National Cancer Institute
Division of Cancer Epidemiology & Genetics
National Institutes of Health
Oral History Project
Interview with Dr. Shelia Zahm
Conducted on April 13, 2022, by Holly Werner-Thomas for
History Associates, Inc., Rockville, MD

HWT: My name is Holly Werner-Thomas. And I'm an oral historian at History Associates Inc. in Rockville, Maryland. Today's date is Wednesday, April 13, 2022, and I am speaking with Dr. Shelia Hoar Zahm from the National Institute of Cancer, Division of Cancer Epidemiology and Genetics. Part of the National Institutes of Health, or NIH. The NIH is undertaking this oral history project as part of an effort to gain an understanding of the National Cancer Institute's Division of Cancer Epidemiology and Genetics. This is one in a series of interviews that focus on the work of five individuals at the NCI-DCEG, including their careers before and during their time with the institute. This is a virtual interview over Zoom. I am at my home in Los Angeles while Dr. Zahm is in—I'm sorry, is it Dr. Zahm?

SZ: Zahm.

HWT: Zahm. While Dr. Zahm is in Hermon, Maine. Before we get started, can you please state your full name and also spell it?

SZ: Shelia, S-H-E-L-I-A. Hoar, H-O-A-R, Zahm, Z-A-H-M.

HWT: Dr. Zahm graduated magna cum laude from Tufts University and received a Doctor of Science in Epidemiology from the Harvard School of Public Health. She joined NCI as a staff fellow in 1980 and was tenured in 1987 in the Occupational Studies Section, became deputy chief of the Occupational and Environmental Epidemiology Branch in 1996, and served as deputy director of the DCEG from 1998 to 2011. Since then, she has acted as scientific advisor. Among her many awards and honors, Dr. Zahm has received the American Occupational Medical Association's Merit in Authorship Award for a paper on job exposure matrices, The Harvard School of Public Health Alumni Award of Merit, the NIH Merit Award, and a Public Health Service Special Recognition Award for her work on the relationship between pesticides and the risk of non-Hodgkin lymphoma. As well as the NIH Director's Award for her program of research on cancer among migrant and seasonal farm workers. Dr. Zahm has served on the editorial board of several journals, and on numerous national and international committees, including service as chair of the United Auto Workers General Motors Occupational Health Advisory Board. She was elected to the American Epidemiology Society in 1995 and is an adjunct faculty member at George Washington University. Her research interests include pesticides and cancer, the etiology of non-Hodgkin lymphoma and occupational cancer among women. Does that all sound about right?

SZ: Yes. My work as a scientific advisor since 2011 has been on contract to the Division.

HWT: And I said it was brief. (*laughter*) So there's more. But let's get into some of those details. I always like to ask people to describe their backgrounds in relation to their career

paths. What guided you towards this career path? What influenced you, and who influenced you as well, if anyone?

SZ: Well, certainly my parents. They were huge advocates for education. And also, I think in my childhood there was quite a bit of illness in our family. So, I always had an interest in health. And in school my favorite subjects were biology and math. And epidemiology sort of brings those two together quite well, so I do think that that was a background.

I ended up being a math major in college. And got a job after college handling data at a cancer registry in a hospital. And through that job, I met an epidemiologist at Harvard School of Public Health. So, it was Phil Cole. And in my first meeting with him, he sent his assistant upstairs and got me an application to apply to school. And then continued to be on the alert and found a fellowship which made it possible for me to afford to go back to school. And I think, my exposure to epidemiology, bringing together both an interest in health and biology and, you know, the math side of things plus organizational skill, it seems like a very good fit.

At the time I wondered, well, should I go into biostatistics or epidemiology? And Dr. Cole, in particular, encouraged me that in epidemiology you're actually digging into the causes of disease. And you're in charge of your studies. Whereas biostatistics, it's much more developing methods and analyzing data in collaboration with other people. And it seemed like a better fit with my interest to go into epidemiology.

Once I entered the fields, the mentors I had at the National Cancer Institute and in the Division of Cancer Epidemiology and Genetics were phenomenal. There were three main mentors during my time at NCI, and they each taught me a phenomenal amount of different aspects of being a research scientist and a scientific manager. And those were Aaron Blair, Bob Hoover, and Joseph Fraumeni. So, I owe a lot to my mentors.

HWT: And I was going to actually ask you about mentors, but now is as good a time as any. Tell me a story about each of them. But going back a little bit, let's start with Dr. Cole. So, what were those conversations like?

SZ: Well, he was a professor at Harvard School of Public Health when I did return to school. And just his extremely sound methodological approaches and study design is what I think I learned. Just clarity of thinking and also clarity of writing. He was an extremely terse writer. Every word had to be the exact perfect word and count. So I learned a lot about epidemiologic methods and then how to present one's ideas effectively from him.

HWT: And go ahead and talk about the other three people who were so important to you.

SZ: Sure. Aaron Blair was, I would say, the main mentor that I had for the first 15 years of my career at NCI. And he was a fantastic mentor. He always provided opportunities for people to lead and gave people credit. He was a very, very good epidemiologist and a lot of commonsense approaches to things. And treats people so well and is a very, very generous collaborator. Not only within NCI, but around the world. I think most of the

colleagues that I got to meet around the world were because of Aaron Blair making sure at meetings that I met them, or we all went out to dinner afterwards and he would invite everyone. He just made sure that people made the connections they needed to make to do the research they needed to do. And his generosity in science and in running a branch were truly, truly excellent. And he's just very, very, I guess, just, you know, a very generous mentor.

The other person I mentioned was Bob Hoover. And he is just a brilliant epidemiologist. And again, both he and Aaron, their priorities as far as, you know, you talk about work/life balance. Well, they were way ahead of that, 20, 30 years ago. But he's probably one of the most insightful, brilliant epidemiology methods people. And again, he gave me a lot of independence in learning how to run a study. And that was very helpful. And his political sense, you know, a lot of what epidemiologists get involved in, especially in the area I worked in, which was occupational environmental exposures, there can be challenging political ramifications of the research with regulators, with industry, and with the public advocates. And he and Dr. Blair were extremely savvy on how to handle that and how to work with lots of people, but to keep the science primary. I also think that his attitude and others in the division, where we are the people's epidemiologists. You know, we're not a special interest. We work for the people of the country. And really, the world. And the science has to be paramount. So, you know, they tell me a lot about epidemiology, but a lot about how to do it and how to navigate some of the waters that we have to go through with our science.

And Joe Fraumeni is the director of the division and the predecessor organization before the division was formed. Really, he led the cancer epidemiology at the National Cancer Institute for about 50 years. And I worked as his deputy director for the last fifteen years of my career. And I'm in awe of his epidemiologic knowledge, his strategic visions, and his ability to look across science all the time. He's always surveying what is happening in every subgenre of science and trying to see what can be exploited. And I mean that in a good way, what can be put into epidemiology's research approaches to accelerate and advance our research. So that was, this was always truly a wonder to watch. He was also extremely good at spotting talent and encouraging it and allowing people to go as far as they could. Whoever they were, whatever their degrees were, wherever they came from, whatever school they came from, whatever country they came from. He had a real ability to spot talent and let people flourish. And again, all three of those men are just tremendous personal examples of character as well as brilliant scientists. So it was a real pleasure, and I don't take it for granted that I had such a good environment to work in. It was really very, very good.

