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Interview with Sylvester James Gates, Jr.

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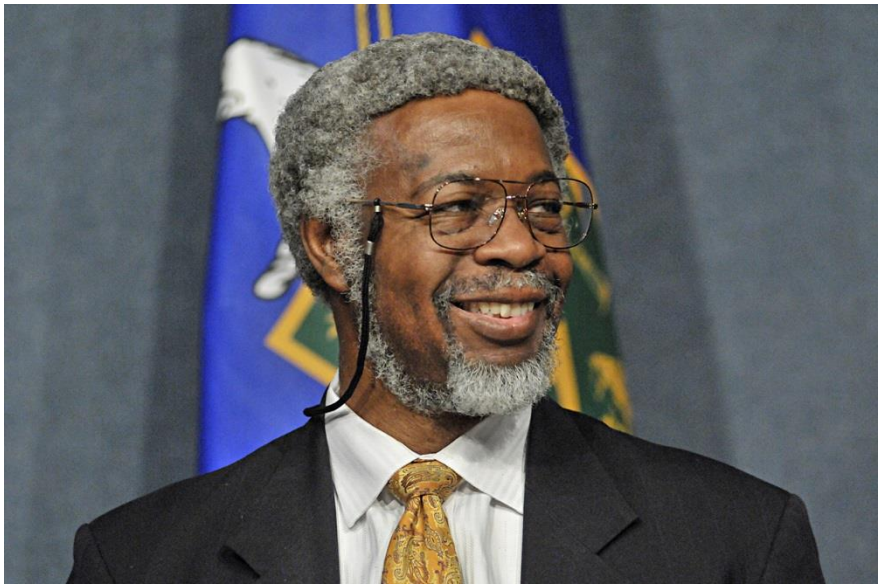

Dr. Sylvester James Gates, Jr.
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Sylvester James Gates, Jr., and Wenxian Zhang Interview

April 12, 2018

WZ: Good afternoon. My name is Wenxian Zhang, I'm the Head of Archives and Special Collections at Olin Library, Rollins College. With me is Dr. James Gates, Jr., Ford Foundation Professor of Physics at Brown University. So, Dr. Gates, I understand you are a native Floridian?

SJG: I was born in 1950 in Tampa, Florida. In those days, segregation really was by practice and law in Florida, and so there was a hospital for African Americans. It was called the Lily White Hospital, and that's where I was born.

WZ: Wow. And then I understand you have a father who served in the military?

SJG: Yes, my father joined the U.S. military in 1942 or '43; I don't remember exactly, but one of those two years. He joined lying about his age. He was only seventeen, and he put eighteen on the forms.

My father's a very interesting man. I've often reflected on my life and how different it would have been with another father. My father decided when he was about fourteen that he did not wish to stay on the farm. His father, my grandfather, was a sugar cane farmer, and he actually owned property on which he actually did the farming. And it was his hope to pass the land on to his children. He had two sons.

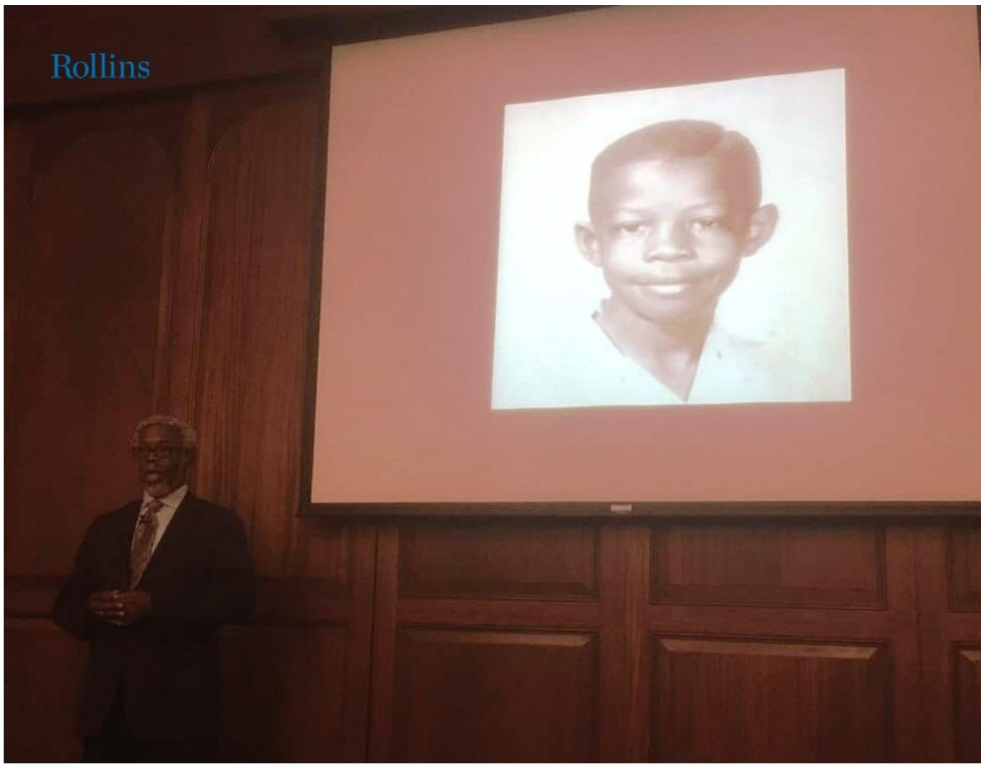
But my father decided at a very young age that—and the way that he put it, a couple of ways—he said, first of all, he didn't think life would be interesting looking north at the south end of a mule. And the second thing he said was that he was sure that the world had something better for him off the farm than remaining on the farm. So he decided at a very young age that he was going to leave when he was seventeen. The Second World War was underway; there were inductions for soldiers to go and become part of the U.S. military. And so he joined.

