Oral History with Cornell Williams, March 18, 2021
Interview by Benjamin Spohn for Hagley Museum and Library
Hologic oral histories project

Q: Okay, we're recording in both of the places I like to record. Today is March 18th, 2021, and I am sitting down for an oral history interview with Cornell Williams of Hologic. So just to get us started and to introduce yourself, can you tell me a little bit about your early life and education? How you get to DuPont and then later Hologic?

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A: Yeah. So you might know from my accent that I'm not born American. I was born in Jamaica in 1959 and moved to the United States in 1973 at age 13. So basically, my childhood is Jamaica basically, in a rural area, I grew up. My day-to-day chores would be to water the goats and the cows and move them from pasture to pasture to make sure they get fresh grass. And my dad at the time I was living with – my mom and my dad separated when I was young, so I was spending time between my mother and my dad. My mom lived in the hills in Jamaica. My dad was down in the valleys in Clarendon[?]. So, I was back and forth between the two.

So my dad takes it serious about the animals. He loved them. My first spanking that I got was I neglect to move the goats. And dad somehow knew because they were crying when he got home. And he knew and spanked me for that. That was one of the few – I got one of the few spankings, like the older brothers and sisters. To my dad, I was the youngest one at the time for him. So yeah, that's my Jamaica thing. So moving to the US – in Jamaica, I was skipping classes. In fact, I would probably be going to a higher education like colleges at age 12, but then fortunately or unfortunately, I moved to the US and into the Bronx.

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And the thing was I was bored in school because the fact that I come from Jamaica, your perception as a third world country, you must be substandard in education. And in fact, I was really bored. I was actually confused on the first exam that I took in junior – middle school or whatever they call it. Junior—PS79 in The Bronx. There were multiple choices. I went up to the teacher and says, "I think you gave me the wrong test. It has the answers on it." So in Jamaica, you probably get four or five questions on a math exam, and they don't care about the final arithmetic answer.

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What they want to see is your thinking process. You understand the concept. So basically, they taught us how to think. And coming to the US, I basically fell off of that pedestal where I was uplifted as being a smart kid, a genius. In fact, I was riding my bicycle when I found out I was coming to America. And the math teacher came out, saw me driving by the school. Came out and said, "Why you not coming to class?" I'm like, "I'm going to America, man." And he says, he asked me, "How did you get number eight?" There was eight questions on that final. "How'd you get that right?" And I'm like, "Man, that easy man." But apparently, I have a hunch. And this occurred several times in my life that you put that on there to see test. And obviously, I'm the only one that attempted it and got it right. I don't know how I did it. I wish I knew. But I wish he would've said something to me then.

Because I didn't know until later on in my life when I came to the US. I started to see that there's something different about me than the other kids. And I tried to dumb myself down to be part of the other kids most of my life. I can even remember that in what we call infant school in Jamaica. I wanted to be cool like the other kids, so I'll answer the question like they did. So anyway, so after getting bored in school, one of my sisters and my mom they talk about, maybe if he goes back to Jamaica, he'll see the difference and contrast in opportunities and may come back and try to immerse myself in school. Between the people in my life that I aspired to emulate – my sister's a doctor. She said something to me once when I was older as a teenager.

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And that's what triggered that [00:04:15]. She was mad at me, and she was cursing and angry. And she said, "I wish I had your brain," blah, blah. And that part I heard – you wish you had my brain? I was I have your brain. You're the one that brought us here – she came here on scholarship at 16. But none of these things mattered. I didn't see these things, and all the obstacles that get in my way to block me to where I got. And in fact, when I was in Jamaica, they left me there. So I wanted to come back. So I wrote a letter to one of my sisters who was living

in Clarendon[?] at the time. And at that time, I was still young because I was ahead in school, you know? And she sent a ticket for me to come back.

