academic unit. The bench researchers at the place didn't care much for the clinical informatics part. They didn't hate it, but it just seemed a little hobby that some people were doing. The bioinformatics, that was science. That was real healthcare computing. So they split it off. In some of our sites the split did not hurt clinical informatics at all, at others, clinical informatics, standing alone, grew weaker. We stopped funding the California pure bioinformatics program because we thought we were taking slots away from the other places, training nothing but bioinformaticians. There's no question, though, that the schools in which computational bioinformatics split off had more trouble coming up with a clinical informatics only application that was satisfying, but a few did it very well. It may have been harder for Minnesota. Certainly, some of the new programs we took on have been very successful. It's probably easier for them, because they didn't have any barnacles, and they didn't have any people who said, "Well, we've always done it this way."

DT: Yes.

MC: Are you full-time faculty?

DT: Yes, I am.

MC: Is that in history?

DT: Yes, in the Program in the History of Medicine, which is actually in the Surgery Department.

MC: Well, I'm happy to see that, as well. Most places don't even have one now.

DT: Right. Some people have appointments in the History Department. There are a few History of Medicine or History of Science and Medicine programs. It depends on the institution. More of the private universities do have them.

MC: They do. I got interested in them when I was at Yale because of the *Journal of History of Medicine and Allied Sciences*, in which you've published.

DT: Yes.

MC: It was edited there and they had a very nice program. The school was so tiny, that medical school. We had seventy in the class. Almost all were male, in those days. If you wanted to, you could become a student editor. The history manuscript came to you first, and you had to write a critique. None of us were qualified to review, of course.

DT: [chuckles]

MC: But it was a good exercise. Then, of course, the person who really was going to do it would sit down with you. It was a wonderful experience.

As you know, we put money into the history grant program every year, and someone always says, “Why don’t you close that program?” However, Don and I know that no one else will support history scholarship. So even though our program is small—this is a huge field—eight grants, ten grants, it’s something.

DT: Which we appreciate. [chuckles]

MC: We wish it were more, because I like the program. I go to the review group meetings. They’re interesting.

DT: We really do appreciate it. We know the competition gets tougher every year, but it means a lot to the field, for sure.

MC: Do you think so?

DT: Oh, absolutely. Undoubtedly. There is so little funding available for historians of medicine that the NLM grants are crucial.

MC: We keep them because we believe that. You guys are even not that expensive

[laughter]

DT: Believe me, I speak for the profession. We are extremely grateful. So thank you.

MC: It’s in no danger. Don Lindberg, myself, Valerie Florance, who now is running the program, all like the program. If we could put more money into it, we could easily spend three or four times as much.

DT: We’d like that, too. [laughter]

MC: Well, the merit scores tend to be very good. Don asked me one time, “Does that review group just love everything? I said, “Not at all. I go to those meetings. They can give somebody a very hard time there,” especially if it’s a non-professional historian, the old school people, a doctor with a hobby.

DT: Right.

I have just one more question.

MC: Sure.

DT: You brought up translational research. I wonder do you have any role in the clinical and translational research awards [Clinical and Translational Science Awards, CTSA]?

MC: Not now. When it first started, they had an informatics committee, and I was co-chair with the woman who is running it now, Elaine Collier. I dropped out for many reasons. And we don't have anything to do with them now. One of the big things they were supposed to be doing when they started was informatics training but that really hasn't worked out well. While the various programs differ, the PIs vary in how much interest they have in the informatics part of it.

Do you have one at Minnesota?

DT: Yes. Minnesota got one in 2010 and the Institute for Health Informatics is part of it, and Connie is part of the leadership of the Clinical Translational Science Institute.

MC: That's very good.

Connie probably has to wrestle with her budgets now, which are probably shrinking, but there are some internal reasons for that, in addition to the Congress and the President [Barrack Obama], the Institute that set them up in the first place was abolished. Are you familiar with this?

DT: No, not entirely. No.

MC: NIH can't add any new institutes. A number of interest groups over the years were able to persuade Congress to fund yet another focused Institute. And the number kept climbing with what some thought was a dilution of resources. We're up to twenty-seven now. I think a few years ago, Congress said, "That's it. If you want to form a new institute, destroy an old one." So when the current director came in, Francis [S.] Collins, wanted a new Institute for some projects he had in mind. He chose to close the Institute that ran the CTSA's, and they were transferred to the new Institute. He may wish to use some of the funds for other important projects. I think the CTSA's will continue to be funded, but I don't think that those budgets will be expanding.