It was really interesting. He told me once, about a year or so before he died, that he weighed 127 pounds when he joined, or 128. And it's interesting because if he had been 125 or less, he would

have not been allowed to join, so those two or three pounds of difference made the world of difference in my life. He served twenty-seven years.

My mother was from Texas; San Marcos is the name of the town. She was an orphan. She and her brother were actually raised by different relatives. And she met my father as he was training in one of the military bases at San Antonio, I think probably Fort Sam Houston. And maybe a decade before he died, I spent about a week with Dad in San Antonio. I was invited to a conference, and I had extended to him an invitation to come, because the hotel was all paid for. And we spent, like I said, four or five days in the same hotel room. And I heard stories about my father's life I had never heard before. For example, how he met my mother was something I had never known about. He says it was in a bar. He was on a barstool, and this elegant lady walked in, and she caught his eye, and he started trying to convince her that he was an okay guy. And the bar's name was Tucker's, I came to understand. The bar still exists to this day in San Antonio, although it's in a different location from where he met Mom. He showed me the place that was there after they got married; their first apartment; and told me a lot of things about family history that was just remarkable to me, and so I treasure that to this day: that I had this opportunity of a week's time, getting parts of the family history that were just unknown to me.

And then he went off to the Second World War, leaving Charlie—her maiden name was Charlie Anglin, A-n-g-l-i-n. And he went off and then when he came back, they got married and stayed together until her death; she died in 1962. And in the process of the marriage, there were four children in total. I was the oldest, born in 1950. I have a brother, Ronald, who was born in 1951; a sister, born in 1952 in San Antonio; and a youngest brother, who was born in 1954, in St. John's, Newfoundland, in Canada.



Dr. Gates sharing a photo of himself at age eight, during his lecture "Why Am I A Theoretical Physicist?" at SunTrust Auditorium *(Photo: Rollins College Archives)*

WZ: Wow. And so you had been moving around with your father and family because of military base transfers?

SJG: Yes, it's the usual thing in military life. Soldiers are posted to different army posts and bases, and there are facilities for families, often—either on base or very close to base. And so that was the first part of my life.

WZ: So when did you move to Central Florida?

SJG: Actually, I was in Central Florida a couple of times. Although I was born in Tampa, I lived in Orlando sometime around the period of being about maybe twelve, fourteen, or eighteen months old. Because oddly enough, I have a memory of my first haircut. I only discovered this in my late forties; that this sequence of images that I carried in my head were from my first haircut. I described them to Dad once, and he was amazed, and he said, "You were eighteen months old, and that was your first haircut. And I know this because . . ." And then he went on to explain the circumstances of these pictures I had in my head, and he said, "When I got home, your mother was still crying from your haircut, because you had upset her so badly." So he knew exactly what I was describing. And I was eighteen months old. So that's one of my first memories.

I have actually one other memory that's older, but it's kind of incoherent, so I don't know how to explain it to people. So that was the first time I lived in Central Florida; I was probably just over one year old.