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And I came back. I was excited. She signed me up in high school, at Clarendon [?] High School. And that's where my career aspirations started. Turns out that when I went there – this is part of the racism, too, but I didn't know that at the time that's what was going on. So they put me in remedial math, not college prep. And obviously, I was bored again, but I knew that I'd have to finish because they were going to send me right to Jamaica. So I paid attention. And the two people, two white men that are probably dead now that made my career, Mr. Roser and Mr. Rosen, strange enough. Mr. Roser was the – so they put me in remedial math and back to work programs, like a program called CIDA back then. I forget what it stands for. But Mr. Rosen was the math teacher and Mr. Roser was the CIDA program teacher.

Apparently they were friends, and they were talking. So Mr. Rosen said to Mr. Roser, "Cornell does not belong in this math class. I have a hunch about this kid. Can you send him to take the algebra II finals?" So sure enough, they signed me up for that. I apparently aced it. And Mr. Roser tried to bribe me to go to college and took me to Camden County College and registered me. And we filled out multiple forms. There was grants. BEOG and DSL, Best College Education Opportunity grant, National Direct Student Loan. So I was reluctantly doing it because he says – I needed a car and he says they want me to get a used car.

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And I took him up on the offer and went. He got me there, and I started going to Camden County College and played soccer. And he didn't give me a car. I didn't get the car. But he wanted me to not waste what they saw in me. Anyway, I ended up – I needed a job, so I was taking – initially, I did sign up for AS, applied science. I mean, AAS. There was applied science and there's – that's the science part. The applied science was more technical. So you get a job in a year [?]. So I was doing both programs because I thought I want to continue my education, but I want a job. Little did I know that they only give you one degree, so I'm like, dammit. I want to get two degrees at once. So instead of doing two years, I did three years there, which is kind of – whatever. So

anyway, I got a degree. Got an interview with GTE. By the way, when I was in college, I was doing odd end jobs like I was a short order cook.

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I remember working at Burger King, Randy's Kitchen, IHOP, which I got fired from because I went to Canada to visit my then girlfriend. Actually, I skipped the part where they sent me to Canada for school because they thought it was better than New York Bronx at one point. I skipped that part. But yeah, that's how I met my wife, which is then my girlfriend. Well anyway, just to keep going on the path – that was a distraction because I remember I mentioned my wife and then how I met her.

So anyway, going to Camden County College after I graduated in '81, it was kind of tough because at the time, I didn't eat [?] – I didn't have a, other than the jobs or I have to give up some of them because it was cutting into my school. So I was going hungry because they didn't have any vegetarian food there. So I was eating bread and butter. Just water. And then my mom that was in New York would send money to my sister that I was staying in Collins with for me. So I used to take a bus to a train to a bus to go to school. And one of those loans that I got – National Direct Student Loans is what ended up helping me to get a car because they give you the leftovers at the end of the year.

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I remember my first car was a Pinto, which got me into a lot of trouble eventually. But anyway, the good part about when my career started to take off – I started with confidence and realized that going to a job interview after I graduated from Camden County College with GTE, General Telephone Electronics or whatever it's called. It doesn't exist anymore. They were leaders in digital communications at the time. And I remember the interview with Ben Coates[?]. He asked the question. I was writing on the board. And then I got the thing to erase it. And he said, "Don't erase that, don't erase that. I want to show that to my boss." I had no idea why he did that. I answered the question in a way – he was an engineer, went to school. And I'm writing down something the way I see it. And it's right. And they hired me. I was a technician. I didn't have a four year degree, which I ended up – that's one of the times that's still in my heart when I

mention about the disparity in people with a conscious brain but not the revenue to develop that. But I was lucky to do that.

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And one of the things I did throughout my education career was I'm fighting a private war. I knew that I had something eventually. And I'm like, you know – so I'm going to college, and people go there to pursue a degree. I'm pursuing an education. There's a difference. I will get a degree, but it will be what I did at Drexel, Camden County, Rutgers, UMUC, and online classes at MIT, University of MIT at Amherst and online. Those were just me educating myself. And now one of the questions that you'll ask me later – I'll allude to some of that if I have to tell someone. I'll make sure my kids don't do that. I'll go through hoops to pay their tuition just to make sure they finish. And that held me back tremendously. Because they can't see my – even when you're doing the work and doing the – so we're all trained to see things the way they're supposed to be, not the way they are.

