

**Interviews of the Margaret MacVicar Memorial AMITA Oral History Project, MC 356**

Massachusetts Institute of Technology, Institute Archives and Special Collections

**Dinah Singer** – class of 1969

Interviewed by Jacqueline Shen, class of 2018

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## Margaret MacVicar Memorial AMITA Oral History Project

Dinah Singer (SB Biology/Life Science '69) was interviewed on June 30, 2017 by Jacqueline Shen (Biology '18) at Singer's office at the National Institutes of Health in Bethesda, Maryland. At the time of the interview, Dr. Singer was Acting Deputy Director of the National Cancer Institute, Director of the NCI's Division of Cancer Biology and Senior Investigator in the Experimental Immunology Branch of the NCI's Center for Cancer Research.

In April 2016, President Barack Obama and Vice President Joe Biden named Dr. Singer one of three co-chairs of the Cancer Moonshot Blue Ribbon Panel, which established the research agenda for the Cancer Moonshot and prioritized key areas of cancer research. Dr. Singer's own research involves the regulation of transcription, gene expression and molecular immunology.

SHEN: Thank you so much for taking the time to talk with me today. I want to start by asking you a little bit about your childhood. Where did you grow up? And is there anything about your family history that you feel is important to your own trajectory?

SINGER: I grew up in Palo Alto, California. My father was [a professor of mathematics] at Stanford University. Both of my parents were immigrants: they fled Nazi Europe, my father from Germany and my mother from Latvia. My mother was a chemical engineer who never worked after they immigrated to the U.S. She brought me up to have a career and to be a productive part of society.

SHEN: Are there any specific circumstances that influenced your attitude toward education? What made you want to go to college?

SINGER: Well, I grew up in a household where learning and education were valued. There was never a question about whether I would go to college. The question always was, what would I study and what should I even do? I spent a lot of time thinking about which trajectory to take, whether science or humanities. I ended up deciding, obviously, to take the scientific route.

SHEN: When did you realize that you wanted to go to MIT? Who suggested it?

SINGER: I don't know that anyone suggested it. I looked at a variety of different schools, and MIT really appealed to me in terms of its philosophy, character and focus on rigorous scientific education.

SHEN: Where did you live on campus?

SINGER: McCormick Hall.

SHEN: I lived there my freshman year.

SINGER: Yes. So when I got there, there was only one tower built. All co-eds were required to live there, so there wasn't a choice. There was no co-ed housing. In fact, men were not allowed up above the first floor. This was a pretty conservative time.

SHEN: How many women would you say were in your class?

SINGER: We had 29.

SHEN: Oh, wow. Do you remember approximately what percentage that was?

SINGER: Well, it was out of almost a thousand. We could figure it out! [LAUGHS]

SHEN: Did you feel like your high school education prepared you well for MIT?

SINGER: As well as anyone can be prepared for their first year at MIT. I don't know what the requirements are now, but they were pretty rigorous back then, and so I don't think any of us was really, truly prepared for the amount of work and the level of work. I don't know if you still have the quizzes every Friday in every course.

SHEN: Maybe not that structured. I think it varies now from course to course. But I can totally relate. [LAUGHS] What was Course 7 [Biology] like? Were the faculty welcoming?

SINGER: Course 7 was very different then than it is now. Biology really wasn't a major department at the time; they were just starting to build it. And so, yes, it was very welcoming. I had a really good experience there. I did undergraduate research there.

But what was fun was that it was small enough that you really got to know the faculty, got to know the post-docs. And a lot of the people who either arrived as assistants or the TAs at the time are now household names in biology. David Baltimore [1975 Nobel laureate in Physiology or Medicine; former president of Caltech; 1999 recipient of the National Medal of Science; did graduate work in biology at MIT in 1960-1961; after returning as an Associate Professor of Microbiology in 1968, discovered reverse transcriptase; among the early faculty members in the MIT Center for Cancer Research; helped to organize the Whitehead Institute] had just arrived as an assistant professor, and he used to teach 7.02. We didn't know then that he would be 'David Baltimore.'

It was clearly a department that was growing, in an area where the new opportunities, as a result of molecular biology and the meaning of understanding molecular and cellular biology. It was clear this was going to be a good area.

SHEN: What was your social life like?

SINGER: We had a lot of fun, within the dorm. Because the number of women students was small, it really was like a sorority. We were all very close, and I maintained relationships with a lot of the women I went to school with.