Then we moved to Texas, where my sister was born. I was out of Central Florida from '53 to '63, so for ten years I was out of Florida. My biological mother died in '62. My dad remarried; his new wife was a teacher here in Orange County Public School system. She would ultimately go on to teach for about thirty-three years. Her name was Miss Edith Bradshaw—Gates, of course, after the marriage. And so we moved here in 1963, and I finished half of my sixth-grade year in Hannibal Elementary, here in Winter Park. And then the next year, I started at Jones High. In those days, it was grades seventh through ninth were considered junior high school, and then tenth through twelfth was senior high school, but they were all in the same building at Jones High.

WZ: So this is after *Brown v. Board of Education*, so schools were supposed to be desegregated.

SJG: It is, yeah, but the reality is that *Brown v. Board of Education* was an aspirational decision. In fact, it's even in the language of the decision, because they say something about "all deliberate speed." So it was not an order for things to immediately change, but it was an aspiration for things to change. And things were changing; things did change. Most Americans don't realize this, but from the time that the *Brown* decision was made up until about 1984, our schools were increasingly integrated across race in this country. That stopped in 1984, and ever since then, we've actually been re-segregating the schools. And it's official policy of the Reagan administration. It's no accident that it stopped. I mean, President Reagan made it very clear, and his Justice Department made it very clear, that that's what they wanted, and they had won the election, and that's what they began to implement.

WZ: So you attended Hannibal Square Elementary and then went on to Jones High School.

SJG: Yes.

WZ: So that is an integrated high school?

SJG: No, no; all the students were African Americans. There were a few European American teachers, interestingly enough, but no European American students. All of us were African American students in those days. And I tell people a large part of my success is rooted in my experience at Jones High.

Before then—because in the 1950s, the only diverse parts of the United States society were actually the military, so—I had in the first part of my childhood always been in diverse communities. We were diverse before the word was even used, so to speak. So we always had Asian American children, we had European American children, African American, Hispanic American—we were all in class, and we didn't really think that much about it. I remember the first time I head the word "nigger," I was actually still living in Canada. I didn't know what it meant, so I came home and asked my father. This story I don't remember, but he's related it to me. And then he told me that he went to talk to the father of the student who'd used the term. But typically, on military bases there was very little racial discrimination or friction in the '50s, and so I had a very pacific childhood in that regard.

One of my fourth-grade classmates, a guy named Marc Curtis, has an online website called militarybrats.com [militarybrat.com], and there's a picture of our fourth-grade class on the web at that website. I reconnected with Marc in 2001-2002, when I was on sabbatical at Caltech [California Institute of Technology]. And I got this email out of the blue, saying, "Are you the Sylvester Gates that went to school at Fort Lewis, Texas?" I went like, "Whoa." And he pointed me toward the site; there's a picture of me, all my classmates. It was just amazing to see this after decades.

But after Dad remarried my stepmom, we moved here. It was the first time I lived in a segregated environment.

WZ: So what is your impression of Central Florida back then? And have you ever made your way to Rollins at all? I'm just curious.

SJG: Yes, I have, because the reason I was in school at Hannibal Elementary was because that's where my mother taught. Even though she lived in Orlando, she actually taught at Hannibal Elementary, so that's why the four of us—her new four stepkids—would get in the car with her in the morning, and we'd all go to school together. So that was our circumstance, and our stepmom was—well, I tell people that my stepmom was like having a stormy sea and finding a port of safe call. That's what she was for me and my brothers and sister as we were children. She provided shelter for us at a time when—I look back on it, she wasn't a perfect person, no one is, she had her issues and problems like everybody else. But she provided a safe harbor for her four children.

My father, by the way, was in Germany for part of that time, because even though we were here, he was actually stationed at Kaiserslauten in Germany. And he did that for several years while we were here.

My first impressions. I have to tell you, even though I'm a native-born Floridian, I am not a fan of the culture generally that I see in Florida. In fact, what's really strange is at twelve years old, I knew that. When we moved back here, one of the thoughts I had is, I just have to survive for six years, and then I can find somewhere else to go. Florida is of course a beautiful state, and there are a lot of wonderful people, but there are remnants of the history of Florida that are—at least for me, they were detectible even at age twelve.

And it wasn't just the overt segregation. In those days, and to some large degree, Florida has a kind of culture which I think of as an extractive culture, where you try to exploit either Mother Nature or people in order to build wealth. This is a culture that increasingly is going to be problematic as we move into the future, because if you look at the progress that humanity makes—first of all, over historical time scales, that has been in cities. *Why is that?* Well, it's true

that continuity of scale of resources is one reason, but another reason is because you bring different groups of people together, and they generate different ideas, and that's in fact part of where innovation and progress comes from. And so this is a very different model of human development. It doesn't depend on exploiting people or exploiting the environment, it's about interconnectivity. And as I said, as a child, I intrinsically could sense that that was *not* the predominant culture in Florida. And so I was unhappy moving here as a twelve-year-old child.

