National Institutes of Health
Clinical Center

Oral History Interview with

THOMAS A. FLEISHER

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PRESENTED BY:

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THOMAS A FLEISHER

Biographical Statement

Dr. Thomas A. Fleisher was born in Rochester, Minnesota, in 1946. He received his B.S. from the University of Minnesota School of Medicine in 1969, and his M.D. from the University of Minnesota School of Medicine two years later. Dr. Fleisher completed his internship and residency at the Department of Pediatrics, University of Minnesota School of Medicine (1971-1975). He then continued his postdoctoral training at the NIH's National Cancer Institute in the Metabolism Branch (1977-1980). For three years, from 1980-83, he served as Assistant Chief of the Allergy-Clinical Immunology Service at Walter Reed Army Medical Center. He then returned to the NIH in 1983, to serve as Chief of the Immunology Service at the Clinical Center's Department of Laboratory Medicine—and stayed with the Center until his retirement in 2017. Dr. Fleisher rose through the ranks within the Department of Laboratory Medicine, finally serving as Chief from 1998-2017. Dr. Fleisher has had a long career in scientific research. He has published over 240 peer-reviewed scientific articles and has authored and co-authored more than forty book chapters, as well as co-edited the textbook Clinical Immunology: Principles and Practice. He was part of a group of NIH investigators who identified and characterized the disorder Autoimmune Lymphoproliferative Syndrome (ALPS). In addition, Dr. Fleisher taught pediatrics at the Uniformed Services University of the Health Sciences in Bethesda, Maryland, for over twenty years. He has served on numerous editorial boards, including Clinical Immunology, Clinical and Diagnostic Laboratory Immunology, and Frontiers in Pediatrics. He is a member of many professional organizations and has served on their boards, including the Executive Committee of the NIH, Clinical Immunology Society, American Academy of Pediatrics, and the American Academy of Allergy, Asthma, and Immunology, which Dr. Fleisher now serves as Executive Vice President.

Interview Synopsis

Dr. Fleisher begins the interview with memories of his childhood growing up in Rochester, Minnesota, where his father was on staff at the Mayo Clinic. Surrounded by physicians, there was little doubt that he would enter a career in medicine. He recalls an early mentor, Dr. Robert Good, in Pediatrics at the University of Minnesota School of Medicine and describes the collegial and intellectually invigorating experience of working in Dr. Thomas A. Waldmann's lab as a fellow at the NIH. Dr. Fleisher describes in great depth the environment of the Clinical Center, and indeed, the NIH during the decades that he worked there. He speaks about the collaborative and supportive nature of ongoing research and includes stories about some of his colleagues, including Anthony Fauci, Steve Holland, Henry Masur, Harry Malech, Sergio Rosenzweig, Carol Langford, Gary Hoffman, and Jennifer Puck, as well as Clinical Center Director John Gallin. He describes how he helped grow the Department of Laboratory Medicine, including renaming it, and the colleagues he has recruited, as well as sharing stories such as how the Laboratory experienced Y2K. He speaks about the team he worked with to discover the new disorder ALPS. Dr. Fleisher speaks about the development of the field of immunology over the years, the importance of professional organizations in a scientist's education and impact, and the power of collegiality, collaboration, and scientific inquiry—and most importantly how these factors affected his life and career.

NIH-CC Oral History Project
Interview with Dr. Thomas A. Fleisher
Conducted on July 13, 2020, by Sheree Scarborough

SS: Today is July 13, 2020, and this is an oral history with Dr. Thomas A. Fleisher for the Clinical Center of the National Institutes of Health. My name is Sheree Scarborough and I'm in my home in Roanoke, Virginia. Dr. Fleisher, where are you?

TF: In Bethesda, about a mile and a quarter from the NIH.

SS: Obviously, we're meeting online because of the coronavirus. Dr. Fleisher, thank you so much for taking time out to meet with me today. As I mentioned a few minutes ago, off record, I like to start with people's backgrounds and their education. When and where were you born?

TF: I was born in Rochester, Minnesota, in 1946, a post-World War II baby, although my parents were immigrants. They came to the United States in 1937, from Germany. My father was at the Mayo Clinic, so I grew up in a medical environment, if you will, small town with lots of doctors. When I was a child, Rochester was about 35,000, and there were somewhere around 1500 physicians at the Mayo Clinic, including their residents, a little bit of an unusual per capita environment in terms of physicians.

I went to public school in Rochester. There was only one public high school. And then I went to the University of Minnesota, both as an undergraduate and as a medical student. I actually started medical school after three years of college. Minnesota had an accelerated program to get into medical school. You could apply early in your junior year. And much to the consternation of my advisor who was a physician faculty professor at the university, I opted to go early. He thought that was a bad idea because it eliminated a year of education with opportunities to learn some non-

science, non-medical topics a little better. I actually started medical school at the age of twenty, which was a little unusual.

SS: Yes.

TF: I really didn't know what I wanted to do. I was young and immature, in retrospect. But Minnesota had a very strong pediatrics program at the time and I stayed on and did my pediatrics training. And in that setting I encountered the first person that really influenced me, a renowned pediatric immunologist named Robert Good who actually performed the first bone marrow transplant in humans, reported in 1967.

I like to think that my life was defined by serendipity at multiple times. When I was a resident we were still at war in Vietnam and some of the people in the training program ahead of me actually were drafted and sent to Vietnam. There was a program called the Berry Plan, which was a deferment program. You agreed to serve for two years. In return, the military would allow you to finish your specialty training. I actually signed up for the Berry Plan in the Navy. I can't tell you why it was the Navy. I just signed up for it. That turned out to be a rather fortuitous decision. In fact, the doctor draft was done away with six months after I signed up for the Berry Plan. If I had been a year later in the training program I would never have signed up for it.

I say that because I got involved in bone marrow transplantation at the University of Minnesota and I presented a poster at a hematology meeting in Houston. Two of the people that visited the poster were physicians doing bone marrow transplantation in the Navy in Bethesda, one of whom was the commanding officer of the Naval Medical Research Institute [NMRI], Bethesda. He asked me some questions and we sat and talked for a while, and then he offered me the option that he could arrange for my orders to be connected to the Naval Medical Research Institute in Bethesda, and I would join the bone marrow transplant program there.

I came to Bethesda in 1975, primarily because of a presentation of some data from patients that I had been involved with while I was still a resident. I took some time off from the actual clinical pediatric training and worked in the bone marrow transplant unit and in the lab, so my residency actually spanned a longer period of time. That additional research time really facilitated my coming to Bethesda where I continued seeing transplant patients. They had a small immunology research lab, with a couple of physicians, a Ph.D. and some techs, and I worked there as well.

Serendipity played into my career again during the second year of my Navy time when I was talking to a friend who had been my senior resident at Minnesota and came to the NIH after two years of residency for research training that was the equivalent of going into the military. He suggested that I talk to a very well known, now world renowned, clinical investigator in the Cancer Institute because there was an unexpected opening in his lab. Interestingly, this was the result of to an allergy to rodents that became really problematic and the fellow in that position had to leave and went back to Stanford. So I interviewed with Thomas Waldmann and he offered me the position. So I came to NIH after my two years in the Navy at the Naval Medical Research Institute.