People like me abstract my own reality. And it's a double edged sword, right? It got me where I'm at with my inventions and my keen way of thinking. I didn't fit into the template. Let's face it. But I'm one of the lucky ones that made it this far because of my persistence and my confidence in myself eventually. So no, GTE, I eventually quit there in '84, I think it was. And started – I worked for a startup company, Human Touch Computer Products, where we were reverse engineering Apple computers back then. Was a young black kid, Hank William, that had the idea to take an Apple computer when it boots up and dump the ROM into RAM and patch it so you could run a faster processor.

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So what at the time was a Macintosh SC and 512 – whatever they call them. And the Apple people came to my job in Cherry Hill, New Jersey at the time. And they were working on a secret project. I forgot what they called it. But they signed stuff with us. They were interested in what we were doing. Because Apple was a closed architecture where IBM was open. So that's why you have all these add-on boards on IBM and Apple – I mean, IBM computers, but not Apple. But we reverse engineer Apple made us great. But the company went bankrupt because of

whatever reason. The guy that was running it, the investor was Mexican and he was lying to them, so filed Chapter 11. So I had to get a job.

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Most of the people there were well off. I wasn't. I had kids at the time. So I remember going down to the unemployment office and our CFO was there. We were laughing. "Hey, you're here too." So I ended up getting a contracting job with DuPont in the '80's mid to late '80's. I'd have to look up the time. So I was a contractor at Eagle Run. That was a DuPont building in Eagle Run, which is off 95, which is no longer there. And my first interview, I was interviewed as a technician, and they interviewed us and said, "You're not a technician. You're an engineer." But the position was for a technician, so I got the technician pay.

And then it takes off from there. So I started doing analog design. And then the guy that was doing it was a postdoc student. I learned a lot from him. He was a very bright guy, Stan Benbensky[?]. And actually, he's one of the ones that actually shaped my thinking as far as taking notes and writing real neat so you can see. Tons of notebooks here, stuff that came from him. And when he left, I took over his job. And part of it was laser scanner and developing laser optics and stuff like that, which I've never done. I ended up – breakthroughs on a lot of those things. I was seeing things differently. I'm not going to go into detailed design, but I ended up getting the [00:14:28] to work, improved the signal to noise ratio, so to speak.

The physicist before me that was doing it was – they used things like – to defuse the light, the glass they used and the pigment they used was advanced lead [?] dense. So the signal from the laser that came through was small, so the signal noise was poor. So I figured out a way to achieve what we were trying to achieve using plastic. And at DuPont central station, I was up there at lunch time. I go up to the DuPont library, and one of the things I read about there was DuPont's big in pigments. And I learned that titanium dioxide is one of the most refractive pigments [?].

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And one of the key pieces of things I learned is that its powerful optical scatter power is optimized when the wavelength of light you're using is half the particle size. So I used that concept to use the titanium dioxide, average particle size to get a uniform dispersion embedded in plastic. And that worked. And Ron Schreiker [?] was another guy that was believing me and got DuPont to later on put me where I'm at. Because he had a choice to pick any engineers to work with him with advanced degrees, and he picked me.

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And we ended up getting a patent in exam-specific algorithms. The other guy that I could talk about, Ron Schreiker [?], is dead. He died when he was only 65. Lung cancer. Smoked. So that was – was still at DuPont at that time. When he died, it was Direct Ray. So the DuPont technology we were working on became Direct Ray, which is what made Hologic mammography work, right? So anyway, to get to – after Human Touch Computer Products, I needed a job. Here I am in DuPont, moving up through the DuPont ranks because people were seeing that I think differently. This guy is important. The word I hear is “genius,” which I tell my wife they're crazy to think I'm a genius, right? So we went from Sterling to Direct Ray to Hologic, as you might’ve been aware.

So how did we get – so this is important because one of the reasons why we ended up in digital radiography was we started to scan films to transmit them called tele-radiography. So hospitals could communicate in different radiology offices over digital communication. It didn’t pan out because it was – at the time, you need high speed transmission lines. When the T1 line was expensive, people wasn’t going to buy this thing and try to pay for the transmissions. So that died. That’s what called it.