WZ: And then you became valedictorian of Jones High School. What made you interested in science?

SJG: So my interest in science long precedes my coming to Jones High. It started actually when I was four years old, and my father was stationed at Fort Pepperrell, which was a U.S. military establishment in Canada. Most Americans don't realize that up until almost the late '60s, the United States had a number of military bases in Canada. This was left over from the Second World War and the so-called Lend-Lease Act, when President Roosevelt had an act of legislation passed which allowed him to loan to the British surplus American destroyer ships, and the way that the British paid for it was by giving leases to the United States on properties that they owned in the Western Hemisphere. And so there were strings of U.S. bases all across Canada, up until the middle '60s and maybe even late '60s.

So I was living on one of those bases in 1954, in Fort Pepperrell, and my mom, who was an artist at heart—she painted, she fired clay figurines, she did macramé and all kinds of artistic things—even though she was an artist, one day in 1954, she took her then three children to see a movie. It was a science fiction movie, and it's that movie that opened my eyes to the idea that there's this thing out there called science. And for whatever reason, even at that age I felt an attraction to doing that.

WZ: And then you went to MIT [Massachusetts Institute of Technology], and I understand you earned two bachelor's degrees, not a double major, so that's quite fascinating.

SJG: Well, that's also a result of going to Jones High. As I've often said to people, the most important part of my education actually was Jones High, because up until that point in my life, I had been in diverse societies, and I had no real understanding of the role of race in America. And what Jones High did was fill out all that missing information, so that I became more capable of navigating prejudice and discrimination. And without that, I'm not sure I would've succeeded, quite frankly, even at a place like MIT, because Americans—you know, we liked to believe that we're making progress on this issue, *and we are.* But the progress is glacially slow. And it's very uneven. And in any particular environment, you might find someone who takes offense simply because you're of a different ethnicity. And I learned how to deal with that at Jones High.

When I got to MIT, it was interesting. It was the hardest thing educationally I had ever done. I was the valedictorian, as you mentioned in asking the question, at Jones High. We had started a chess club at Jones High, and I'd done a lot of very interesting things. I worked at the Orlando Public Library while I was at Jones High, earning some money. But when I got to MIT, it was the first time I had to work hard at school, quite frankly. And that took an amazing adjustment. It was emotionally very trying; I mean, during my senior year at MIT, I'm pretty sure I came close to a nervous breakdown. But, partly because of the things I had learned at Jones, partly because of my personal history in having to deal with the loss of my mother at age eleven, I had enough sort of psychological reserve that I survived MIT. And not only just survived, I actually thrived.

I did earn two degrees in four years, and that's an accident. I did not set out to earn two degrees at MIT. When I was at Jones High, I had a fantastic physics teacher, Mr. Freeman Coney. Two weeks into his class, I knew it was not all of science that I wanted to do, but I wanted to do physics. When I got to MIT, I was dreaming about becoming a physicist. But my grades were better in mathematics, so I declared myself a math major and took the regular sequence of courses to get a bachelor's degree in mathematics.

And then on the side, as extra courses, I just kept taking physics courses, because that's what I wanted to learn. And this went on the entire time I was an undergraduate, 'til my senior year. In my senior year, a friend of mine, a young woman by the name of (inaudible) asked me, "So we're going to graduate in the spring. What degree are you getting?" I said, "Well, I'm a math major, so I'm going to get a bachelor's in mathematics." She said, "Yeah, but haven't you been taking all these physics classes?" I'm like, "Yes, well, I do that because I like physics and I'm trying to learn about it." And she said, "I bet they would actually let you get a degree," and then she took me over to the physics headquarters. They looked at my transcript in terms of the physics courses, and they said, You look just like a physics major, except in your senior year you have to do lab courses and write an undergraduate thesis. And that's how I wound up accidentally getting two bachelor's degrees in four years.

Dr. Gates sharing a photo of himself as a student instructor for MIT's Project Interphase EDGE
(Photo: Rollins College Archives)

WZ: That's fascinating. And then you pursued a Ph.D. at MIT. I understand your dissertation is one of early research on supersymmetry.