SS: It's amazing what role serendipity does play in our careers, isn't it?

TF: I just talked to the NIH fellows last week and we talked about nature, nurture, and serendipity.

SS: May I interrupt you a minute. I have some questions I'd like to explore a little bit about some earlier things you said. Your parents emigrated from Germany in the 1930s. Were they fleeing Nazi Germany?

TF: My father was very concerned about the politics of the Nazis and they were the only people that left from their respective families. He was a Ph.D., and his Ph.D. mentor in biochemistry, had arranged interviews with both German and American entities. So my parents left in 1937. They actually were on the last German Ship, the S.S. Bremen, that was allowed to take passengers to the United States. They got married in January of 1937, and they emigrated in February. Gerhardt and

Gisela Fleischer (they changed the spelling to Fleisher when they became naturalized citizens in 1943).

It was obviously rather remarkable timing. His mentor, Professor Adolf Butenandt, ended up getting the Nobel Prize in 1943, I believe, for steroid chemistry. My father was also a steroid chemist. He went to the Schering Drug Corporation, which was a German-based company. When the war broke out and the United States declared war with Germany, all German nationals were actually relieved of their jobs. So my father went to Cornell Medical School and worked there, it must have been 1941. Then in 1945, he went to Mayo Clinic because there was somebody named [Edward Calvin] Kendall who got the Nobel Prize [in 1950] for cortisone (Kendall and [Philip] Hench). Cortisone is a steroid as well—a steroid compound—and from that start he ended up running a laboratory as part of the Department of Lab Medicine, later in the 1940s or early 1950s.

It's funny that we both ended up in the same departmental entity, very different pathways. His via a Ph.D. in biochemistry, mine via pediatrics, which was unusual. That's how they ended up in Rochester and how I ended up being born there. My father stayed there until he retired I think in those days it was at age sixty-five. So it probably was 1976 or '77.

SS: You went to school in Rochester. Maybe it was the fact that your father was a scientist, or can you remember being interested in science?

TF: I only knew professionals who were doctors, basically. The person who started pediatrics at the Mayo Clinic was a German physician who had been originally at Johns Hopkins. He graduated in 1898 from Heidelberg, a very fascinating physician. He didn't care for me, but we stayed in touch with him. Samuel Amberg was his name. I still remember visiting him when I was in medical school. He was in his nineties and was reading the Journal *Science* with a huge magnifying glass, in a three-piece suit. He was always in a three-piece suit. Fascinating person. He always gave me books and I still have some of the books that he gave me as a child.

I went into medicine in good measure versus something else in science because of where I lived, because of the experience I had with my parents' friends, all of whom were staff members at Mayo. It was kind of a fallback position for me. I started out as a math major and decided that wasn't going to be where my future lay, so I said, “Okay, I'll go into medicine.”

SS: That's such a heady environment for a young person growing up. The Mayo Clinic is so impressive.

TF: It was a special kind of environment to grow up in. I suspect some people found it repressive and parochial. For me, it was everything that I liked. It molded me to decide on medicine, which for me was the right choice.

SS: Then you went to college at the University of Minnesota, in the 1960s.

TF: Yes, I went in '64 and I went to medical school in '67, graduated in '71, started my residency then came east in '75. I had a parochial life in that it was entirely Minnesota-based until I was twenty-nine years old.

SS: Was there unrest on the campus at Minnesota?

TF: Not the same as in many campuses, but there were marches. At one juncture I told my parents I was going to join the Peace Corps, they had an absolute conniption and told me I was nuts and to go back to school and be quiet. The times were turbulent, clearly. The unrest over Vietnam was palpable. But I was busy going to school, so we didn't really get involved in most of that.

SS: Do you have siblings?

TF: I have one brother who is a good bit younger than me, seven years younger than me, and he's not in science.

SS: I find all that interesting. Then you left and you went to Bethesda, which is close to D.C. where a lot of stuff was happening.

TF: We came to Bethesda ostensibly for two years and it's now forty-five years.

SS: When you say "we," were you married?

TF: Yes, I was married. I got married in 1969. It was a very different time. Most of my classmates in medical school were married by the time that we graduated, probably not the situation now. We have three sons, all of whom are married. All the children got married much later than we did. It was just a very different time. We had two kids when we moved here, a three-year-old and six-month-old.

SS: My goodness.

TF: In retrospect, a lot of things happened that are not easily explainable other than they happened. It wasn't based on some master plan that was being fulfilled. My wife was a social worker in Minnesota. She dealt with child custody cases and child abuse, which was not so great. When we moved here she recreated a career later when our kids were in elementary school, working with the elderly as a social worker.

SS: What is her name? What was her maiden name?

TF: Hopkins.

SS: And her first name?

TF: Mary.

SS: Before we jump forward again, I have a question about pediatrics. Why pediatrics?

TF: I had been a camp counselor for a couple of summers. I liked working with children. The program at Minnesota was really quite an exceptional program at the time, very academically oriented. I had no intention of ever being a private practitioner.

SS: Oh really?

TF: Growing up in Mayo, I thought everybody worked in multi-specialty settings. I never heard of somebody as a solo practitioner. That was a non-entity. Pediatrics at Mayo was actually quite small. It was not nearly as robust as at the University of Minnesota other than for surgical requirements. Children don't travel like adults do for medical care. There was really not a lot of competition between the University of Minnesota and Mayo at the level of pediatrics.

The residents in my class, I would say at the time I was training, three-quarters of the residents came from other institutions, not from the University [of Minnesota]. I don't know what it's like now but I think it is a different scenario than it was at the time. I think there were twelve of us in each residency class. Historically, there were always a number of M.D. Ph.Ds. in the Minnesota Pediatrics training program back in the '60s and through the early '70s, but that changed. It became much more focused on preparing people for pediatric practice.

SS: Are you an M.D. Ph.D.?

TF: No. I started a Ph.D. program when I took that one-year off to work in the lab and do transplants. Then for reasons that I don't even recall, I concluded that it was not going to be worth four years of effort. I had the obligation to the Navy that was coming up and they weren't interested in having people pursue Ph.Ds. before they came. The person who actually arranged for me to come to the NMRI ended up becoming the scientific director of NIAID [National Institute for Allergy and Infections Diseases] for five years when Dr. [Richard] Krause was the Director of NIAID [1975-1984].

SS: Who was that?

TF: Ken Sell. He's now deceased. This would have been probably the late 1970s until Dr. [Anthony] Fauci became director.

SS: He's the one that brought you there?

TF: He was the commanding officer at NMRI then he retired from the Navy and became scientific director of NIAID after which he moved to Emory and became Head of Pathology. Dr. Sell passed away quite a few years ago.

SS: On the heels of why pediatrics, why immunology?