HWT: So the middle person you mentioned, Bob, was it Hoover?

SZ: Yes.

HWT: Okay. And I didn't catch his reference. In other words, was he also at NCI? It sounds like it.

SZ: Yes. Yes, he was. He was the director of the epidemiology and biostatistics program. So kind of over many of the branches within the division. We were divided into epidemiology, biostatistics, and the human genetics program. And he was over six of the branches. So he was a scientific manager in the chain of command within the division. But truly, you know, the architect of most of the really important initiatives the division had over the years.

HWT: Wonderful. I want to stay with your background a little bit before we move forward. Where did you grow up?

SZ: I grew up in a suburb of Boston. A town called Hingham. On the ocean. I loved it. It was a beautiful place. Actually, through my childhood, I did a lot of drama club and music kind of activities. And I think that helped later with having to do speaking at scientific conferences and things like that.

HWT: And just take a moment to describe going into math and science as a girl, and then a woman, what barriers did you face?

SZ: I really wasn't, I can't say that I was aware of barriers through college and that kind of thing. But when I went to graduate school, the field was in a time of transition. Prior to the years I entered, most epidemiologists were physicians, and they had come from—you know, and all the faculty was male. And I think we were an experiment, my class. We had women and non-MDs. And I think that was a challenge. And to be taken seriously as

epidemiologists and not relegated to an assistant kind of role. But no, we'll actually lead studies, and we can do this.

But I have to say, at NCI, there was not an atmosphere of that at all. In fact, both Bob Hoover, Aaron Blair, Joe Fraumeni, they promoted women and they put women in positions of responsibility and leadership. But I'd say my graduate school, it was a little, they were making the transition. (*laughs*) They weren't there when I went there.

HWT: What years were those, by the way?

SZ: I was in graduate school from 1975 to 1980.

HWT: Very much a transitional moment.

SZ: Yes.

HWT: Okay. So I noticed that you were a finalist for Maryland's Outstanding Young Scientist Award twice, 1986 and 1987. Can you tell us what that was for? And also, what being a finalist meant to you at that time?

SZ: And I aged out by year three, I think. (*laughs*) It was a very nice honor to have my work recognized. And I believe it was primarily the work on pesticides and cancer. And I think it was important that public health and population science like epidemiology was actually

included in the competition. And I think prior to that, it was mostly basic sciences from the labs. So, you know, that was nice to have my nomination be something that kind of was a little different from what they usually recognize. And there was a lovely event at the Maryland Science Center in Baltimore, which was very nice. And it was nice to meet other scientists across the state who, not just the ones from NIH that I might have met, but others. So, it's always nice to be honored.

HWT: You have several. So, I will get into the details, of course, about your work. In fact, I wanted to ask you, why did you choose to focus on what you focused on? So, pesticides and cancer, the etiology of non-Hodgkin lymphoma, and of course occupational cancer, as well. Can you take each of those in turn? Let's talk about pesticides and cancer to begin.

SZ: Sure. Well, I think if I can go up to a higher level first, my interest in occupational and environmental cancer, which all the three main areas of my research fit under, was really, I think, it appealed to me a lot because I felt like something could be done in that area. Now if one is successful in identifying an exposure that is leading to some adverse health effect, and especially cancer, with those exposures, I felt there was a good chance something could be done about it. At least when I started, there was a very strong environment of regulation and control. You know, the EPA was kind of growing. OSHA, you know, these were new agencies, and they were effective at regulating. And in the work setting, there was a lot of improvements and control of hazardous substances. So, unlike looking at something now, this was science then. It has changed then. But looking

at things like genetics or host factors or some lifestyle factors, you know, I felt like I could make more of an impact in the area of occupational/environmental exposures.

And in particular, these exposures are ones where they are avoidable. The exposure can be prevented. But often the people's personal exposure is not really a voluntary one. You know, if you drink your water from your city system, you may—you know, nowadays there's lots of bottled water. But at that point it was like, you know, you really didn't have a choice. Or if you were in a job and there's an exposure in that workplace, you know, people can say oh, yes, you can quit and go somewhere else. But that's not, it may not be something that people really can do. So, I knew them as kind of involuntary exposures, but preventable. And to me, that makes it a high public health priority to work on it. So, I always had an interest in that. And my doctoral work, both master's and doctoral work were in this area.

So, when I got to NCI, one of the projects that was offered to me to work on did relate to pesticides and cancer, and that was with Dr. Aaron Blair. The studies were initiated because of patterns seen on the cancer mortality maps for the United States. There was a band of red high-rate areas through the center of the country for lymphoma and leukemia. And it wasn't in the cities; it was in the rural areas. And Aaron, having grown up on a farm in Kansas, was very interested in this topic and sort of brought me along on the first project that I worked on there. And we dug into the issue of many exposures in agriculture, but pesticides, in particular. And started seeing patterns between exposures to different herbicides, different insecticides, and the risk of lymphoma or leukemia, or

multiple myeloma. And that just grew to many other projects. And also, then looking at people other than people on family farms in Kansas, to looking at licensed pesticide applicators, to looking at farmworkers who often have much less control and heavier exposures and less ability to clean the exposures off than farmers. So, it led to a broad area of research. But the cancer maps really were what started that research off. And they definitely helped generate a lot of clues.

Because of that research on pesticides in relationship to lymphoma, when we do a study, we don't just ask about one factor. We ask about everything. So, we ask about diet and medical history and family history and genetics. So, the work on the pesticide-related issue led to more research on lymphoma.

When I started my research on lymphoma, there had been a rapid increase in the rates of lymphoma from the 1950s to the 1980s. It was rising more rapidly than any other type for cancer other than melanoma of the skin and lung cancer among women. But other than that, you know, and even if you excluded HIV-related lymphomas, it still was rising. And it was rising too fast to say, well, this is a genetic change in the population. You know, it had to be something environmental. So that led to a lot of research just looking at lymphoma. And you know, we have learned a lot. My work made some contribution. But many, many collaborators. And now there are many other scientists in the next generation who are taking it even further. And we do know a lot more than we did back then about what causes lymphoma. So again, looking at, the pesticide work came from the maps. Looking at cancer rates generated a lot of research on lymphoma. Sometimes these basic

studies of trends and patterns can lead to hypotheses and a body of research from which we learn a lot. And that was a truism across the division in the division's history. We always looked at descriptive data and launched studies in high-risk areas. Not only in this country, but around the world. And we've learned a lot over the years because of that approach.

And then, having done work on occupational groups, it did not escape my attention that even when there were enough women in the population to study them, people often didn't. So, at a certain point, I got involved with a project to hold a conference on occupational cancer in women. Like survey the literature. And for that conference, I did an actual survey of, I can't remember now, 20 years of literature and looking at how many studies actually – looking at the size of the population, how many women were in each occupation; had people actually analyzed the data or not. And sometimes people were even studying occupational groups, like nurses for the nurses' health study or other studies, but they weren't looking at them as an occupational group. And asking about what their exposures [had] been. You know, they were just a handy group to study diet or, you know. So, we just tried to shed light on that and tease out what data there were there but stimulate more research and attention to that issue over time.

HWT: I have one follow-up question. I'm just curious. Where did those cancer maps come from? How were they produced?