SHEN: That's great.

SINGER: There was a very dynamic social life outside of that, through activities, through dating, going to parties, you know? It was fun. We had a good time.

SHEN: Were there are any activities that you were particularly involved in?

SINGER: I was in the McCormick Hall student government. And I was on Technique, on the editorial board there.

SHEN: Cool. What would you say was the biggest challenge you faced while at MIT, if any?

SINGER: Everybody has challenges. I think the biggest challenge really is trying to figure out what your life trajectory is going to be. What are your priorities? What is it you really want to do? I think that's the challenge for everybody. At MIT, because the experience is so intense, I think it's a greater challenge.

SHEN: What do you think are some of the most useful skills you acquired through MIT, be they social, academic, political?

SINGER: It's a good question. It's one I haven't been asked before, so I have to think about this. I think, certainly, the academic skills: How you take on learning a new area? But also, the ability to thrive in a different culture than you're used to, in a setting where there really were – where we were hugely outnumbered by men. But learning how you manage and negotiate in that kind of setting, I think, is an important skill. As for the social skills, I think relating to groups within the dormitory, that dorm living, was important for me, personally. MIT was very apolitical at the time.

My senior year, I guess, we were very proud, because we had our very own Vietnam protest day being the students, and that tells you how long ago that was. But fundamentally, MIT was very apolitical and actually somewhat sheltered. We were a very closed society within MIT.

SHEN: Yeah. There is definitely still a campus bubble.

Would you have done anything differently?

SINGER: No. I really enjoyed MIT. It was an amazing experience academically, intellectually and socially. I found MIT to be very supportive. Not that there was a lot of hand-holding. There was a dean of women students, but she wasn't the major focus for any of us, I don't think; some of us more than others. It was a

very supportive academic environment and social environment, so I really loved it. I loved the approach to teaching, what we were learning, the openness to doing research.

SHEN: Glad to hear. I love that about it, too. So what did you do after college? Can you give a condensed timeline?

SINGER: Sure, very easy: I went to graduate school, I did a post-doc and I started my own lab. [LAUGHS]

SHEN: Well, there you go!

SINGER: You wanted condensed, you got condensed!

SHEN: Well, maybe expanding that a little bit. I know you were at one point a Senior Scientific Officer at the Howard Hughes Medical Institute.

SINGER: Right.

SHEN: What did that entail?

SINGER: Let's back up a little bit. I came here to NIH, after I finished my Ph.D., to do a post-doctoral fellowship. And I actually fell in love with it, because NIH is more like MIT than any other place I know. (Our buildings are numbered.)

It is an intense academic experience, an intense intellectual experience, so it really fit me. After three years of post-doc, I was offered the opportunity to set up my own lab in a new research area, which I've had ever since. But after about 10 years, I really felt I wanted to give back to the NIH community, so I became more involved in administrative scientific leadership.

I'd maintained my lab throughout that period, but my first foray was in the Office of Intramural Research here at NIH. From there, I was recruited over to the Howard Hughes [Medical] Institute, where I spent two years as a Senior Science Officer. The responsibility there was really to administer the spectrum of research portfolios within HHMI, and I loved it. It was fun and I enjoyed it, in part because HHMI was really patterned on the NIH Intramural program. So it was very familiar.

After two years there, I was recruited back to be director of an extramural program here at NCI. All of the NIH institutes, with one exception, have two components. At NCI, National Cancer Institute, about 88% of the budget and the effort is in funding research throughout the country. The remaining 12% of the budget supports intramural research here on campus.

My lab is in the intramural program, but I direct the extramural Division of Cancer Biology, which manages the grant portfolio in that broad spectrum of

portfolios. MIT has a large grant portfolio funded by NCI. So, for instance, many of our grantees are in the biology department at MIT. People who you probably know are Bob Weinberg [SB Biology/Life Science '64 and Ph.D. Biology/Life Science '69; Daniel K. Ludwig Professor for Cancer Research at MIT and a founding member of the Whitehead Institute], and Richard Hynes [Ph.D. Biology/Life Science '71 and Daniel K. Ludwig Professor for Cancer Research at the Koch Institute for Integrative Cancer Research], and Tyler Jacks [MIT Professor of Biology, an HHMI investigator, and director of the David H. Koch Institute for Integrative Cancer Research at MIT] Doug Lauffenburger [Ford Professor of Biological Engineering, Chemical Engineering and Biology Head, Department of Biological Engineering at MIT], and on and on. They have grants managed by the Division of Cancer Biology.