TF: We had a lot of immune deficient children that came from all over the United States, actually some from outside of the United States. While I was doing a year of graduate school I took some immunology courses. They were fascinating and I worked in Dr. John Kersey's lab. He was actually a [Dr. Robert A.] "Bob" Good trainee. He was trained as a pathologist, but his appointment was also in pediatrics. He resurrected the bone marrow transplant program when Bob Good went to Memorial Sloane Kettering. I worked in John's lab for about a year and a half. It was interesting and I liked it. We wrote a couple of papers and it cast my lot.

The transplant program, it's a question of manipulating the immune system, in our case, actually most of the patients we transplanted in that era were not immune disorders, but had either malignancies or aplastic anemia.

Then the Navy was, again, immunology oriented. Next, Tom Waldmann's lab was entirely immunology oriented. I don't know that I had a burning interest in the immune system when I was twenty years old, but I acquired an interest because of opportunities that presented themselves.

Then it became a natural path to follow. It was clear that it was an area that would only increase in terms of impact. When I think back to what we were doing in 1973-1975 to try and understand immune function, those forty-five to forty-seven years have really witnessed a dramatic expansion in our understanding. There's plenty more to learn, but it has been revolutionary.

SS: I bet. Thank you for allowing me to dig a little deeper. Now we're in Tom Waldmann's lab. Tell me about that.

TF: That was an extraordinary experience. He's a fascinating person. He's a brilliant scientist and knowledgeable clinician. He was full of extraordinarily good advice. He came to the NIH I think in 1955 and had a sixtieth anniversary a few years ago.

It was a really remarkable period of time in that lab. The name was the Metabolism Branch. At the time Warren Strober (moved to NIAID in the 1980s). Mike Blaise and Jay Berzofsky, Warren and Jay are still active at the NIH. The people that trained there, I always felt humbled. The group that was in Tom's lab included somebody who's now deceased, Stan Korsmeyer, but became the Sidney Farber professor at Harvard and a member of the National Academy, and another is at the Gladstone Institute, Head of their Virology Division. It was just a remarkable place. We were the primary facility caring for immune disorders at that time, interestingly enough.

NIAID had John Gallin who recruited Harry Malech and Steve Holland. They took care of patients that had defects in neutrophils, a particular kind of white cell. The antibody deficiency patients came to the Metabolism Branch in the '70s. Also there were Wiskott Aldrich Syndrome patients, and others who came to the Metabolism Branch. So despite the name and the fact it was it was in the Cancer Institute, there was actually a quite active clinical program involving immune disorders. This was complimented by a very active investigation program, and there were probably in the neighborhood of twenty physicians between faculty and fellows.

What do I remember most: a busy lab and incredible preparation for oral presentations. We still made slides with medical illustrators and you started practicing weeks before the actual presentation because you knew you would have to redo virtually all of your slides. That's one of my long term memories is making sure that anybody who presented an oral abstract and came from the Metabolism Branch had been grilled so much before they got to the meeting there was no way that they would not be able to answer any question and would not give a very smooth, polished presentation.

SS: These were presentations outside of NIH?

TF: These were for presentations like the American Federation for Clinical Research, which has been relabeled since, the American Society for Clinical Investigation. The Society for Pediatric Research I think was my first talk in Atlanta on a new disease we described. That is one memory I always will have is how incredibly well prepared anybody who presented, coming from the Metabolism Branch. I've chaired sessions and can certainly comment that there are many other facilities that do not prepare their fellows for their talks at that level. It actually was really a good learning experience.

The science was high quality. It was demanding. Some of it actually impacted on my career choice in that I concluded after three years there that investigator-based basic science probably was not my calling. I did better at more translational and collaborative work.

SS: Why was that? Why did you come to that conclusion?

TF: I think the people that I was working with were more capable. One of the things I learned in that setting was to be introspective and sort out what you do well and try to align your career choices with what you do well, deemphasize what you don't do so well. I've had fellows that spent a year with me who talk about what they want to do and they seem to come up with a plan for their future that destines them to fail based on their past track record. If you've been in a lab for four years and you have one publication, which was not what happened to me in that setting, that's not particularly

consistent with a future successful and funded investigator outside of the NIH. You have to learn where your strengths lie and where you're not so strong and try to mold that into the best career opportunity.

That's one of the points Tom Waldmann talked about. For instance, I'll never forget when he said, "If you are offered the opportunity to be chief of a division directly out of fellowship, turn it down." In the first place, what kind of division is looking for somebody who has no experience other than training? Your business card will look good; your job will be bad. I happen to think that the valuable learning experience included the meetings with the lab and the advice about don't let your ego get caught up in your job choice. Pick something you're confident that you will be successful. It really did help guide me in how I proceeded with my career.

SS: It sounds like you would make a very good mentor for students.

TF: I don't know. I think I have influenced people. I've also understood that there are some people who you can't possibly change what they're going to do. They're going to go on and they have the right to make their own mistakes. I enjoy teaching and I enjoy working with fellows. Personally I think a program with people in training is so much more advantaged than a program without people in training. They bring vitality, energy, different perspectives, enthusiasm and that's what really ultimately makes things fun.

SS: Yes, I agree. You were in that lab between 1977 and '80. Where does AIDS fit into this?

TF: I'm trying to remember when Henry Masur's paper was published when he was at Cornell. It was one of the two original *New England Journal* [*of Medicine*] articles about AIDS-related [illness]— I think it was 1981.

SS: Sounds familiar.

TF: Dr. Fauci was starting to get involved in immune disorders, in the 1970s, not HIV immune disorders, but congenital immune disorders, because they were setting up studies looking at similar things to what was being done in Tom [Waldmann's] lab. That was early on. After they were involved with autoimmune disease when Sheldon Wolff was still there.

I remember discussions regarding HIV with Debbie Birx, the coronavirus [task force coordinator] who spent a year in my lab in 1983 regarding this new "immune deficiency syndrome", when I moved back to the NIH. She had her first daughter and had a lot of post-partum bleeding, the last thing she said post-delivery was "no transfusions" because at that time there were no tests for HIV making the blood supply potentially a source of HIV. It was actually a story in the newspaper, so I'm not providing privileged information.

SS: Following the fellowship at NIH you left. You went to Walter Reed. Tell me about that.

TF: I had published a paper in the *New England Journal* and there was senior staff member in the Allergy Immunology Group, a well-known allergist named Dick Evans who called me and asked me if I'd be willing to come to Walter Reed, that they needed somebody to lead a little research lab. I had taken the Allergy Immunology Specialty Boards. And [he asked] if I also would help teach the Army residents and see some patients. Honestly, it was again a serendipitous moment that at the time I didn't really think much of it other than that at that juncture we had three kids. The youngest was two and it seemed easy while I decided what ultimately to do. So I agreed.

Then another colleague of mine at the NIH from NIAID, somebody named Mel Berger, who ended up at Rainbow Babies at Case Western Reserve some years later, also came to Walter Reed the last year I was there, and he took over the lab when I went back to the NIH. I viewed it as a transition opportunity without moving, with some opportunity to continue doing research, continue teaching residents, fellows. It was very different than NIH because their fellows really didn't do any research. They were all clinical until Debbie [Birx] came as she trained there.