SZ: The ones that were the impetus for our work were based on U.S. mortality. The causes of death from U.S. mortality at the county level across the entire country. There are also data on cancer incidence. There were data on cancer incidence. And those were generated by the large network of cancer registries that the National Cancer Institute funds around the country. For many, many years, it had only covered about 10 percent of the country. Certain states, certain cities. But over the course of my career, there has been more funding gone into it now. And now every state in the country has cancer incidence registries. And that coverage is much greater than it was for most of my career. But the maps at the beginning were all based on mortality rates from the National Center for Health Statistics, part of the federal government.

HWT: So, what drew you to working for the federal government? You joined the NCI as a staff fellow in 1980. How did you come to work there? What were your initial goals and that kind of thing?

SZ: Well, when I was a student at Harvard, I was working with Dr. Brian MacMahon, the chairman of the department. And he was a friend and colleague of Dr. Joe Fraumeni here at NCI. And Joe would frequently ask Dr. MacMahon, "Do you have any students graduating soon that I should know about?" And so, he got in touch with me and invited me for an interview. And I had also been approached by an industry and an academic department. I really wasn't interviewing. I had a year to go. But when I went to visit NCI, I thought, all right, I can compare these three completely different venues for work. And the thing that struck me about NCI versus the other two is that there was such an

opportunity to learn. It provided opportunities to learn. I felt in industry and academia, I would kind of be expected to just go to work, you know. I'd be working independently, and not in a place where there were other epidemiologists I could learn from to the extent that I could at NCI.

And my plan was to come to NCI and work here five or six years and learn as much as I could. And then I would continue south, you know, from Massachusetts, Maryland was heading [south], and actually I never left. I was either a slow learner or, but it was such a tremendous place to work. I stayed. I never, never did leave. So. Oh, you had asked my initial—

HWT: Yes, I was going to follow up with that. So, some of your goals. You're freshly out of graduate school. What you knew, I mean, you just mentioned that it was a terrific place to continue to learn, which is obviously appealing.

SZ: Right. So, in graduate school, I felt like I had been taught well the concepts of study design and the methods for data analysis. What I hoped to learn from NCI was how do you launch studies? They had a lot of big studies. Well, they had a lot of studies. They got bigger over time. How do you collaborate and connect across disciplines? I wanted to learn more about cancer, per se. Most of my classes in graduate school were on the methods side, and not much on the actual biology of cancer. So that, you know, that was, those were my goals, I would say.

HWT: So then in 1987, you were tenured in the occupational studies section. Can you talk about your evolution between 1980 and 1987? That's quite a long time.

SZ: (*laughs*) Yeah, I would say that during that time I learned, well, some of what I had hoped to learn. Learned how to launch studies. I went from conducting studies under the leadership and mentorship of Dr. Aaron Blair and Dr. Bob Hoover. And then really evolved to be able to develop hypotheses on my own, to identify what the next steps in a scientific line of research would be, to take the lead on writing proposals for new efforts and setting up—so having done it, kind of watching them and doing it with them, then you evolve to taking the lead yourself. Although NCI fosters a very, very collaborative environment for people at every stage of their career. But there is a shift to playing more of a leadership role over that time. And for tenure, you know, it's nice to have one's work acknowledged. And you know that with tenure, you're likely to be able to stay there longer. So, you can make a commitment to longer, bigger studies than you might if you thought, well, I might have to leave in two years, I'm not going to launch a study that's going to take me five. And also, there's an ability to maybe do some higher-risk research that may not necessarily pan out. It's safer to do that when you're tenured than when you're on tenure track. (*laughs*)

HWT: So a few follow-up questions: Just getting into the weeds a little bit more about the process. So, for example, if you were, if I were about to ask you this question and I was applying for a job, I was a young scientist just out of graduate school applying to NCI

and my question was what's an average day like for you? What can I expect? Or what is that process in terms of creating these studies? What would you say?

SZ: Hmm. So, for a new graduate, you know, they're usually working under the leadership of someone who is a principal, what we would call a principal investigator at NCI. So, they are the folks who have responsibility for the resources, and they've been, usually before the fellow arrives, they have research or data already in hand, or a research plan for some study that needs to be conducted. And so, a new fellow would come in, learn that, learn the background of the literature, learn the aims of the research, and start figuring out where they can contribute, either helping with the field phase of a study or with analyzing data.

But then as they dig into the literature and as they are analyzing data, if they start to develop hypotheses on their own, or they see opportunities to add to their research on a particular topic, there are many ways within our division where they can apply for funds. They're usually competitive award programs. But then also apply for regular research funds through the annual budget process where they can start to lead projects. So, it's a transition.

HWT: Thank you. You mentioned that you could take on higher-risk work in studies. And I wanted to ask you what it meant to you to be tenured. So, can you combine those things? That's obviously one change. But what else did it mean to you to be tenured there?

SZ: Hmm. Let's see. Well, it's interesting, because when I was first hired, the tenure system didn't really exist. It was created and formalized during my first few years there. So, I think we were all trying to figure out what it meant exactly at that point. (laughs) But yeah, but as I said, it meant an acknowledgement of the quality of the work. And that the institute was willing to take a risk on me. That they thought I was a good bet for future quality work. And that was certainly nice. But I think the idea that you could start long-term studies is really the big difference; that you think of what the science needs and you're not having to be constrained by your career considerations of having to produce something because you have to leave in two years. You can really say no, what really needs to be done is this longer, more expansive project, and you can do those things.

HWT: That sounds like one of reasons that tenure was created to begin with. Do you know of other reasons why the tenure idea was brought to NCI?

SZ: Yeah. The tenure process was coupled with the site visit reviews every four years. Prior to this formalization, people got government jobs and they were just in them forever. (*laughs*) But this agency, and National Institutes of Health, is different from other government agencies in that it's much more like an academic environment. So what happened when this system was put in place, was a requirement that every four years panels of outside experts – we call them site visitors, boards of scientist councilors – these site visitors would come in and evaluate the research that each investigator had done over the prior four years. And if it was good quality, you know, you got a green light to keep going. But people who are not doing a good job, they can lose their tenure

status. They're given lots of warnings, and people get re-reviewed and that kind of thing. So, making a formal tenure process of some security, some long-term investment, being willing to take higher risks, it is coupled with an accountability component that wasn't there before the system was put in place. And there was demand for that. You know, I think around the country, people going, we have to apply for grants every so many years. And our work is looked at and reviewed. And that should be the same for people at the National Institutes of Health who are intramural researchers.

HWT: Thank you. I'm glad I asked. That's really interesting. I'm going to ask you a broad question before then coming back to your specific career. In your time at NCI, you know, between 1980 and when you retired, how would you say that it changed in and of itself?

SZ: Oh my goodness. A lot. I think I'll just stay within how did epidemiology change. I can't really speak to everything across the institute. When epidemiology, when you think of the state of it in 1980 when I first came, most people around the country, if they were doing a study of a particular tumor, you would interview people, you know, 200 people who had the cancer and 200 people who didn't. It was very small. Cottage, kind of cottage industry. And primarily through the work of the epidemiologists at NCI, they supersized it. You know, developed methods of reaching people. Developed methods of working with the field study contractors, so that much bigger studies were being conducted and better questions could be answered with more sensitivity than with very small studies. And so that was the first thing. And instead of everybody having their own little study, people had to band together. There had to be consortia where a large number of

researchers and large studies would be combined to answer these more and more refined questions.