SJG: Yes, I had lots of adventures at MIT through the years. We won't go into, perhaps, those; I don't know if we have time. Two years into my graduate program at MIT, I had an advisor who was an African American faculty member; I think he was the first African American hired by MIT's physics department. His name was James Young. And he had begun to teach me some mathematical techniques, looking at the physics of things like electrons and what have you, in an area called high energy physics or relativistic quantum field theory. And I had started reading the physics literature, looking at what other people were doing as research and comparing that to what I was doing. And at some point it occurred to me that I was working on research problems that professors were working on who had ten, fifteen, twenty years, perhaps more, experience than I had. And I concluded this was not fair.

So at that point, what I did was to make a big survey of everything that I could see that was being developed in my part of physics. In the old days, a computer printout was on these big sheets of paper. You could turn them over, and they were perfect for pads. And so I had these big lists with names and topics and arrows pointing out how people were working. In constructing this list, I found this subject that was two years old. And that struck me as something that would be fair, because that means that no matter how much experience a professor has had before, I could know just as much about this particular thing as anyone else in the world. The research literature was very small.

So I picked this as the topic I wanted to do my thesis on—at least half my thesis, because I had actually already started with my advisor. I took some of the research papers to him and said, "Professor Young, I'd like to work on this stuff." And I'll never forget: he looked at me, and he scanned the papers, and he said, "I don't know anything about this." And then he stopped and sort of looked up at the ceiling and said, "Actually, nobody at MIT knows anything about this stuff. So how are you going to write a thesis?" And I said, "Well, it's a new subject. What's known about it is very small, so I can master the literature. I know how to read research literature." And I had learned different mathematical techniques from him that I could apply to this new thing. And so very rapidly, I wound up being one of the few people in the United States working on this.

And at the end of the day, it was MIT's first thesis on the topic of supersymmetry. Now, I don't know if this was the first thesis in the United States, because there's no central archive of that. But it was certainly one of the first theses written in the country on the subject, and it was MIT's first thesis on the subject. And I was just following my nose, because in reading the research literature, I realized that what was being proposed in this mathematical physics is that there are more forms of matter and energy than anyone beforehand had ever thought about. And I thought, You know, if this just has a small chance of being accurate, it's going to be tremendously important for the future. And I couldn't understand why other faculty members or other graduate students at MIT could not see this potential. I like to say I was wandering around like a chicken with its head cut off trying to get people interested in this, so I'd have someone else to study with. But no one else at MIT had any interest.

So in 1977 I completed my thesis and next I went to Harvard.

WZ: That's such an impressive accomplishment. Tell me about your Harvard experience, where you encountered Stephen Hawking.

SJG: At MIT, as I said, no else knew anything about actually what I was doing. And in going to Harvard, I became what's called a Junior Fellow, so let me dwell on that just a little bit before I talk more about the experience.

So there's something called the Society of Fellows at Harvard; it's a very prestigious educational entity. And it consists of young Ph.D. students just finishing their Ph.D.'s, but it has a bunch of Senior Fellows who are among—you have Nobel laureates and world-distinguished literature people, scientists; it's just an amazing organization. And when I was getting my Ph.D., a professor at MIT named Ken Johnson, who had tried to discourage me when I was a graduate student, wound up recommending me—because you can only be recommended by other Junior Fellows and he had been when he was young—to become a Junior Fellow.

It's a typical admissions process: you give a dossier, people look at your grades and what you're doing. There's some kind of committee that's trying to assess your potential for future contributions and success. And I made it through all of that, and so I was invited for an in-person interview. And this interview consisted of each candidate coming to one of the dormitories at Harvard, and seated around a large U-shaped table were the Senior Fellows. And it felt a little bit like a prosecution to me, because you have this young person, and there are these Nobel laureates and names that you've been reading about for decades seated all around this table. And they want to talk to you and ask questions.

It began with a scientist by the name of Howard Georgi asking me questions about physics. And I like to tell people, the first thing that you try to do is make sure you're not an idiot in what you think you know. And so they ask you about your disciplinary basis: what you know and what you're doing, where it's going, and try to get a sense of you as someone who's mastered that part of the canon.

Then after I apparently successfully did that, the question came: Besides physics, what other intellectual interests do you have? And I said, "History." Because I had been reading history, and to this day I read history. I had always been reading history. And when I said the word "history," it was as if—I mean, figuratively, the room lit up. You could see people sitting next to him—Whoa, there's something interesting going on here. And so the next question was, What have you been reading recently? And what I had been reading recently was the Peloponnesian War in ancient Greece. And I started talking about it, and I could just feel the room—people were saying, You know, maybe this kid's okay. I could sort of get this sense that they were saying, You know, this guy may be okay. He's a physicist, but he's studying history and he's delved into it and thought seriously about it. And to make a long story short, they selected me to be a Junior Fellow.