It proved to be a bit of an eye-opening experience because most of the patients that came there were routine allergy patients for asthma, for venom immunotherapy if they had bee sting allergy or wasp allergy, for allergic rhinitis, for eczema. There were two people in the lab that I managed and we published a couple of things while I was there. It was not going to serve me in the long term, but as it turned out, serendipity played in.

I went there in 1980 and in early '83, there was an ad in the *New England Journal* about an immunology lab being created at the Clinical Center in, at the time what was called the Clinical Pathology Department.

The NIH is an interesting place. When I was training there was no virology available in microbiology. It only could be done in a research lab. Dr. Ray Dolan, who went to the University of Rochester from the NIH, had research lab at NIAID and did some virology, but the microbiology people didn't seem interested in 1977. Many things happened. HIV created the need for critical care. There really was no critical care. Most of the patients that came to the NIH in the '60s and even the early '70s, came for long stays as part of natural history studies, not for acute illness, other than there was a valve replacement program that was ended by Congress, I think in the 1990s, maybe even earlier. There was some intensive care need for surgical patients, but general medical patients were handled on the ward, covered whoever had the patient.

When I was there actually the head of the Cancer Institute was Vincent DeVita and his son was in a laminar flow isolator room on the second floor for many years related to aplastic anemia. He had complete failure of blood production and died at the NIH after I left. There was a pediatric oncology program, the Pediatric Oncology Branch, and they did some bone marrow transplants in the 1970s. That came to a halt in the 1980s.

I really think the HIV program under Dr. Fauci is what drove the Clinical Center's movement towards full service medical care for really acutely ill patients along with NCI cancer patients undergoing intensive chemotherapy. This also made the laboratory change dramatically. Early in the 1960s, they

called people back at night to perform needed lab tests because most of the patients weren't acutely ill. They were here for long-term studies and basically were housed at the Clinical Center. That may be a bit of an over-simplification. But the reality is the lab became a 24/7 operation coinciding with cancer and HIV patients.

SS: Interesting. I have not heard that perspective yet.

TF: Somebody can probably come up with the dates. I came back in 1983, the department was already 24/7, and I think maybe even in the late '70s you could get lab studies 24/7. I know there were early years in the Clinical Center where it was not routine. Somebody had to come back in to do the testing. I spent those three years at Walter Reed and it was fine although I was not so enthusiastic about that at the time. It did get me connected to the American Academy of Asthma, Allergy and Immunology, who now is my employer, because I really never considered allergy as a career choice, even though my boards are in allergy and immunology (and pediatrics). I always viewed myself as an immunologist.

As often is the case, there are unintended consequences or unintended happenings or events or changes, and it did connect me to the allergy community. It served a useful purpose, in retrospect in my career. At the time I wasn't aware that this was happening. The ad came out in the *New England Journal* and I submitted my CV and a letter of intent, and I don't know who all were applicants, I do know one outside candidate who would have been excellent, but his wife was unwilling to move, so he may have withdrawn his name and ended up becoming a friend of mine. I was offered the position. I'm not a pathologist, so it was a little unusual. So I took the position and I arrived.

SS: And that position was for chief?

TF: Chief of Immunology Service. It's easy to be chief when there's only one position, one doctor. I had four technologists, two were transferred from chemistry and two were transferred from microbiology. Previously, Immunology was handled piecemeal without any real emphasis. Just

critical testing as absolutely necessary was done. Some of the high-volume testing like antibody levels were being done in chemistry and some of the serologic testing for autoimmune disease were being done in microbiology. Nobody in either service was particularly interested. This was just being done.

I arrived and I inherited people and testing. Then we moved into a multitude of new avenues, for the NIH. We moved into cell evaluations and flow cytometry, contributed to the evaluation of autoantibody with some autoimmune disorders, but interestingly, we were not directly involved with HIV. All of the testing was being done in Frederick, [Maryland]. NIAID continued to send all of their samples to Frederick for their HIV patients.

SS: Why was that?

TF: Part of it was longitudinal. By the time I got there they already had a couple of years of testing done in Frederick.

Over the years there have been a number of collaborations that were clinically oriented. I collaborated with the group that studied vasculitis after Dr. Fauci stepped away, Drs. Gary Hoffman and Carol Langford, who both went to the Cleveland Clinic, he to be Head of Rheumatology and she to run the vasculitis program. We developed some new assays with Gary Hoffman and Carol and also worked with Harry Malech in chronic granulomatous disease [CGD] to develop a new flow cytometry assay that's actually the standard used around the world to diagnose CGD.

Most of my career was really facilitated by fabulous collaborations with colleagues in the institutes who had access to more patients than anybody else in the United States with one diagnosis or another. I think over the course of five to eight years, the Immunology Service became an integral part of many of the protocols studying diseases where the immune system has a role in the disease, either absence of immunity or inappropriate immune responses. That really facilitated, in my mind, my career.

I don't think any other institution would have had the same kind of opportunities or would have impacted on me at the same level. It was a unique position at a particularly unique time in terms of our understanding of the immune system that was developing and attributing immunologic mechanisms at play, contributing to a disease process, either absence of certain parts of the immune system or hyperactivity in certain parts of the immune system. That was all coming of age. We knew about it in the 1970s. But the 1980s and then really the 1990s it became an explosion of new information because of genetics and genomics. In the mid-'90s, I spent three months in Jennifer Puck's lab over in the Genome Institute [National Human Genome Research Institute, NIH] in the morning to learn new methods for genetic evaluation and then I'd come back and do my real work in the afternoon.

I attribute the NIH as a major player in my career, the collegial nature of the principal investigators, our opportunity to mold specific evaluations to fit the needs of protocols. And if we couldn't do it in our lab, I was fairly facile in finding somebody that could fill the gap. We could turn to another person within the NIH or on occasion actually summon somebody from outside the NIH to collaborate.

To my mind, once I got back to the NIH, serendipity isn't a word I'd use because I think it's the nature of the institution. There are so many opportunities at the NIH. It's an extraordinary place if you're interested in intellectual endeavors and you have an open mind and you're willing to collaborate. It's hard not to succeed, in my mind.

I always like to tell fellows: “The NIH has the most fertile soil you'll ever find. Whether or not the seed grows is somewhat dependent on how good the seed is plus you need sun and you need water. So there are some other contributions there, but it starts with the seed and the soil. The NIH is the soil and you guys are the seeds, and you've got to seek out the other requirements to flourish and part of it is when you choose a mentor. Do your due diligence. Find out what past fellows that have been in that lab think of the experience.”

My perspective on the NIH is one of great fondness. I am absolutely convinced I would never have been able to replicate what I had in my fairly lengthy period of time at the NIH. The Clinical Center is a very unusual institution as a hospital. The saying that "there's no place like it" is spot on. It's absolutely accurate.