I also think in the early 1990s there was this whole genomics revolution. And all of that started to get worked into our epidemiologic studies. And the technologies that were developed on the laboratory side of things, there high throughput analyses could be done. So instead of one person working at a lab bench on one sample and it takes months to get 300 or 3,000 samples done, now the laboratory techniques have this high throughput where automation and other developments occur where we can analyze hundreds of specimens in a very, very short period of time, thousands of specimens in a very short period of time. So all of that meant, [it] just had an enormous effect on how epidemiology is conducted and what kind of questions the studies can answer.

And at NCI, we can often play the role of bringing groups together. Because sometimes there's a lot of competition between different academic centers and we can kind of be the broker in the middle to do these large consortia studies. So, I think we went from everybody having their own little study in their corner to it's a global endeavor often. And the technology for the computing, you know, and when I started, we had the types, the McBee cards, for crying out loud. We had little calculators. We would run these tabs through to get little programs to analyze data. It's just so different now. So you know, I think technology in computing, technology in the lab, and other approaches to conducting research in epidemiology has changed the field completely from when I started.

HWT: And you've anticipated one of my questions, which is about technology and technology influencing your field. Can you tell me, you mentioned, what is it, a "B card"? Can you talk about that for a second?

SZ: Oh, McBee cards.

HWT: McBee. So what's that?

SZ: Oh, this is fun. (*laughs*) These are cards, they're about, you know, eight inches, I don't know, they probably were eight-and-a-half like paper, and three or four inches high. And you would have the numbers, one through ten down. And they would punch holes in them, depending what this line of code was. It was all done manually by reading these cards with holes in them. So in graduate school, we would walk around with these boxes with decks of cards and feed them, not the computer. That was how we ran our programs. This is really making me sound old. (laughs) Anyway. You just didn't want to drop your deck. That was the problem. So, there's been a lot of changes.

HWT: That's just, I think that's wonderful. And it is super important to everybody I'm talking to, obviously technologies of all kinds in the last 40 years have just completely changed in many fields. And we can come back around to that as well if there's anything you want to add. But it's super interesting. But getting back to your own career now, so you became deputy chief of the occupational and environmental epidemiology branch, again,

in 1986. So, can you talk about your evolution now between 1987 and 1996? Which again I know is quite a while.

SZ: So, I was a member of the branch, and became deputy chief. It was a very large branch. And we were doing field studies all over the country, and really all over the world. We had many projects. So, there was a lot of management to do. A lot of work with contracts and funding and people and political issues. So, my job was really to support the chief, who was a phenomenal manager. And that was Dr. Aaron Blair. And to help the staff. And for me, it was a time of really learning the processes. You know, how does the funding of contracts to support our work work? Just learning management. Personnel, space, budget. You know, all the usual things that come up in every organization. So, it was a real—I was still actively involved with a lot of research—but I was learning about scientific management, I would say.

HWT: What are some of the lessons that you drew during that time regarding scientific management?

SZ: Oh. Well, budget, funding, and scientific review. All those things. I think it's very important to be transparent. Take care of the details. Be transparent about the processes so that people understand why decisions were made the way they were made. I also think in terms of when there are personnel difficulties that have to be worked through, it doesn't help to ignore them. (*laughs*) So intervene early and often if you have to, and it will work out better in the long run.

HWT: In terms of budgets and funding, what were the changes, if any, during that time?

SZ: Yeah. We did have, you know, for many years, a feast and famine. There were times when the budget was growing, and it was easy to say yes to things. And then there were times because of political things outside of NIH, you know, there would be freezes and we would have to ratchet down different projects. And that's, you know, it's just hard. If you're doing a field study, you can't cut and stop it. So you have to figure out, well, what can you slow down, what can't you slow down? You want to make sure you do it, if you have to slow things down, you want to make sure the junior people who have a different timeline on getting things finished than those with tenure, make sure that they get the resources they need. So just trying to balance all those factors.

HWT: Can you give me an example of a time that you had to cut back? And when that was. What was happening politically will be reflected in that answer.

SZ: Well, just in terms of budgets being cut, and also pressure on contracts: Either not having sufficient money in the contract to be able to finish the work in that calendar year. You know, in the laboratory realm, costs are kind of steady throughout—well, I'll say they're likely to be more steady than in epidemiology, where you may have a very expensive field phase of a study where you're out interviewing people and collecting data. And then the costs drop, well, they're supposed to drop when you're analyzing data. But now that we've added the biological components to all our studies, then there's well, when does

the lab cost kick in? So sometimes an investigator may need a big budget one year, a smaller budget the next year. And someone else needs the reverse. But it's awfully hard to tell a researcher, you know, your budget's going to be a lot lower this year, but it's based on the science you're doing this year. You know, try to change that mind frame from everybody gets the same amount every year or they get an increasing amount every year. You can be the best scientist in the division, and you may have a much smaller budget the next year just because of what you're proposing to do. So that's tricky. And then if there's outside changes, cuts for whatever reason, then you have to decide, does everybody feel the pain equally? Or do you do it more strategically based on what the science is and where the investigator's at in their career? So, it's tricky.

HWT: Sounds very tricky. Can you talk about the balance between management and your own research?

SZ: Well, the second half of my career, when I was deputy director for the division, it was much more management and much harder to keep the science going on my personal side. You know, the priorities, if it's a priority that affects someone else's paycheck or their research, I wanted to make sure that was taken care of. So, a paper that was waiting for me to write was definitely slowed down. So, I learned to bring in junior people who could really take the lead on projects. And started handing leadership of projects over to people, just because of the demands of the deputy director job. So, I admire people who are amazing at keeping both going in full force. But I found that was a challenge for me, so I definitely switched to a more secondary advisory role, rather than being the person

without was mainly responsible for making something happen in the scientific realm after I became deputy director.

HWT: So, again, a couple of follow-up questions. One, did you have any management training within the institute or outside? Was that something that was on offer?

SZ: No. Actually, when I became deputy director, I started bringing in trainers for the branch chiefs and myself. (*laughs*) So there's a training office at NIH. And I would reach out to them, and we would look through the recipe book or look through what they might have that fit [the] needs that our branch chiefs and I felt we needed. Because very few of us have management training, going through science backgrounds, science education. So, we definitely needed it. *Now*, the institute provides a lot of management training. This was just not the case in the Jurassic age when I started. But they have a lot of management training. And when people are becoming supervisors, what is offered [is] management training for people who are going to head up their own lab or their own research program. So, there's a lot now. But back then—I actually brought in some training programs for us. And we held them regularly over a number of years.

HWT: How were those received?

SZ: Good. Very well. Very well. Yeah. Mm hmm.

HWT: And then I had asked about political forces outside. But can you be specific with any example at all? And if not, that's okay. I just wanted to ask that again in terms of—because there are political, because the NIH is obviously affected by forces that is way beyond its control. Was there a particular moment, a year, or a period of years, where there were cutbacks, or years that were flush? And what was the situation, what did that mean for you? You've described this in part, in other words. But I'm looking for what those were.