And then a year ago, I was appointed as a deputy director for NCI to oversee the cancer moonshot program.

SHEN: So just to back up a little bit, what is the difference between intramural and extramural programs?

SINGER: The fundamental difference is that in the extramural program, the research grants are funded prospectively. Someone submits a research proposal for what they plan to do. At the end of the five-year grant, the extramural investigator has to submit another proposal for future work. In the intramural program, we are reviewed retrospectively. We are reviewed at the end of a four-year period for what we've accomplished, and that determines how much more we can do. So it's prospective versus retrospective.

SHEN: I see.

SINGER: The main notion is that the retrospective review allows people to take larger risks than they otherwise would be able to in a prospective review. To some extent that's true, but it also allows people who have different approaches to science to function differently. Not everybody is a good grant writer.

SHEN: Right.

SINGER: And you don't have to be a good grant writer to do good science – so there is a place for those people.

SHEN: And managing a research portfolio or managing grants, what factors go into the decisions you make?

SINGER: There are really two aspects to managing a portfolio. One is the more straightforward one, which is that we don't actually review and decide on the funding of most of the grants. Grant applications are peer reviewed by study panels of scientists who review the applications and score them. So we fund

about 14% of all the grants that come to NCI. We fund a few more by our own discretionary funding, but by and large, the funding is through peer review.

SHEN: I see.

SINGER: Our responsibility is to advise the scientists as they're going forward, as they're writing their grants, as their research is proceeding. We're there if they have questions, if they need advice. But also, because we have the perspective of the entire portfolio, we can sometimes create collaborations. Let's say you're doing something in an area and someone else is doing something that might be helpful, we can put people together. So that's one part of the job.

But the other part of the job, which is actually a really fun part, is by having that perspective across the entire portfolio we can see where new areas are emerging. And we can facilitate the emergence of those areas by convening meetings where we bring people together, by sponsoring initiatives where we'll fund people.

So as an example, a number of years ago, it was clear that in order for us really to understand cancer or any disease, we needed to begin to look at cells as systems, and not as a single pathway. So we launched a cancer systems biology program, which was really the first systems biology program. But it was because we have that overall view of what's going on that we could anticipate the directions that research would take.

SHEN: That's very cool.

SINGER: Yeah. It's fun.

SHEN: So as director of the division of cancer biology, what would you say is one of your biggest challenges?

SINGER: I think the challenge – but it's a good one – is really identifying those areas of cancer research that are really going to be the next major area that we need to pursue, that is going to lead to the great advances and insights. And seeing that early and being able to anticipate it is really the challenge. And that's also what makes it interesting.

SHEN: That sounds like a fun challenge.

SINGER: It is!

SHEN: So you've served in a lot of scientific roles, as well as administrative roles. Do you think there are more similarities or differences between the two types of roles?

SINGER: Oh, I think they're very different. In my scientific roles I deal with the science, with the data. We ask, "What is next interesting question? What do we know? What do we not know?" It's very fact-based, very concrete. In the administrative roles, we're dealing with people with different individual personalities, different individual interests, goals, agendas. And so that's a very different kind of interaction.

SHEN: Right. So do you feel like you use--

SINGER: --consensus building. You don't have to build consensus on data.

SHEN: Do you feel like you use very different modes of thinking when jumping into those different roles?

SINGER: Absolutely.

SHEN: You've also been at the NIH for a long time now. You joined as a researcher and then came back. Now you are the acting deputy director of NCI. Do you feel like there have been significant changes in the work environment or the culture?

SINGER: Since I started? Yes, a lot. NIH is much bigger now than when I started. Interestingly, 9/11 significantly changed it. Because of the fence around-- Because of the security, it no longer feels as much of an open academic environment as it used to be.

SHEN: Oh, interesting.

SINGER: Because it's larger, and because of that change in culture to some extent, there's somewhat less interaction than we used to have, although there is still a lot there. But it is different. The budget has become much more of an issue as we've gotten bigger and bigger, and now the budget is flattening out. So there are a lot of changes. Nevertheless, we are still able to pursue our research interests and know that there's someone here who is an expert that we can talk to.