I also have to say that I started in 1983. By the early '90s, Dr. John Gallin became the director of the Clinical Center. John, of course, had come from NIAID, had been the scientific director of NIAID under Tony [Fauci]. He had an image of the Clinical Center that was a bit different than the predecessors, the directors. He viewed that the Clinical Center should spawn science at the NIH, whether it's basic science or collaborative science. Because of the mission of the NIH Clinical Center, it had an absolute responsibility to facilitate, support and enhance science.

John [Gallin] is the person who chose me to be chief of Lab Medicine in 1998, so he definitely had an impact on my career, a favorable impact because of the atmosphere that he established in the Clinical Center and the expectation that patient care, is a requirement and you do as well or better than anybody. But it isn't sufficient. The expectation of the NIH is that you should contribute to advancing knowledge.

John was inappropriately singled out by the Red Team Report. I'm one of the people who wrote a letter to the editor published in the *Wall Street Journal*, disagreeing strongly with a number of the conclusions of the Red Team Report. It was a low point for the Clinical Center, in my mind. In fact, and I think I'm reasonably capable of judging, if I got sick and it involved a disease that was managed at the NIH, I would choose the NIH to care for me at the Clinical Center.

SS: Today?

TF: Today. I think the care that's given at the Clinical Center is first rate. I think the lab support is first rate. I think the radiology is first rate. Nursing care is exceptionally good.

Like many things, opportunities present themselves, sometimes subtly, sometimes pretty vividly, but it's what you do with the opportunities that really define how things end up. I have always—my entire time in what was the Clinical Pathology Department and then what we became the Department of Lab Medicine—viewed that we must be providing the highest quality testing. But we also need to always look for opportunities to enhance the clinical research component of the NIH. I think by and large the members of the department have contributed, some more actively than others, but that's something we always talked about.

Under Dr. Gallin we had a Board of Scientific Counselor review every four years. We took it seriously and I used the Tom Waldmann approach for the presentations. Everybody got to present to the rest of the department, and virtually everybody got to go back and redo their talk and then present it again, correct it, and present it again. I had been versed you have your ten or twenty or thirty minutes, whatever it is. You better make sure that your presentation is accurate, interesting, and tells a story.

Dr. Jim Gilman has a different perspective as CEO and I don't know whether John Gallin will still be having the BSCs. I think we went through four when I was chief. We also had a clinical service review by laboratorians who primarily didn't do research, but ran labs. I think that was another example of how John balanced the scientific component and the clinical component of a department. Our clinical reviews always yielded stellar reports. Each service was reviewed and these all went to Dr. Michael Gottesman [Deputy Director for Intramural Research, NIH].

I take a certain amount of pride. I think the department was viewed favorably. I know that part of the reviews always included NIH senior investigators meeting with the review team to discuss how the department met their needs, were they satisfied, whether it was just clinical testing or whether it was collaborative support for research projects. It was an adventure. I think the most difficult part of my career was dealing with personnel and HR, to be frank.

SS: Isn't it always the case?

TF: It's interesting. People said the perfect size group is two, one person that reports to you. I think, by and large, we had always had very capable employees who were committed to the mission, but there were hiccups and there were rules and changes that made people unhappy. It's the least satisfying to try to resolve personnel problems, interpersonal conflicts that arise. And the bigger the group, the more the risk is for interpersonal issues.

We were quite successful in recruiting service chiefs in the DLM [Department of Laboratory Medicine] while I was chief. We had a famous clinical microbiologist, Pat Murray, who spent ten years. Karen Frank, who's now the chief of DLM was the second recruit for microbiology. We recruited somebody to hematology from Mayo for ten years, and recruited Raul Braylan who replaced Pierre Noel. Then we recruited the Head of Chemistry from Harvard, David Sacks. I think DLM at least in the past was known and seen as an unusual opportunity in a clinical lab to pursue academics and science.

Most clinical labs are strictly managed by MBAs and they're primarily interested in one thing, making money. We really had an extraordinarily unusual but wonderful scenario that we actually can do testing that would lose money in the marketplace. If it supports a protocol we will go out of our way if some specific test is necessary to provide that. We're not looking to make sure that running test X, Y or Z ends up putting us in the black at the end of the year. It's a blessing, not to be abused, I would say, but to be cherished as an opportunity that nobody else in laboratory medicine actually has. We can actually initiate studies within the discipline that normally you'd have to find a manufacturer to provide the money. Historically, extramural NIH doesn't support clinical testing. That's partly because there's an industry out there that sells it.

There were niches that came up in unusual diseases or newly described diseases where we could actually pursue some specific testing that would not be reimbursed based on the ICD-9, ICD-10

code. Again, that's another aspect to DLM that is unique in that we are not driven by expenses versus income.

SS: You were chief of DLM for twenty years?

TF: Yes. I was acting chief for a year and chief for nineteen and a half.

SS: About twenty, then, for those of us who aren't mathematicians. It sounds like to me what you've been telling me is that Walter Reed wasn't that much of a challenge for you. When you came to NIH, intellectually, you were able to collaborate and that's where you have over 200 publications and actually doing your academic and scientific work while being chief of a lab. Is that right?

TF: Yes, that's right. The other thing that I emphasize with the fellows is that professional organizations are another avenue to your professional development. The Clinical Immunology Society is one that I've been involved with for many years. I was president a while back, maybe fifteen years ago. That morphed into a very different organization over its history. It really now focuses on immune disorders and if you're interested in immune deficiency, it's the premier North American meeting each year—if we ever have meetings again.

I got very involved in the American Academy of Allergy, Asthma, and Immunology. My primary focus was on immune issues. It was fruitful. I was on the American Board of Allergy and Immunology, a subspecialty board, in the 1990s. I actually spent ten years on the board because I filled an unfulfilled term. We basically wrote the board exam. Now they still write the board exam and then there was a recertification process that involved an exam in the 1990s and early 2000s but now involves a different process. The board was half and half immunology and allergy.

It was an opportunity where I got to know people that I probably wouldn't have been so actively involved with, one of whom is Bob Rich, who ended up becoming dean at UAB [University of Alabama at Birmingham]. He was deputy dean at Emory and associate dean at Baylor. I co-edit the

one major textbook in Clinical Immunology [*Clinical Immunology: Principles and Practice*] where Bob serves as the senior editor. Our interactions began while we were both on the American Board of Allergy and Immunology.

I don't know if that's serendipity, but it does point out that spreading your wings, expanding your horizons beyond your home institution through different opportunities, is professionally valuable and important. That led me initially to get involved with allergy physicians, who were members of the board and then I ended up getting elected to the board of directors of the AAAAI and then ultimately became president (2016-2017). Somewhat of a different organization, but I have come to recognize there's a lot to the AAAAI because it's a larger organization than CIS [Clinical Immunology Society] has about a thousand members) with about five or six thousand. It has a more active direct involvement with lobbying Congress over issues, dealing with CMS [Centers for Medicare & Medicaid] over Medicare issues, telehealth issues, etc.

The last two and a half years I've learned about items that don't impact NIH so much. Although, even at NIH, I know people that are having to deal with telehealth to communicate with their patients.