SZ: I think for, in my experience, the influence and the struggles with political forces were not so much related to the budget. But it was more related to the ability, first of all, the ability to conduct research on some topics. For example, if your topic requires you to gain access to a workplace, and is a company going to let you in. Sometimes they do, sometimes they don't. There are government agencies that have the right of access. NIOSH and OSHA have the right of access to go into workplaces. NIH does not. So, it has to be voluntary on the part of a workplace to let you in. When the protocols and methods are being developed, one has to make sure that it is under the control of the researchers and not a company or the union who is, the labor group who are providing data or allowing access. And when publications are being prepared, again you want things reviewed for accuracy, but you want academic independence. And when information is released, sometimes there can be a flurry of publicity in some of our studies and other studies by people around the world. You know, there will be expert reviews that are conducted to look at the quality of the research and decide if regulation should come from the research. So sometimes it's very contentious. Sometimes it's

wonderful. (*laughs*) Sometimes there are Freedom of Information Act requests for all the data, and they're reanalyzed by consultants. All of which is fun in terms of our, we want quality science. And this is a check to make sure things are quality. But we have to make sure the privacy of our subjects [is] protected. And if you've collected a lot of data on subjects, you can triangulate and you can maybe put people's privacy at risk. Especially if, you know, a company may have their own data. Getting a little into the weeds. But I just think for us, the political forces have a lot more to do with the special interests who are affected by the results of our work. So.

HWT: Again, super important. Is there anything you want to add about your years between 1980 and, say, 1988? Which we're going to go forward now. Anything at all in terms of management, research, the institute itself, changes over time?

SZ: Nope. I don't think so. We can move on.

HWT: If you think of something, just mention it anytime. It doesn't have to be completely chronological or anything. So, in 1988, and then from 2011, you became deputy director of the DCEG. Can you talk about the process of becoming director? And again, your original goals in becoming that?

SZ: Well, actually, when the division was created formally, I think it was in 1996, Dr. Fraumeni had asked me if I was interested—well, it wasn't that direct. But it was clear he was asking me if I was interested in being deputy director. And at that point, I said no,

that I actually still really enjoyed finding the findings. I still really enjoyed doing the research and being the primary lead and that kind of thing.

But over the next two years, I had more and more exposure to NCI leadership and NIH leadership. Some very interesting projects. A lot of them related to breast cancer. That was really at the agency level. So, I just saw a lot more of what goes on at the higher levels of science management and was more interested in it. So, it looked like the first deputy director was going to be taking another job. And so, I went and talked to him. And he welcomed me into the position at that point. (*laughs*)

And my motivation really was I thought I could help the division and have a bigger impact by facilitating the research across the whole division, than continuing to do just my little project off in the corner. The division is just a phenomenal organization that really covers, maybe not the whole waterfront, but pretty close in terms of exposures and cancers and approaches. And I felt like helping that, all the aspects of the program, and helping the people in those programs, would be a bigger impact than just doing my own research. And it appealed to the things I liked to do. So.

HWT: This is going to sound incredibly obvious, but why was having a bigger impact important to you?

SZ: Oh. The most obvious is the hardest to answer sometimes. (*laughs*) Well, one always wants one's work to make a difference. And I could see that there were things that could

be improved and helped. And it would accelerate progress. And it would help the researchers doing their phenomenal work across the whole division. And that brought a lot of satisfaction.

HWT: And then specifically, obviously Ukraine and Chernobyl are very much in the news right now. Talk about your own work on the DCEG Chernobyl Oversight Panel between 1999 and 2008, including as chair from 1999 to 2002.

SZ: You know, I would have to say, that was one of the most unique and interesting experiences that I had in my career. It was challenging. (*laughs*) The project, so the accident occurred, I think it was 1986, the Chernobyl accident. And there had been an agreement between President Reagan and Gorbachev right after the accident that the U.S.—well, maybe two years after—that the U.S. would help. And they would do research on the cleanup workers, and also on people who had been exposed to the fallout from the accident in the areas of Belarus and Ukraine. And it was, so many years passed, and the projects were struggling. They were hampered by lots of political things on the ground. For example, in Belarus the health minister would change over and over and over again, so you'd make an agreement with one set of actors and then the people would change, and you sort of had to start all over. The longest health minister, or one of them, was the mother of the president's mistress. You know, so things just were not going well. And it was very difficult for the people who were trying to do this research to pay for, get money. You know, if you sent it through traditional channels, the money disappeared. So, there were just a lot of problems in actually getting a study conducted.

On the other side of the ocean in the U.S., there was a lot of political involvement and advocates fighting for more information on I-131 [iodine 131] fallout from nuclear testing in the US. And the thought was that the Chernobyl project would yield important information that would be relevant. And those advocates got very angry about the delays with the Chernobyl project.

Eventually the NCI director decided to transfer management of the project to our division. It had been in another division at NCI. And they transferred it to us because we had a radiation epidemiology branch, which had the largest groups of world experts on radiation epidemiology. So, it came over. (*laughs*) But it came over with a huge amount of congressional interest. Because there had been a hearing related to the I-131 fallout in the U.S. And that was the impetus for the cancer director giving us responsibility. So, the Congress wanted an audit of the science. You know, what the protocols [were]. They wanted a management audit because it was very complicated. They wanted a financial audit. So, we had to jump in and figure out what was going on, and how to actually get these studies going the way it should. And we had external advisory panels for the thyroid studies, the leukemia studies.

And then the collaboration, you know, it's challenging. Because you've got [different] languages, you've got [different] countries, politics. For many years, we had these trinational meetings where people from Belarus, Ukraine, the U.S. were there. And it was like the UN [United Nations]. We had booths with translators in the background. But the

project really got on a solid footing. And the people who deserve credit for it are really Elaine Ron, the radiation epidemiologist from NCI; and Geoff Howe, [a] tremendous epidemiologist at Columbia who had led a contract to provide the clinical expertise and epidemiologic expertise to the Ukrainians and Belarussians. Gil Beebe, who had been involved with the atomic bomb survivor studies, he came and gave advice. André Bouville, who is a radiation dosimetrist, who is expert and figuring out what exposures people had. So, there was just a tremendous team that did jump in to help and to turn the aircraft carrier around and get the study going.

And really, there's been a lot learned about the radiation effect on the people exposed, people exposed in utero. And right now, there's a second generation of scientists at NCI and elsewhere who are looking at the genetics, and if there's an interaction between host genetics and the radiation is affecting thyroid cancer. So, it actually has been a very productive, it became a very productive scientific endeavor. But it was unique (*laughs*) in terms of just the, even getting money to pay the researchers over there. Before we took it over, we heard a lot about big money belts going across. We thought, we're not doing that anymore. So, we worked with the Red Cross to get money to the people on the ground who are doing interviews and measurements and collecting specimens. Because as I said, going through the official channels, other than this, the money wouldn't get where it needed to be. So anyway, it was fascinating. And meeting the people from Ukraine and Belarus, it was a great experience. But it is tragic now to see what has happened. And know there are efforts afoot to help the researchers when this settles down.

HWT: So, contrary to what we were just speaking about, I wanted to ask you also if you could take us through kind of an average day as deputy director. And I'm sure there really isn't such a thing. But we can try. So, what's an average day, or an average set of days?