And so at Harvard, I was a Junior Fellow. I expected to find no one who knew anything about supersymmetry, but I was wrong. I met a young man by the name of Warren Siegel, who had a story that was somewhat similar to mine. He had been a graduate student at the University of California, Berkeley, and had gotten his Ph.D. and been attracted to this new subject near the end of his writing a thesis. And so when I got to Harvard, although I had expected it to be like it was at MIT, where I was the only person working on this one particular subject, during the first week there, they had a gathering of all the new postdocs and graduate students and returning faculty and even new faculty. And the secretary, a lady by the name of Miss Blanche Mabee, met me. She probably sensed my nervousness, and she was trying to get me to be more relaxed. So she sort of took me by the arm and said, "I'm going to start introducing you to people in the department." So we went to this large room where the gathering was, and she was introducing me to various people, and then she got to this one person, and said, "Oh! This is Warren Siegel. He works on exactly what you work on." And I thought, That's impossible; no one here could be working on it. And so Warren and I began talking. Turns out, Warren's a genius. He's one of the few geniuses I've met in my life. And his ideas were so radical to me, because I was actually

trying to follow in Einstein's route and do something very similar to Einstein's theory of gravitation, called general relativity. I was following patterns and sets of rules that he had set out. And Warren was trying to work on the same problem, but from a perspective that was totally disconnected from Albert Einstein. So, in our conversation, I concluded that he was insane. And I'm sure he concluded I was an idiot. And so we didn't talk to each other for several months after that, even though we were the only two people at Harvard working on this same idea.

Sometime after January, we had another encounter. And something clicked in my head about what he was trying to do. And what was interesting to me was, when I finally got an insight into what he was doing, I thought, That idea is so advanced that no one is likely to understand it. Now, on the other hand, what's really interesting is what I brought to the table, because I had been following the pathway that had been laid out by Albert Einstein. I could understand how what he was doing was tied to the ideas of Albert Einstein and therefore would create a pathway for other people to actually understand the entire work. So, I think it was probably in 1979, the two of us completed this very extraordinarily long calculation. It was at the time the most complicated calculation that had ever been done in this subject. And one of our fellow graduate students by then had left Harvard and gone to Cambridge and was a postdoctoral researcher for Stephen Hawking. And Stephen was very interested in this area in which we were working. So we got invited to come to Cambridge in 1980 to attend the Nuffield Conference. That's where I met Stephen Hawking.

WZ: Wow. Then you went on, working for Caltech (inaudible) to have a very distinguished academic career.

SJG: Believe me, it was all done by accident and luck. And a lot of hard work and crying and pain.

WZ: Sure.

SJG: Yes, looking back at it, everything that you just said is true, but it's segmented in my mind.

So, going to Caltech was wonderful. First of all, I got a chance to meet Richard Feynman, and actually had a chance to joke with him. He's one of the greatest physicists since Einstein. And he was a hero of mine; I had heard about him the entire time I was an undergraduate at MIT. And here I'm in the same research group with Richard Feynman. The other principal faculty member in the research group was a gentleman by the name of Murray Gell-Mann. Also a Nobel laureate. So they had these two Nobel laureates at Caltech and I'm in the same research group as these folks. So was my friend, Warren Siegel, because we had met a physicist by the name of John Schwarz, who would later go on to invent superstring theory. He, like Hawking, had understood what it was that we were doing and had convinced Professor Gell-Mann that we were extraordinary young people doing something that was of great value for the progress of physics. And so that's how we both wound up at Caltech, because they wanted us to continue work as a team that we had started at Harvard.

During the two years I was there, one of our colleagues who had been working with Hawking—the same young man, his name was Martin Roček, and a senior faculty member—because we were all kids, the three of us—and a senior faculty member from Brandeis by the name of Marc Gisaru also came out. We were all working together sort of coherently, and my friend Warren Siegel said, "We should write a book about this." So we wrote a book; it's called *Superspace, or One Thousand and One Lessons in Supersymmetry.* It was the first comprehensive book on this subject in history, and many people describe it as being the bible to this very day. And of course

I'm very happy that we were able to do it. But it was just a bunch of young kids trying to push science in a way that we had great passion for, and we had a lot of insight for how to do that other people didn't have, and we thought we could leave a legacy that was of value in science. And so I did that. That was from the period of 1982 to 1984 [1980 to 1982].

At the end of that period, I was again trying to get a job. And by hook, crook, and some amazing set of circumstances that fall, I was an assistant professor of applied mathematics at MIT. My alma mater. And I was stunned. I mean, I didn't think anything like that could happen in this world.