In my waning years of professional life I am again experiencing somewhat of a different path. Getting back to the Clinical Center, it's interesting. What I miss most because of the pandemic, I have continued as a scientist emeritus, the three or four days a week I would come in for grand rounds, for some of the lab research meetings, to be with my colleagues, to go on ward rounds at least one day a week. All of that has been shut down.

SS: I'm sure it's frustrating.

TF: Everybody has had to redefine their lives. I really miss those person-to-person interactions in the same room. I've been on lots of Zoom meetings but they are not the same.

SS: It doesn't quite do it, does it?

TF: They work. We just had a board of directors meeting four weeks ago. It's quite different and you get no warm chocolate chip cookies.

I also actually think that involvement, outside of your home institution through professional organizations, has a role. It's not the primary means of career development, but it contributes to your career development. I think part of it is I'm somewhat of a people person and these opportunities enable you to meet people that are not necessarily focused on the same thing you are in terms of your scientific, medical interests. They are people you are unlikely to have encountered without being involved with an organization. And that's actually enriched my life. A lot of smart people that are fun to be around and have interests that are quite distinct from mine, but have enhanced my general understanding of science and the biology of the immune system. It's also been fun.

Being at the NIH has a certain cache. It remains an extraordinarily respected institution. It's a good stamp to have on your forehead when you go into a group of strangers.

SS: Let me ask you a couple of questions. I don't know where the lab actually is in the Clinical Center, physically.

TF: Do you know where the second floor cafeteria is? It's in the ACRF [Ambulatory Care Research Facility]. It's the middle building, the Magnuson Building, and if you're walking out of the cafeteria you turn left and go straight, and it's 45,000 square feet immediately to the left of the cafeteria when you're walking out or to the right when you're walking in.

SS: It was always there?

TF: It's been there since I joined it. I think they moved there in 1980.

SS: You were chief over a long period of time and I'm sure you saw so many changes: technology, genomics. Is there any specific tale you want to tell about any of the changes over time?

TF: I'm not one to seek a lot of credit. But I think our FTE, from when I started until when I left, had diminished maybe by ten, in the face of that we added a section on genomics, both microbial genomics, so for instance, the Covid-19 or the SARS CoV-2 specific test, is called an RTPCR is performed there. We actually started a program in microbiology to do viral detection and other microbe detection such as parasites, etc. Many institutions have them developed this capacity, but when I became chief we had very little. Actually, Dr. Gallin identified funds and we did a very simple redesign. NIH architects came in with a preposterous quote for this remodeling, so we engaged a couple of private architects, maybe two or three years after I took over and ended up with a very function lab for microbial genetic testing. We later started genetic evaluation for immune disorders, sequencing of genes.

In hematology, when Dr. Noel came from Mayo we started processing our own bone marrows to insure better quality. We added flow cytometry to the bone marrow evaluation and then added genetic evaluation of the bone marrows for leukemias and lymphomas. In chemistry, we started mass spectrometry for a number of endocrine disorders. As an extension of microbiology, we are providing sterility testing for the cell processing program and cellular engineering program, because obviously you don't want to infuse cells that are infected into somebody. These include cells that are manipulated genetically and then given back either for cancer treatment or potentially for other anti-viral treatment as has been discussed. In immunology we came up with a markedly expanded flow cytometry program to evaluate patients with immune disorders as well as more recently genetic evaluation for the large number of genetically defined immune deficiencies. All of that was accomplished while we were decreasing our FTEs.

SS: Tell me what an FTE is.

TF: Full time equivalent. It's the number of people in the department. We went from 175 to 165, but we added substantial numbers of new tests. So we actually learned how to be more efficient.

I do think that the sophistication of the lab went up substantially over the twenty years that I was chief in terms of different aspects that support major programs within the NIH clinical research portfolio. I think there was improved quality of some, for instance, the bone marrow evaluations that are done in hematology. We do about 1,500 bone marrows a year. When I took over we had no board certified hematopathologists. They were all internists who were self taught in bone marrow pathology. We now have five board certified hematopathologists. It's completely shifted the program.

SS: Is that because of your interest in bone marrow?

TF: No. It's because that's the right way to do it. When we recruited the chief from Mayo he was somewhat aghast at how the processing was being done and this resulted in bone marrow processing that we completely revamped. In any case, we really focused on improving the turnaround time and the range of studies done for diagnostics on bone marrows. There is a much broader range of specific testing, not just looking under the microscopic, but flow cytometry and genetic testing that are really necessary in today's world to make the most accurate diagnosis and have criteria for deciding on the most appropriate therapy.

SS: It sounds like there were a lot of improvements that happened during that time period.

TF: Some of it was just part of what's happened to the field. I don't want to make it sound as though I was leading the charge. But I think we answered the call to bring the lab up to a cutting edge diagnostic lab in the various areas that we support within the hospital.

SS: A question that occurs to me and maybe it doesn't have any relevance, a 24/7 lab that you're chief of, did you ever have to go in, in the middle of the night?

TF: I did for things like Y2K. Each of the services has a staff person that covers. There's a clinical chemist, microbiologist and hematopathologists who's on call. Nine times out of ten the questions can be answered over the phone. But there is somebody available in hematology, in chemistry, and in microbiology, a staff person every day/night including the weekends.

Immunology is for the most part not an acute care related service. Our staff, our technologists don't work on the weekends. Chemistry and hematology are doing the testing that is critical patients really ill particularly in an intensive care unit. Microbiology has staff until eleven p.m. and then they have an on-call tech in the evening. Weekends they're there except at night as well when there's somebody on call. So they continue to do cultures seven days a week as well as read the cultures.

The staffing level is highest during the week, during the day, somewhat less in the evening and quite a bit less at night, but enough that they can run any test that's necessary for acute care. If it's just a routine test like thyroid function, there's no need to do it in the middle of the night. You can do it the next day. Everything is geared in that way.

Part of lab medicine is also the phlebotomy service. They do all of the outpatient blood drawing and they also do early morning draws on the inpatient units. We get many compliments about our phlebotomists. One of the things I've always dwelled on is they're often the first encounter that a new patient has. They go through admissions and then they go to phlebotomy to have their blood drawn. Our people understand that and they care about their patients. Many of them develop relationships with long-term patients, positive relationships. These patients often will ask, “I want Mr. X or Ms. Y to draw my blood. He/she always draws my blood and they do such a good job.”

SS: Yes, it's important not to be hurt. Is there a story about Y2K that would be interesting to share?

TF: Yes. It turned out to be nothing. We all sat there all night. We were crazed the whole world was going to come to an end. No computers were going to work. Instruments were going to shut down.

Nobody should be in the hospital. It was going to be tantamount to disaster. We sat all night. Morning came, we walked away, and we said, "Well, that was a dud."

SS: That's a good story to share. Do you want to speak to any of your research or any of your articles or your scientific findings?