SZ: Well, it certainly would bear, a big part of the job was reviewing scientific proposals for studies, or additional components to studies. So that was it. Overseeing, helping to manage the funding and the flow of funds. Sometimes the work involved maybe personnel actions. Helping other people who are going up for tenure or going through their site visits. Helping them review. A lot of strategizing. I think the job had this combination of a lot of attention to detail to make sure the trains were running on time. (*laughs*) You know, was this getting processed? Was this moving forward? Science and personnel and money. But then combined with big initiatives that were really special. You know, creating some infrastructure that all the researchers across the division could use. And that continues now. The current deputy director has done a fantastic job of creating a new digital pathology lab that people can use. Or bioinformatic infrastructure. So there always was a combination of, as I said, keeping trains running and then big strategic things that would affect everyone's research and facilitate it.

HWT: How would you describe your working style?

SZ: Well, let's see. Let's see. I would say I am detail-oriented but also try to be really responsive to, I try to see what's working and what isn't working well across the division.

And people were pretty good about coming and telling me those things. (*laughs*) And so trying to figure out what we can change. And again, try to make things transparent. You know, when the division was first created, you really didn't have processes for anything. So, trying to figure out how things can be run in a way that's fair, open, and obvious to all. And a way that just helps people do the research instead of getting in the way of them. Try to be respectful, encouraging.

HWT: I have some general questions, as well. Of course, we've talked about some of these things in terms of what inspires you, what motivates you. But I'm also interested in what bores you.

SZ: (*laughs*) Okay.

HWT: So let's start there.

SZ: Okay. I think about some things, and it's not so much they bore me as I think I don't know enough to appreciate them well. For example, I was a math major. I know Greek letters. But listening to a biostatistician's talk that's meant for other biostatisticians, it's, you know, I don't have the expertise enough to really understand or stay with them. So those are things where I'm like, maybe I'll skip that lecture. Because I won't get a lot out of it. So, I know what they do is important. I appreciate what they do. They're critical for every collaboration. But I just don't know enough to be able to sit there and listen to the nitty gritty on their work.

HWT: As they become more and more specialized, they become a little bit atomized as well.

SZ: Right.

HWT: Is there anything you want to add about what motivates you? Obviously, we've been talking about that.

SZ: No, I think it's fine. I love, even now in the role that I'm in now, I love hearing about new research directions. Especially if it looks like it could have a real public health impact. So, I think that's still, [having a] public health impact is still a major motivation. What I value.

HWT: Overall, what do you feel are your main accomplishments? Or what are your biggest successes? And what made them so?

SZ: I think probably the research on pesticides and cancer. You know, we went from having sort of vague ideas that something might be going on to really identifying some issues, and also helping to launch the agricultural health study, which was, it is the premier study for learning about agricultural hazards and cancer. So, I think the foundational work that I did with, obviously the mentorship of Aaron Blair. And seeing that work continue and how it just keeps growing and how much we've learned from it. So, on the research side, both for that and the lymphoma work specifically, it makes me feel good.

But I think probably the bigger impact was just the work I did to help the division and to see the division grow the way it's grown. And the quality of the research, and the amazing breadth and depth the division does. And the public health impact of the division. We have gone through sometimes looking at all the various regulations and changes and clinical advances that have come out of the division's research. And just knowing [or] having helped with any, having helped any of that occur is very rewarding.

HWT: And then, I always like to ask the flipside of that, because it's very revealing about what people have learned in terms of any setbacks that you've experienced or even bad ideas that you've had. Some people say there's no such thing as a bad idea because you're taking a risk and you are learning something. Is there anything that comes to mind?

SZ: You know, not so much in the science area. But I think, you know, I certainly had some missteps in managing situations with people. And you know, I just try to learn from it. Apologize if you need to. And go on from there. I think those are probably the things that kind of I think about more than oh, you know, this study maybe didn't yield as much hard data as I hoped it would, or useful data as I hoped it would.

HWT: Do you have an example that you want to share?

SZ: No. I'll keep those anonymous. (*laughs*) But I do think one of the things I learned is it always helps to just go to people and see them in person and talk. And I do worry about

the Zoom culture now. It makes it harder to do. The walking down the hallway and just talking to someone. I hope that can resume soon for everyone.

HWT: So, we'll get there eventually. So you retired in 2011. But you continued to publish. And you are also a scientific advisor. Can you talk about your relationship as scientific advisor to the NIH?

SZ: Sure. The thing that I've seen with friends in research careers is that no one seems to just stop. It's a step function. You stop some things, preferably the things you don't like. And then you keep going and going. And papers, in particular, tend to have a long developmental span. So, it's not uncommon for people to continue to finish up papers after they retired. And I certainly was one of them. But the role that I've had as scientific advisor was a contract, I'm under contract to the division to do that. And that's to provide some institutional memory as long as mine lasts. (*laughs*) To help the new leaders and the managers gain familiarity with some of our processes. We've kind of done things where I did something with the new hire so they could see it. And then the next year, they did it and I looked at what they did. And then the third year, they're on their own. So some of that. I continue to contribute for scientific review of new proposals and help with some personnel and practical issues. And also help with some special reports that the division had to provide to NIH like salary and resource equity. Just whatever was helpful.

HWT: I have some general questions for you. What is, you know, the Supreme Court just, I believe, overturned the Clean Water Act. And I wanted to ask you, yes, so, highly

problematic. What are the reforms that you would enact to regulate chemicals in this country? You've also said that little attention is paid to prevention in the United States. What do you think that would entail here? What would change that?

SZ: Well, I think, I don't know the date of the quote when I said little attention is paid to prevention. But I think there has been a shift. I think, for example, President Biden, the current administration, he just stated a goal for reducing the impact of cancer. And it was a very ambitious goal. But there's an acknowledgement now that if we just apply what we already know, we can get a long way towards that goal. And a lot of it has to do with prevention. And there's been such an advance with what we know about smoking and alcohol and environmental and occupational pollution and screening, and things like the HPV vaccine. So, I think there's a lot more known and a lot more support for preventative activities now than I think there has been in the past.

The regulation to me is so discouraging. Because we had good regulation. And then we went to a period where those regulations were not enforced because everything was tied up in the courts. And now we're in a period where the regulations themselves are getting dismantled. So, it is discouraging. I think people, you know, a lot of people don't remember what it was like before. I mentioned how I grew up in a suburb of Boston that was on Boston Harbor. When I grew up, the water was filthy! Often, we would see raw sewage floating by. And now it's beautiful. It's pristine. It's clean. So people forget that regulation really made a very good difference. The smog. Lots of things. And I definitely worry [about] that as we dismantle it. So, I think if we could enforce regulations that exist

and stop dismantling it, stop putting foxes in charge of the chicken house, we would be in better shape.

HWT: We've talked about technological advances that changed your field. Is there anything that you wanted to add regarding any of those?

SZ: I think the ones I mentioned, the computing and the high throughput laboratory processing thing. I think the early part of my career, computing just became a faster way to analyze. But now, I think these international collaborations, you know, they couldn't be happening without the kinds of technology we have.

Some technological advances I think are negative. For example, we used to select controls for our study through a random digit dialing process that was quite scientifically sound. Well, you can't use that at all now. No one answers their home phone. (*laughs*) That's not the way people communicate. But the flipside of that is maybe you collect information online from study subjects in a much cheaper way. And repeated and active way than we could before. So that I, it all helps advance the field.