When I applied to MIT, there's a story that sort of represents my mindset. So I was still at Jones, and I had taken the Graduate Record Exam and the SAT, and I had done okay. But in physics, I had just like this amazing score, because I had this fantastic physics teacher at Jones High, Mr. Coney. And I had fallen passionately in love, so I had really mastered a lot. Even though at fourteen, I identified MIT as a school I wanted to go to, by age eighteen, I had bought into the diminished expectations that young minority people in an environment of discrimination often accept. And even though I had this fantastic physics score, and I was getting letters from all kinds of universities to apply, including MIT, I was not going to apply to MIT. My father actually had to literally physically force me to write the application to MIT, because I told him, "Dad, you know they don't admit people like us at places like that." And I just didn't want to be bothered with it. But he made me, and so I did. So this is 1969. In 1982, I become a faculty member at this same place, which was my dream institution.

And it was interesting. For me, it was a point in time of actually great disappointment. Because although I was worried about the typical career issues, the entire time I had been a student at MIT, I thought MIT was different from a lot of institutions like Harvard and a lot of the Ivy League institutions. My sense was, as a student, it was a true meritocracy, where people judged you on what you were capable of doing, both educationally and in terms of research. When I returned as faculty, I saw lots of evidence that just was not true. And so a few weeks after I accepted the position at MIT, mentally I started looking for other jobs. Now, it took me two years to find another position at the University of Maryland, College Park, but I was extraordinarily disappointed. And to this day, in fact, I've said to people, "Diversity doesn't truly live at MIT." And that's how I feel about it, strongly. And as a consequence, I was completely ready to leave in 1984, when I joined the faculty at the University of Maryland.

WZ: Yes. So you are really, truly a trailblazer. We only have a few minutes left; I have a couple of questions I want to ask you. So in your opinion, how, in today's and age, should we encourage minority students into science and technology?

SJG: Well, the funny thing about this country is, it's not just a matter of encouraging minority students. It's encouraging *any* students to go into science and technology, engineering, and mathematics, because our country's culture doesn't support, generally, young people thinking about these things as something that will be interesting, something that will be exciting, something where you can make a contribution to society.

Our country, unfortunately, in my opinion, we're in what I like to call an "entertainment society," where entertainment is the biggest value that young people are exposed to. And that entertainment can be in music, it can be in art; it also could be athletic entertainment, because that's just another form of entertainment. I figured that out when I was twelve years old—that's just entertainment also. And those are the values that young people see largely portrayed in this society. And this is not just minority young folks, but all of our young people.

And so one thing that—as I said to an audience earlier today, I don't have a global solution to that problem, because I don't know how to have an impact on the large global set of values my society holds. I know a local solution: I know how to raise my children. And part of that in our family was, we actually did create a cocoon around our children to insulate them from the larger media culture. So for example, in those days, we had a large VHS collection, so that instead of watching TV, we would sit and watch the movies that we wanted them to think about as establishing who they are and their personality. A lot of these were musicals from the '50s, so my kids actually know large numbers of songs from musicals of the '50s, because that's what we—I mean, we controlled the environment to do that. We had a set of internal expectations in my household that were like the ones that my father had suggested for me. So I know how to do that, and apparently I've been successful with my children, because both of them have gone on and both of them are seniors, so they're going to actually become scientists. That was not my intention; I just wanted to create an environment where they were given more choices than what they saw in the popular media. And that's something that each parent has to actually wrestle with: how do I allow my children to explore the totality of their potentialities without the large imposition of values that will come from the larger media?

WZ: You have served on the President's Council of Advisors on Science and Technology and received the National Medal of Science. What advice would you give to the current administration?

President Barack Obama awarding the National Medal of Science to Dr. Gates in 2013
(Photo: White House)

SJG: I would not give advice to the current administration. I've been asked this question before; numbers of people are aware that I served as an advisor to President Obama. And my answer is: Viscerally, I could not do it. Were I to attempt that, I would not be able to sleep at night. Look, I'm going to be very blunt: this administration is in the process of damaging my country and my country's future; they're in the process of aggravating racial tension; they're in the process of

supporting white supremacy, which has had such a terrible effect on my country's history. And I as an individual would not be able to sleep having anything to do with this current administration. I couldn't do it; I would physically get ill. And so, when I was asked this question before, I said, "Emotionally, I could not do this." I hope there's some good people out there who can, but it can't be me.

WZ: What would be your advice for people currently working in higher education? What can we do?