TF: I was part of a group of investigators primarily in NIAID who described a new disorder, the autoimmune lymphoproliferative syndrome [ALPS]. This began in 1992 with the initial report of this disorder (published in the *Journal of Clinical Investigation*). Over the course of my career I was an author or co-author on more than 30 publications linked to ALPS (as well as chapters). One of my fellows, Joao Bosco Oliveira, M.D., Ph.D., while in my laboratory followed up this work by describing and then characterizing a related disorder named RAS Autoimmune Leukoproliferative Disorder [RALD]. Initially published in the *Proceedings of the National Academy of Sciences* [USA, 2007]. In addition, another fellow in my laboratory, Jakob Bleesing, M.D., Ph.D., defined some of the hallmark immunophenotypic features of ALPS reported in four separate publications. So involvement in the definition and characterization of ALPS and related disorders was one of the major accomplishments during my scientific career. In many ways it was the accomplishment that characterized a number of other more focused efforts done in collaboration primarily with investigators in NIAID during my tenure at the Clinical Center.

Virtually everything I did was in collaboration with individuals within the NIH. We did develop some new approaches to testing that either had become the standard worldwide for diagnosing an unusual disease. There was another test that we developed together with Dr. Harry Malech and a couple of other people that we've talked about, and we asked ourselves, "Should we apply for a patent?" We did not and now it's being commercialized by various entities. I was the senior author in the first publication of this approach, fifteen, twenty years ago.

I think that most of what I published was in response to an issue or a need associated with a patient group followed at the NIH. Sometimes it took some extra thinking. Sometimes it was just a common sense approach that nobody had bothered to follow previously.

When I reflect back, diagnostic immunology is a relatively smaller field within the world of immunology. And particularly when I started in 1983, it was a very small field. So that was part the serendipity of the position and then recognizing that there were many unanswered questions and we might have the opportunity in the lab to answer a few questions. It proved to be from a professional perspective a choice that was totally serendipitous. Professionally, again, if you're an HIV doc, there were thousands, diagnostic immunology was maybe a few hundred people.

It's also strategically a lesson and I talk about that to our fellows. When you're looking at a new opportunity, the first thing, is to have a passion for the position. You have to like what you're doing and hopefully you may even love what you're doing. If you can't say that about whatever it is you choose, you're going to be an unhappy person professionally. Once that hurdle has been reached, if you have more than one opportunity think about how broad, how large the environment is that you're entering. And if you have two options that are equally good and you feel passion about both of them I always recommend pick the area where there are fewer people competing with you.

SS: To be the big fish in a small pond?

TF: It's easier to establish credentials when you're not competing with thousands and thousands of people. It's being practical. Everybody likes to get some recognition for what they do. I don't think I've met anybody who never would like a compliment that they did a good job or this is important or thanks for helping. I think that what I ended up choosing from a career perspective had lots of opportunities to participate and get positive feedback.

The person who replaced me in immunology, Sergio Rosenzweig, he and I have become close friends, is in that same boat. He had not been involved in diagnostics. He was recruited at NIAID to

provide clinical care. When the position opened after a lot of worries, I talked to his senior person and said, “This is an opportunity. I think he'd do a great job.” Expecting that he'd tell me, "You are trying to steal him from me." And instead he said, "I think you're right."

SS: It's that collegial atmosphere you talked about.

TF: Right. In a facility that appreciates support, doing something a little above and beyond the typical, going a little bit deeper or maybe even more than a little bit deeper.

SS: Were you ever tempted to leave it?

TF: I looked at jobs twice, once with some interest at a large multi-specialty clinic, and concluded that it would not replicate what I had. My salary would have gone up, but everything else would have been mostly service in trying to be more efficient and balancing between expenses and income, in favor of income.

Then I looked at a position with a very large commercial laboratory just out of interest to see what it was like. They called me a couple of times to ask me if I would be interested. I visited and quickly became uninterested, none of what they thought was important had any place in my career objectives. My conclusion was I had found the right place at the NIH.

Overall, I would conclude that I had a wonderful experience at the Clinical Center. It was always stimulating. I made a lot of friends amongst colleagues. Most of my friends are my colleagues. I retired for a number of reasons in part related to health issues my wife was dealing with, and the fact that the position at the Academy [AAAAI] opened was only a half-time job and would not be available again for a number of years.

SS: The executive vice president position?

TF: Yes. It's a serendipity that path arose at a time when my wife was having some serious medical problems. I, at times, lament having left, but I'll be seventy-four shortly, so it's not like I'm a kid. On the other hand, Tom Waldmann is ninety now.

I did get a lot of flak. Dr. Henry Masur, Chief of Critical Care Medicine, kept telling me, because we're about the same age, "What the hell is wrong with you? You don't retire at seventy-two and a half. That's nuts. Nobody retires here at seventy-two." You have to adjust. It's fine, but I do miss some of the aspects of the old job.

SS: Are you still teaching? I know that you taught for many years also.

TF: I just gave two lectures to the fellows last week, virtual talks. I'll be doing less. I do think as I'm becoming more focused on the strategic issues for the allergy-immunology community, I'm not sure, but I still participate in the preparation course for the Allergy Immunology Board Exam. I gave two virtual talks since we had to cancel our Chicago meeting, the live course. Last year, I gave grand rounds at four different places. I suspect this will start diminishing.

I'm learning about what CMS [Centers for Medicare & Medicaid] does. There's a bit of a learning curve for some of this. We work with a lobbying organization that only represents professional medical societies. The beauty of the NIH is you are isolated and insulated from all of the issues about reimbursement and private payer decisions. Do they or do they not reimburse for this or for that? I look back and I know every time we had our clinical service review, the people reviewing us were all dealing with things that we just didn't have to worry about.

I was very cognizant and I would repeatedly tell people in DLM: "You all are really lucky because each of us gets a budget and our budget is very manageable and we aren't getting hammered by administrators telling us we aren't making enough money." I know that happens to colleagues of mine.

SS: The NIH has such a major role in our country and we can see it now playing out. Right?

TF: Yes. It's very interesting. The one thing I will say is the Clinical Center is still an under-appreciated institution. I was on the ABAI [American Board of Allergy and Immunology] board for ten years, and six of them I was together with a really fabulous clinician that I respect immensely. Some years later, I was talking to him and he said, "What is it that you actually do at the NIH?" And I explained my job to him. And he said, "Oh, you actually see patients there?" I thought, “Whoa!”

I have to say that my experience is not unique. Part of it I think is that in the 1960s and 1970s, the people that rotated through, are all professors now about my age or older or a bit younger. More recently in the 1990s, people that came to train at the NIH are a different group of people with fewer clinician investigators and more PhD post-docs. I think that it is incumbent on the NIH to do a better job of advertising the clinical research program at the NIH amongst younger academicians for referrals.

Now people can self refer. When I originally came back, it required a physician's referral to get you to the NIH. That's changed. The Patient Advisory Board, which was another John Gallin initiative, has generated some real disciples of the clinical program at the NIH. But I still feel the NIH could do a better job of advertising the intramural clinical program. Steve Holland (Scientific Director of NIAID) and I had talked at times about ways that might be available to try to increase awareness. About how people come here, they get great care, and they don't have to pay. You have to fit a protocol. It isn't a free-for-all. If you have a disease that's being studied here, I personally think you would benefit from coming to NIH and at least getting input.