HWT: Can you talk about DCEG's transdisciplinary approach across divisions, institutes, and broader populations?

SZ: Now I think it's probably one of the biggest strengths of the division. First of all, within the division, I can't think of a study that is launched that does not include people from

multiple branches. You know, every study you'll have someone from the biostatistics branch, someone from, who has the expertise in this exposure and that exposure. So, within the division, there's just a lot of collaboration. But there's also outreach and collaborations with laboratory scientists, information technology scientists, different exposure assessment scientists around the country and around the world. So it enhances the research enormously. Couldn't be done without it.

HWT: And then also, what about partners in government, academia, industry? How have you worked with those? I know that's broad. Take one at a time. Government's obvious, but academia and industry.

SZ: Well, government, for example, we actually in many of the studies we worked closely with folks from NIOSH [National Institute for Occupational Safety and Health} on the occupational side and EPA [Environmental Protection Agency] for the agricultural studies we did. They have programs where they're out monitoring exposures regularly. Other government agencies, there are studies that we've done looking at contaminants in water systems. So, working with the municipalities and states, getting their water quality data. Or the USGS, the geological survey. So, we definitely tap into many government agencies for either folks with the expertise or the data. They have the data we want.

In terms of academia, we have many, many collaborations with researchers in academia. And they may be epidemiologists, but they may be people in other disciplines like

pathology or immunology that are needed to really shed light on what it is we're studying.

HWT: What about industry? Anything there?

SZ: Yes. Well, as I mentioned, we often have to have access to industrial populations. So, there are collaborations, partnerships, I would say, there. And that is true in other countries, as well. There's also collaborations with industry in terms of development and technology. So either the chips, working with the companies that help the genetics, the machines that geneticists are going to analyze their specimens on, you know, what we need, so kind of interactions there. The HPV natural history studies, and the vaccine studies, those are all done in different types of partnership with folks from industry.

HWT: Before we move on to just a handful of general questions, as we wrap up, and I know we're almost at time. But I hope you have a few more minutes.

SZ: Sure.

HWT: I'm wondering if you could just take a moment to talk about your work with the farm workers. And having access there, for example.

SZ: Yeah. So, the access there, well, the work I did was identifying a number of methodological problems that could inhibit an epidemiologist's study. And could we

solve or get real information on those problems because then that could open the door for research. So, for example, there's always this thought, well, you can't trace them. So how would you find people later? If they knew they had worked in a certain crop, how could you find them later and find out what happened to their health? So, we did two studies. One where we identified people at the northern part of the migrant stream at a clinic and tried to see if we could find them a few years later. And the other study was we identified them in their home county in Texas and see if we could find them later. And our success rate, particularly in the starting in their home county, was very, very good. Because if you sent people into the community, people knew people who knew people who knew people and we could find them. So that kind of flew in the face of you can't do research because you can't find them again.

Then there was the thought of, well, they can't tell you what their exposures were. No, but they could tell you what crops they worked with and what tasks they did and where it was. So, can we link that to pesticide application records that we could find elsewhere and assign possible exposures? So, we did a lot of methodological work like that.

And it led to our research but also people in various universities in the country were able to use those methods papers when they applied for grants or for other projects to say it is feasible. Because what was happening was, people would just say, "Oh, none of this is feasible," and they wouldn't get funding. So it helped. Those body of studies that we put together. And it was all done with researchers in Texas and California and Wisconsin

who are "boots-on-the-ground" with this population. So you know, it helped facilitate research. So that was that aspect of research on farmworkers.

We did have strong connections with the farmworker's union [United Farm Workers]. And I did spend some time looking at the data that they had inhouse. Some health insurance records. But there was not enough information on the health outcome, or the reason for the visits. It was very much a financial database and not medical. So although they were very interested and cooperative and helpful, we did not actually do a research of the union, involving the union itself.

HWT: Before we move on to just a handful of general questions, is there anything that we haven't talked about in terms of your own career, in particular, of course NCI, that you would like to mention?

SZ: No. Dr. Fraumeni always has this quote that he cites. It's a saying from Confucius, which is: "Don't forget who dug the well when you drink the water." And for me, I think the three mentors that I had not only dug the well for the work that I was able to do, but for many researchers across DCEG, they laid a really good foundation for a phenomenal research program. So, that's all.

HWT: Thank you. So I have some Covid-19 questions. I'm just not sure how relevant they are, because you did retire. So you tell me.

SZ: Oh, I'm not there. Yeah. (*laughs*)

HWT: Yeah, you're not there. So in terms of response at NCI and all of that, even as an advisor, is that something that's relevant to you?

SZ: I really haven't been involved. I've certainly seen and observed how there were some projects that the division did to help the effort, both based in the laboratory and also having – creating a platform where testing data could be saved and used for research. But I really haven't been involved. So.

HWT: I'll ask one question because it's about health equity. But again, you'll tell me if it's relevant. Of course, Covid-19, in particular, you can see this, had a disproportionate impact on marginalized communities. But is that something that's relevant, has been relevant to your work, the idea of marginalized communities? I mean, farmworkers can be described that way.

SZ: Right.

HWT: Can you take a moment to talk about health equity? Is that something that you've thought about?

SZ: Yeah. I think certainly the farmworker research was related to health equity issues. This was a population where their potential for exposure for going into fields after treatment

and perhaps not having access to laundry facilities and things like that, they could end up with higher exposures than others. So that was certainly a concern that helped drive that research. I think, you know, across the division there are many research endeavors to address this sort of thing. Particularly in the area of HPV screening and vaccine. But screening in particular. How can we perhaps change the way samples are collected so that things can be done in an acceptable way to various population subgroups that we were screening may be low screening rates, may be lower than would be optimal. But you know, I haven't personally been leading those studies at all. So.

HWT: Are there any studies related to, my understanding, my limited understand, is that women, at least historically, tend to be left out of health studies in terms of, say, automobile safety or things that might surprise us. That the safety measures in car design, for example, are geared toward men more than women. Things of that nature. Is there anything that you came across in terms of sex differentials?

SZ: Well, the work that I did on occupational cancer among women definitely revealed that the data just aren't analyzed. Never mind even when they're not collected. But when they're collected, they're not even analyzed. But also, the idea that many times the protective equipment that is provided in an occupational setting has been designed for men, not for women. Even, and obviously the size of the equipment and that kind of thing, but sometimes even like the height of a hood that's supposed to protect you from ventilation, if you're shorter, you may be below the hood. So, there are just a lot of aspects of that.

But there's other new research areas that the division is launching that has to do with marginalized populations, too. There's a young researcher who is looking at transgender health risks and screening and healthcare delivery and the effects on cancer rates, so there is a lot that's going on that's new that I'm not involved with. But the division is certainly keen to address those issues.

HWT: Well, I'm glad I asked. So, a few questions about medicine and society. And obviously you devoted your career to public health, so these are very relevant. What skillsets and attributes do you think you need to work in public health? And we've talked about collaboration, but what role does collaboration play? And also, what do you like and dislike about being on a team?

SZ: Well, I like teamwork. I think it's really important to bring different expertise, different disciplines, but even different viewpoints and life experiences and approaches. I think it's really important. And people excel at different things. And you can get a much better product if it's a diverse team.