So it has changed. It's also older. I think the entire biomedical profession is older. When I started, people were getting their first grants when they were in their mid-30s. Now it's in their mid-40s. So people stay as post-docs longer, they come older, they tend to have families, and so there's less staying late at night and just hanging out.

SHEN: Do you feel like the workforce has changed to accommodate women more?

SINGER: Slowly, very slowly. There are many more women who are principal investigators. The number of women post-docs is probably more than 50%. But there is a real problem and that is that we're not getting the women post-docs to apply for tenure track positions. I think this is true across the country – that

women are opting out. It's a tough life, especially if you have to live on grants, or if you have to be here and get tenure. It's very difficult. And it's a problem, that we're not getting women staying in this career path. So we are starting to look at ways to make the career path more stable and more attractive – not just for women, but for men too.

SHEN: Do you think the incentives are unbalanced for men and women, or do you think it's a difficult problem for both genders?

SINGER: It's a very difficult problem for both, I think. I think we still live in a society where women feel they have more options, so that there are more who are willing or inclined to go into alternative careers than men are.

SHEN: Really? Interesting.

SINGER: At least, you know, that's my interpretation. Now, I don't know how many women are dropping out completely. But my sense is they're just doing other things.

SHEN: OK. Why do you think women feel like they have more options than men?

SINGER: I'm just speculating. I think, for men, being a successful scientist has somehow more stature than being ... than doing something science-related that isn't a research position. I don't know. I don't know if we're still in a society where the default is for women to stay at home, and so that's OK. I don't know. But we're certainly seeing it as a problem. I don't know what the underlying causes are.

SHEN: Before we get into the Cancer Moonshot initiative, I wanted to ask about your life in general. Have you had major conflicts between your career and other life choices?

SINGER: No, actually. I've been very lucky. And I have two kids. I worked throughout the time they were growing up, but I also have a very supportive husband who carried the weight with me, so we were able to manage it. We did work less when the kids were growing up than we do now. I won't say it was a piece of cake, but we managed. And I didn't think there were serious conflicts. You always make compromises, and so there were some compromises. But on the whole, I thought it worked out really well. But you'd have to ask my kids.

SHEN: Well, I'd like to talk a bit about the Biden Cancer Initiative. You were asked--

SINGER: Let me just say, backing up to the discussion of career choices. I think it's important to note that among my classmates, I think nearly all of them went on to have careers; at least among the ones whom I've kept up with, they've all had careers. So, I think the women who go to MIT, or at least in those days who went to MIT when it really was not the norm, stayed with it. They made a

commitment early on in their lives that they wanted to have a career, and they did.

SHEN: That's great.

SINGER: OK. Moonshot.

SHEN: OK. You were asked to serve as co-chair of the Blue Ribbon Panel for the Cancer Moonshot Initiative. What was that like to be asked by Vice President Biden?

SINGER: Obviously, it was quite an honor. My role was both as a co-chair, but also as, really, the organizer from the NCI side of all of the panel meetings, the working groups and getting the whole thing going.

The panel was named a year ago, April [2016], with 28 people from across the entire cancer continuum. And that alone was a lot of fun and interesting, because these were all leaders in their respective areas, very well-respected, who were coming together and really sitting down and giving very careful thought to how we could accelerate private cancer research. It was extremely interesting to do that.

One of the first things that the group realized was that even though each of them had a level of expertise in their field, to really get a broader view of where we stood and what could be accelerated, we needed to bring in more people with much more focused expertise. So we assembled seven working groups, each of them focused on a different area. Each of those working groups was charged with coming up with two to three recommendations of things that could be done to accelerate research. Those groups met over the next month or two – they actually were meeting weekly. It was quite an intense time.

They developed recommendations, which then the Blue Ribbon Panel looked at, discussed, and came up with a total of 13 recommendations, again, across the entire spectrum of cancer research, which were summarized in the Blue Ribbon Panel Report. We're now implementing 10 of the recommendations.

So that year, from April until September of 2016, was incredibly intense, just developing the recommendations. There was a bit of a hiatus at the end of '16 until we got the funding through the 21st Century Cures Act [passed by the 114<sup>th</sup> Congress in December 2016, the legislation authorized \$1.8 billion in funding over seven years], and now it's ramped up again. And since January [2017], the NCI has been working, through implementation teams, to develop the actual initiatives to accomplish the goals of the recommendations. There are a total of 12 initiatives that have now been approved that are going forward.