SJG: Well, a couple of things I think are extraordinarily important for higher education. One of them is to understand that our society as a whole is changing, and that our models for how we've operated—certainly since World War II—they're probably going to need changing. Tenure may disappear. In fact, I expect tenure to largely disappear in higher education in the United States over the course of the next 50, 60 years, and maybe even more rapidly. And the reason's very simple: as we developed this system of higher education, the United States as a whole was a place of optimism, and people without higher education degrees could get 30-year-long secure lives. They could have careers in factories and farms and they could raise their children, send their kids to college, go on vacation, perhaps buy a second home, and there was what's often called a compact: an understanding between those who worked and those who owned the factories. That's been broken since the '80s, at least—maybe before.

It's funny. When I was young, I remember watching this one lawsuit about Motorola television. Motorola was an electronics firm; they made televisions. And there was this one lawsuit about the issue of what American workers could do in manufacturing (inaudible) layoffs. And that was good and bad. It was good because, for example, that was the leading of this amazing renaissance that we've seen in China. I tell people, "You need to understand that China has done something that no country in history has done. She has created a middle class that's about 300 million people, and she's done it faster than any country in history." So that's the upside of it. Because of the choices that were made in America, there are more people living a higher-quality life in other countries.

But the downside of it has been, that means that American workers now have competition. And they never had that before. And this competition is what's ripping through our society, and it's the thing that basically says that 30-year-long careers are probably not going to exist. Careers in manufacturing are going to be overtaken by computers and robotics. So the things that people used to do to secure themselves financially in society are not going to be happening in the next couple decades, in my estimation. And under those circumstances, it is going to be impossible for a group of organizations or institutions to say, We can shelter our workforce with this thing called tenure. I just don't see how (inaudible). So I think that one of the big things that higher education is going to have to do is to figure out how to maintain the best academicians, researchers, in the face of a new kind of—what in the business world is called a business model. The business model has got to change. It's going to break and change. And academic leaders, who in my mind are not thinking about this, are not doing their institutions any service. Because I just don't see how you're going to avoid this.

WZ: Last question: as a theoretical physicist, what is your predication of the future of science and technology to infinity and beyond?

SJG: So, let me say a couple of things about the future of science and technology. Let me first of all talk about my science, the thing that has been my passion in life. So there's this idea of supersymmetry, which I started working on as a graduate student in 1975. We've seen no

evidence of it so far in the laboratory. That doesn't disturb me, because I actually know the entire history of the subject, and in the early 2000's when people were talking about finding evidence of supersymmetry at the Large Hadron Collider in Geneva, Switzerland, I knew how weak those arguments were. And in fact, I was quoted in a published work in *Physics Today*, saying I didn't expect it to occur. I was one of the few people—in fact, I think I'm the only person who publicly and published said, "I don't think this is right." So for me, if I could live another hundred years, it's within that time frame that I think that all of my work will be found not just to be mathematics, but will realize a dream I had as a young person of finding a magical piece of mathematics that was an accurate description of something buried in nature. And if it doesn't occur within a hundred years, I'd start to get worried. So on the micro level, that's my sort of biggest wish, hope, dream.

Macro-wise, well, science and technology are going to continue to remake the rules for how wealth gets formed. As you mentioned, I work in public policy. One of the things I did while I was advising President Obama as a member of PCAST was work on groups that looked at the issues of work force in the future. And in that hat, that lane of my activities, I became convinced that we see a disruption coming. I like to call it the A2I2TR. Namely, it's automation, artificial intelligence, information technology, and robotics. Take that basket of things, and think about what it's going to do to the economy. It's going to displace millions of people in terms of jobs.

So as I think about the future of my country and my children's future—because they're going to be embedded in this country—I tell my children, as well as young people that I meet, that you need to understand that these processes are underway. You should not look at my generation and think, I'm going to do what they did, because these processes are not going to make that possible. It's going to put a lot of emphasis on what I call being intentional; namely, not just sort of riding with the wave, but trying to look out to what the waves are going to be and decide whether that's compatible with your skill set. That's what I did as a young person. And I think that's going to be an increasingly important thing for young people to do—everyone to do.

The thing that worries me the most is that I fear that we as a country will not understand the need for fairness in our society. We talk about truth, justice, and what have you, but fairness is going to be something that if we don't get it right, we can lose this country as a democracy, and it would become something else.

WZ: Thank you so much, Dr. Gates, for your fascinating story and sharing your insight. I greatly enjoyed it.

SJG: Well, thank you so much also.