Do you have a particular interest in that or just because it's informatics?

DT: Just because it was informatics. I was just curious whether there was any involvement, because informatics was a part of it.

MC: I'll be glad to send you Elaine's Collier's email address. You might ask her what she sees about informatics training in the CTSA's in the years to come.

DT: Yes, that would great. That email or phone would be great for that.

MC: I'll be happy to do that.

DT: Thank you.

Do you have anything else that you would like to say about the field of health informatics, how it's changed over your career, as you see it?

MC: Well, I think it's changed a good bit. It has evolved from focus on toolmakers into being more accepting of informaticians as scientists. I think the future of the field is in the people who are going to be information scientists, discoverers of something. It's not that the tools aren't important, but I think the people who just make tools, rightly or wrongly, are never going to have the same respect at a school of medicine or an academic health center as someone who either takes care of patients or is discovering something about health and disease. We have great interest here at NLM in seeing what happens to the people who, in fact, do some discovery.

I'll give you an example of that. Does the name David Bates mean anything to you? It probably wouldn't.

DT: No.

MC: Decision support stuff is software you stick on a medical record system and, at its simplest, it points out an error or says, "Did you know the patient is already taking miraculamycin? You can't now give him this. It will kill him." David actually studied what *happened* when you use such tools. He found out some common sense stuff. If you interrupt a doctor too many times with a little note saying, "Did you know this or that?" the off switch goes on. He doesn't want to listen to you. You wouldn't accept an overload of interruptions either. So David captured the reality of human beings interacting with an extremely complicated decision making process under uncertainty

A good friend, one of the most senior people in informatics, and I were chatting once and he said, "Yes, Bates has published important information, but he's not an informatician because he didn't write any of those programs." My friend is not necessarily wrong-Bates didn't create the tool. But I think the future of informatics is in the David Bates-type people. We're starting to go in that direction. Someone like Connie is probably interested in the big data initiative. We are getting all this information out of the electronic medical record and now we need to be doing something with it. I think it's the people who analyze big data who are the informaticians of the future.

I'll give you an example of somebody who is doing just this in the translational field, Atul [J.] Butte.

Butte is a graduate of our training program at Harvard. He's now at Stanford. Basically, what he does is he collects everybody else's thrown-away sequencing data, and he analyzes it productively. He doesn't do many bench experiments.

[chuckles]

MC: Anyhow, that's an example of informatics as science. I also suspect that there's a lot of stuff waiting around to be discovered, perhaps cures, except that the information is buried in the literature, and no one's been able to make the connection because no one has read all of it. But doing discovery science on what's already been published is very difficult artificial intelligence. The head of our program in Colorado, [Lawrence] Hunter, does some work in this domain.

DT: That's really interesting. I wrote it down, "From toolmakers to scientists" as a potential article title.

[laughter]

DT: I like that. I'll credit you. Don't worry.

MC: Yes, that means I'll be egged at the next meeting of course.

[laughter]

DT: Maybe I won't give you credit. Whatever you prefer.

MC: That's all right. I said it. I believe it.

DT: This has been wonderful, very informative. Thank you.

MC: Well, I hope so.

They have a day-to-day history that I think the people there can give you...

Are these my copies? [Dr. Corn refers to informed consent and donor agreement forms.]

DT: Yes, those are your copies.

MC: ...that is some ways richer and more informative. It's like having, say, the church records in England.

Are you going to put it on the website?

DT: As I said earlier, having this outside but informed perspective is going to be really valuable. So what will happen is my transcriber will transcribe it. I'll send you a copy for you to review and make any necessary edits.

MC: Okay.

DT: Then, I'll send you a copy for your records. We'll deposit it in the Archives. Then, we'll put it on the history website that we'll develop to celebrate the anniversary.

MC: I think that's fine. In the meantime, I owe you at least the emails for Roger Dahlen, because he's a check on what I say. It's a different witness.

DT: [chuckles]

MC: And Elaine, who will know about the CTSA's. I'll send you her email.

DT: That's great. Thank you.

[End of the Interview]

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