In terms of collaboration in public health, I think it's key. Maybe you can do lab research not interacting with other people. But you cannot do that in public health. Both the research projects themselves require collaboration just to pull them off. But then also if you want to implement any of the recommended actions that would come from it, come

from your findings. And the research is not necessarily the ones who do the implementation. But even to get that message delivered takes collaboration. So, it is key.

HWT: What about in dealing with the public? Because obviously public health is concerned with the health of entire populations. And the population itself is not always well-informed. We can speak to climate change denial or antivaxxers. What are the challenges for you in terms of public health policy?

SZ: I think that the challenge is to get people to look at and base decisions and thoughts on high-quality data. I often hear from people about an anecdote, either positive or negative. And an anecdote is not evidence. That is not good enough evidence. It may be a starting point that gives you an idea to do a study. But people have to really – it would be great if we could educate people better on what makes a good study and what doesn't, and what data can be believed and which data are really not high-quality scientific data. And I think that science communication is really important. In our division, when we inherited the Chernobyl project is when we had our first science communicator. That communications manager joined the division. And it has grown in importance since then to be able to explain what we've done, get out good information.

And I think the frustration sometimes with dealing with the media is they always want to hear the other side, too. And sometimes they present it as if they are equal weight. You know, this is what this study of 100,000 people showed, and here's somebody over here who disagrees. So, what's the equal weight? It's a false equality sometimes in the way

media stories are presented. And that can be very frustrating. So, I think, again, I think it's trying to get the word out. And it's very, very difficult with any Google hit has the same merit. (*laughs*) And it's frustrating. But that's all we can try to do is get a good message and explain the difference between what is being reported here versus what might be better information over there.

HWT: Another factor, of course, is competing narratives. So right now, there's a Netflix documentary, super popular. I believe it's called *Fantastic Fungi.* And there's somebody, Paul Stamets, who's billed as the main expert. He gave his mother turkey tail mushroom capsules to beat back her breast cancer and it appeared to work, although maybe it's anecdotal. Would you say that this is quackery? Or how should the public become informed?

SZ: Well, I haven't seen it. I'll put it on my list to watch. Again, I think I would just try to stress it is an anecdote. I mean, I can't tell, I haven't seen it. But it sounds like it's an anecdote. And you know, randomized clinical trials are really good. Are really important.

HWT: So, moving on from communicating with the public, let's go back to the mentorship, which we talked about in the beginning and throughout. You obviously had some really amazing mentors in your life. But you've also received awards as a mentor, and more than once. Can you talk about the role that mentorship in general plays in science? And also talk about your own style as a mentor and what it means to you.

SZ: It was a great honor to receive those awards. Because I do think mentorship is key. It certainly played a huge role in my being able to learn and do anything. And you know, I think when I have mentored people, I really just try to encourage them. I think it's important to find out what people's goals are. Not sure I always did that well. But to someone, what is it that they want to head towards? You can almost think at NCI well they're coming in and they must want to end up as a tenured PI. You know, this is the treadmill, the track, and do they want to run on it? But that's not always the case. And some people have very different goals and ideas. So, I think it's important to find out what those are and then help. I think when I mentored people, it was a combination of maybe giving people an opportunity to work on a project. Maybe it was they were working with other people on projects, but they needed help with their writing. Or I made sure people were introduced to potential collaborators. Nominated them for awards. You know, just that kind of encouraging and helping them get to the next step.

HWT: I noticed in my interviews that in science in general, mentorship is super important. But you don't see that in all industries, if that's the right term, all the time. What is it about science that mentorship plays such an enormous role?

SZ: Well, I think it's important everywhere. I think people are missing out by not having it elsewhere. I'm not sure it's something unique about the scientific endeavor, or if it's just been built into our culture because of the structure. People, the old professor model with people coming in and working in their lab and then going off. You know, maybe it just, it

was built in a little bit more. But I can't believe that it wasn't important in every endeavor across industries.

HWT: So, what advice would you give to encourage young scientists to continue pursuing their goals or seek out necessary resources, even sometimes in spite of setbacks or barriers that they might face?

SZ: I think if there is a particular problem that they see is hindering them, to really get help on that issue. Seek it out. And if it has to be from people other than your primary collaborators and mentors to do that, I was thinking of one investigator who was brilliant and very talented. But their writing was a challenge. And I would say, "What are you trying to say here?" And they would tell me, "Well, this is what I'm trying to say." It was perfect. So write that down. (*laughs*) You know, they couldn't get it to paper, but they could say it. So sometimes people don't want to show the weakness to their immediate supervisor. So maybe go outside your immediate chain of command and find help and input outside that, if you find you're running into a roadblock where you want to look around and see if there's someone else who could help you to the next level.

HWT: So, one more question, which is, and again, obviously you're retired. I read in the strategic plan 2020-2025 that major goals of the DCEG include developing and implementing strategies for workforce equity, which a lot of people are talking about right now. Women and people of color are typically underrepresented in science. What would you like to comment on?

SZ: They're not particularly, the women, are not particularly underrepresented in epidemiology, per se, and public health. We actually have some of the best statistics across subgroups of medical research than others. And in our own division, as I said, the leaders were really good about promoting and giving responsibility to women. There's been a big change in the field from when I started to now. As I said, it was sort of male physician-dominated. Now I think it's much more, the women outnumber the men. And over the years when I was deputy director, we looked every year at salaries by years since degree and by gender. And would look and see were there any people who looked off the line and there was not and was there a good reason for it or not. Was there something that needed to be corrected? And we would do that.

But having said all that, I think you're absolutely right about people of color being underrepresented. And what we've tried to do is just encourage the pipeline from an early stage. Get involved with recruiting people and having special programs to bring people in. Provide – and also provide opportunities to do research on topics that are most of interest, that might attract people of color to the division.

And I think the big thing is to interview and advertise widely. And perhaps in batches. I think rather than, oh, this one person was referred to me by some professor. Oh, they look good, I'll hire them. Well, it's very much a network that's sort of closed. Whereas if you're advertising openly, transparently, and widely, and looking at all the candidates

together, you might go oh, well, these stand out. So you might find that you're attracting people that you wouldn't have met otherwise.

So, the field has changed as far as women. And I think we're in good shape. And I know internally, we make sure the salaries are fair. But for people of color, I think we need to continue to take efforts to make the opportunities known and try to find good candidates. There's a lot of competition. (*laughs*) So.

HWT: So, one more question. Why did you choose to spend your career at the NIH?

SZ: Well, I found that it was a tremendous place to learn. It was a tremendous place to work because you'd go down the hall and there was the world's expert on any topic in an office. And the other experts were coming in to visit all the time, so that was tremendous. The resources were there. The field was appreciated and respected. And I had terrific supervisors. I think a lot of people end up leaving a job because of issues with who they worked for. And that was not the case. It was a very, very positive place. And it's wonderful to be part of the organization, even at, you know, the local level, NCI level and NIH level that has such an impact on the country's and the world's health. It's very rewarding to be part of that.

HWT: Fantastic. I think that's a terrific place to end, unless there's anything we haven't talked about. (*laughs*) It's been thorough. So, you're satisfied that you've said what you wanted to?

SZ: Yeah. Thank you.

HWT: Well, thank you so much. It's been a pleasure to meet you. Enjoy Maine. It sounds beautiful out there.

SZ: Thank you.

HWT: Okay. Take care.

[End Interview.]