SS: Yes, definitely.

TF: All in all I have no major regrets. I have mostly positive thoughts about the time I spent at the NIH, which was a good part of my life, and I don't think I want to redo anything.

SS: That must be a wonderful feeling.

TF: It's not bad. I was coming for two years and stayed for forty-five. All three of our children and their families are [close by]. Two are in Rockville and one is in Loudoun County, so I don't see us leaving the area, despite the fact that Maryland is a not such a good state to retire in for tax purposes. Where are you?

SS: I'm in Roanoke, [Virginia].

TF: We used to go to a soccer tournament in Roanoke every Memorial Day Weekend.

SS: It's a nice small community. You saw my phone number. I'm from Austin, Texas, but moved here about ten years ago. Luckily, I'm not there now because of the Covid numbers.

TF: And the heat.

SS: I'm a native Texan, so I'm used to that.

TF: Our neighbor's daughter is a pediatric ER doctor in Austin at the Dell Medical School.

SS: Any final thoughts that you want to say about the field of immunology or even about how that is going to affect the coronavirus or what situation we find ourselves in today? I don't often bring in current events, but it's such a momentous moment, and with your immune system specialty, I thought maybe you'd have some thoughts.

TF: I don't anticipate being on an airplane for another year, as an aside. I think that the recognition of the immune system as a contributor to human health and to human disease has grown, decade by decade. Who would have said that coronary artery disease is actually an inflammatory [problem]? When I was in training you would have been laughed out of the room.

The immune system really is involved in most chronic disease. Harnessing the immune system has translated into a revolution in cancer therapy, but it's still in its infancy to toddler stage. The checkpoint inhibitors are great and resulted in the Nobel Prize, but we're at the beginning of that understanding. There's plenty to learn about in the immune system. People aren't going to be out of business in twenty or thirty years if they pick immunology as their career. There is always going to be new information and challenges.

It is sobering that SARS COV-2 is a virus, very closely related to the original SARS virus, but much more communicable and obviously a worldwide threat as opposed to a very narrow, smaller threat. It does underscore the fact that we still have a lot to learn about the immune system. In this realm the Academy is involved and has a very active program. We're just releasing our thirtieth email, we release two a week, updates for practitioners in allergy immunology about Covid-19. Some of it is about PPP and support for this and that. But there's always something about science and patient management in this new world associated with the pandemic.

We were just discussing (in an email) that we really don't know very much about the immune response to Covid-19, and the studies remain in many cases not well designed. A lot of studies out of China are iffy. How many people that get infected actually mount an antibody response? We don't know that yet. What is the duration of the antibody response? We don't know that yet. How important is the T-cell, the cellular immune component? We don't know that yet. If a vaccine is effective in a forty-year-old, will it be effective in a seventy-four-year-old? We won't know that after the clinical trials because they don't enlist elderly people like me. Will you need a booster? If you need a booster, how often will you need a booster? I think this is an eye-opening experience.

Sadly, politicians, one in particular, have gotten involved with absolutely no knowledge and have confused, confabulated, and threatened the management of this disease, and it does serve as a case study. Politicians should stick to politics and stay out of health care and particularly public health.

I'm hopeful. There are a lot of really brilliant people in immunology. I know they're working in overdrive to learn. But I think back to HIV, which was extraordinary. I was there from the beginning fearful that if I needed a transfusion or would get a needle stick, I would get infected. But the move from identifying the virus to identifying effective therapy was mindboggling in reality compared to any other disease.

I think we're in a similar scenario. It's quite different in that because the transmission is not focused on a particular group or sub-segment. It's anybody living. And we don't even know yet what the role of aerosol versus micro-droplet transmission. It's theoretical and persists in air much longer indoors. How much is that contributing to transmission? It has been shown aerosol is present after micro droplets fall out.

I would say this is like most intellectual endeavors. When it's brand new it takes a while to catch up. I think in a couple of years when we're looking back, hopefully, it will be actually quite remarkable how rapidly information was generated. But of course when you're dealing with tens of thousands of deaths, taking a year or two, isn't viewed as very rapid. But that's the way knowledge goes. You can't just say, “Okay, we're going to conquer this in three months.” Politicians can say that. You can say warp speed. You can pick any word you want. The vaccine will be available when there's an effective vaccine proven to protect and that is safe. I certainly would be foolish to suggest it would be January or April and anybody else who says there will be one and it will be effective at a specific time, is risking being wrong.

I think immunology continues to be a fascinating field with an extraordinary learning curve that has already happened. If you go back to textbooks in the 1950s, they didn't even know where antibodies were produced. It's really remarkable. I've seen quotes, from Tom Waldmann in particular, picking sentences out of textbooks that are just amazing how wrong the thoughts were in the 1940s and the 1940s. They may say that about us. But they'll say that about us in ten years. There's a timeline for advancement that continues to shorten and shorten. In many respects that is the two-edge sword. It's amazing and extraordinary. It's also a bit threatening with knowledge

expanding so dramatically. There's so much out there. It's a bit frustrating to keep up. I remember Bob Good once said, “When I started,” he started in the 1940s, “there were three journals and I read them cover to cover.” This was at his seventy-fifth birthday. He continued, “Now there are sixty journals and it's humanly impossible.” And now there are that many more, and these open access journals. Maybe I'm getting out at the right time because I'm probably not smart enough to keep up.

Immunology is an extraordinary field and it has already impacted favorably on medicine. It has since we started vaccinating people. Think about it. The original vaccine for small pox, using cow pox, that changed human history in one step and all the other vaccines that have been developed since have all had a huge impact. Vaccines and antibiotics have been the two most significant impacts on life expectancy. It's a great field to be in.

In my mind the other field is neurology and the brain. To me, that just blows my mind. You can have emotions based on biochemical reactions. It's hard for me to grasp that. Anyway, immunology is terrific. There's a lot that has yet to be defined. I think you're right. Today in the Covid world, it's going to depend on smart immunologists and good science and well-designed clinical trials, and hopefully not only a vaccine, but also effective therapies. A vaccine is a hit or miss. It may not work. Not every infectious disease has been amenable to prevention by vaccine.

At the same time, because but some form or multiple forms of therapy, really need to be developed. That's where we are. Understanding the viral cycle and trying to figure out how one can impede the virus's replication is incredibly important. And that's where HIV actually has already played a role, conceptually, in terms of some of the drugs.

SS: Thank you so much for your input on that and also for your wonderful interview today. I've really enjoyed hearing about your life and your career. You seem excited about ideas and thoughts, and I'm glad you're still involved.

TF: Thank you. It was fun. I didn't understand. I thought this was for some Clinical Center publication like a new book.

SS: This is about the Clinical Center because you're telling your own story, which is part of the Clinical Center. Thank you so much.

TF: Thank you. It's been nice meeting you.

[End of interview]