SHEN: It's really cool that you got to direct the recommendations and then see them through in implementation.

SINGER: Yes, It's really been fun.

SHEN: So, reflecting on the trajectory of your career so far and kind of the role of women in science and policy, and how it wasn't the norm for people in your graduating class to necessarily go on to careers like the one you have, do you think your mother would have imagined being in the position you are?

SINGER: I doubt it. You know, she made a conscious decision not to pursue a career, for reasons that were actually never quite evident to me. So I don't think she could ever imagine--

SHEN: Actually, what were your parents' occupations?

SINGER: My father was a mathematician. My mother had trained as a chemical engineer and worked a little bit, but barely.

SHEN: Do you think she could imagine *you* being in the position you are in now?

SINGER: By the time they passed away, I was already doing both the science and the administration stuff, so probably.

SHEN: How do you think your MIT education prepared you for everything to come afterwards?

SINGER: As I mentioned earlier, I think it really did, both in terms of learning how to think, which is the most important thing your school can teach you, and learning how to function in a social setting, which you also need to do in college. But I think MIT really prepared me very well. So in fact, when my younger son was applying to colleges, we took a tour of MIT. And the end of the tour, I was ready to go back!

SHEN: [LAUGHS]

SINGER: He didn't, but-- [LAUGHS]

SHEN: Are your children also involved in science?

SINGER: Not at all. My older son is an entrepreneur here in D.C., which people have pointed out to me is not that different from research, because you sort of explore and build and do your own thing. And my younger son is an architect in New York.

SHEN: Oh, fascinating.

You've become a role model to a lot of people. Who was your role model?

SINGER: I think one of the limitations of being a minority at that time was, I didn't really have role models. My post-doc advisor, Maxine Singer [NIH researcher in molecular biology and biochemistry best known for her work on RNA synthesis; recipient of the National Medal of Science] – no relation – was a little bit of a role model. One of the other people in the department, a woman named Claude Klee [an NIH biochemist for more than 40 years who died in April 2017; Klee was a pioneer in the biochemistry of calcium-binding proteins and calcium-dependent signaling], I think, probably served more as a role model. I interacted with her a lot, but that was really more in terms of being a scientific role model.

As an administrative role model, my real role model was Max Cowan, who was the scientific director at the Hughes for the two years I was over there. He played a very important role in my thinking about how to be a scientific administrator.

SHEN: Were there any particular lessons that you learned from either of the role models?

SINGER: As I said, with Claude, it was how to be a rigorous scientist and to run a lab. With Max, it was how to manage a portfolio, always keeping as your North Star scientific rigor.

SHEN: You've also trained a lot of students and other scientists to go on to successful careers. What are you most proud of?

SINGER: I'm most proud of their success. I've had a number of students who have gone on and are having terrific academic careers now, either well-established or just starting. And that's really been very rewarding.

SHEN: Are there any specific takeaways in terms of opportunities or challenges for women that stand out to you, as you nurtured these scientists?

SINGER: I don't think they differ for men or for women.

SHEN: Fair.

SINGER: I think that the takeaway-- I take a lot of students who want to take a year or two off between college and medical school – usually it's medical school – to do research for a couple of years. And I guess what I've been gratified by is that many of them end up going into research, either straight to a Ph.D. or M.D.-Ph.D., and that they had the opportunity here to really discover a passion for science and for research. So that, to me, is very gratifying.

SHEN: I bet.

SINGER: I've met a lot of mothers who are very unhappy with me--

SHEN: I'm sure. [LAUGHS]

SINGER: --because their kids aren't going to medical school, they're going to graduate school. But I can live with that.

SHEN: If you were giving advice to young women grads today, what would you say?

SINGER: Follow your passion.

SHEN: It's a good one. OK, is there anything about MIT, its role in your life, that I missed or that you'd like to talk about?

SINGER: Well, I think you've gotten the impression that MIT played a really important role in my life. It was a fabulous experience. It really, I think, challenged me intellectually in ways that I don't know that I've been challenged since, except to the extent that I create those challenges. But I think having gone to MIT also allowed that to happen.

I hope that MIT continues to really value merit, scientific merit. It's something that made it very special – that it didn't matter who you were, but if you could show that you were able to make it through, that you could do the work, that was all that counted, that they were first. And that, in many ways, sets it aside from other schools.

SHEN: Thank you so much for taking time for this.

SINGER: Thank you, Jackie.