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So we got into -- using the digitizer was so advanced, none of our competitors could touch us to do archiving, digital films and archiving them because hospitals have to save the film for ten years, right, in the warehouse. So we’re going to archive them. And then AT&T bought a bunch of these things to do it because we didn’t – DuPont pulled the plug. That’s not one of its core businesses. It died. But from tele-radiography came the concept of digital radiography. So in

order to sell more films, our competitors were [00:17:48], Siemens, Fuji. One of our main competitors was doing CR, computer radiography, which is a phosphor plate where they trap the X-ray light and go to a reader, a laser to re-excite those trapped charges, if you understand physics and chemistry. When the light changes its shell, it emits light. And light that it emits is in proportion to whatever energy photon that it's lodged in, right?

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So they read it out. So that's an indirect method. So they were showing – so in order to sell films back then, we would go to big film groups, hospital groups that buy films like HCA Columbia and stuff like that. And people would try to get them and say, "Hey, we're working on stuff in the future." So DuPont needed to be working on something for the future. So this is where this whole thing started. So we were trying to do something different. So we had laser cameras where we would digitize a film and write them back. Sorry, no one cares about that. Fuji's doing this neat technology. We actually licensed, DuPont actually licensed Fuji CR. We were selling it. So we got to the point where they hired some physicists, [00:19:02], he worked for Xerox, and Denny [?] works some nuclear plant. He was literally a nuclear physicist. So those two was working on stuff. DuPont coming, Lothar [?] coming from Xerox knew about xerography, which is a plate where they had a toner and they used X-ray to charge it up and then read it out, and then copy it off to a paper.

So we took that base technology and pixelate it, basically. Put little islands on the toner that we were using on the plate, which we called – so they used selenium. That's where the selenium concept came from. And put little islands, and then we used needles to read it out. And man, we got a beautiful image. We took it to marketing, and they were excited. Here's a digital image from X-ray. "How long did it take you guys to read out this image?" Eight hours. Okay, they were no longer excited.

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So we ended up going back to the lab. And one of my ideas was to parallelize the needles. Instead of using one needle like a stitching machine, you have a bunch of needles going down. So we got it in under two hours. We realized that we're not going to benefit. So, one of the

reasons I'm telling you this – the way I played the role, we were brainstorming, me, Lothar, and Denny. And [00:20:21]. George Robinson was a mechanical engineer. He's one of the coders once we got into the clean room in the vacuum to vacuum chamber.

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So one day we're sitting there on the table. Turns out, my office was a big lab with a room, a lab and a conference table at the experiment station. So I was designing a lot of hardware then. I designed RAM because I worked at the small company, startup company doing development. Even those guys – they were calling me "Cornell Williams [00:20:49]. He can just wave his hand above stuff and tell us what the problem is."

But what we were doing was looking at the logic analyzer, and the bits would fly by. And whatever it's doing, I could tell which bit was shorted to what. I don't know how I knew that, but they didn't get it. So I mentioned in there that, "Hey, if we could read this thing out, like we do memory, like we have a RASS[?] CASS[?], row address strobe, so we need rows and columns. So that's where the nucleation of that concept. So mmm. So we have some connections with University of Michigan. Antona [?] was doing stuff at the time. He told us about some charge amplifier. It's called EG&G[?] was developed in Rutherford's laboratory in England. That was the first charge amplifier in fact. I could show you the world's first—[audio breakup] [00:21:42]. –in my office. I don't know if you can see this. Yeah, I did this. This is the stuff I was doing, like quick, throwing stuff together real quick. These are the early days.

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Unfortunately, a lot of the stuff I did, they threw out. What a shame. What a waste. I was doing stuff like this. A lot of these boards[?] they plug into, back then is XT computers, or AT. So this is where everything came from, right. I designed it and built it myself. Plug it into a computer so I could read out charges, right. This stuff you won't hear about from anyone else. But I didn't think about it until just now, actually. This is [00:22:21] [noise]. That's what I did.

So they got the—So Lothar[?], that charge on file there, put a wire on it, and we use the light to excite it at the time, visible light, because it's got photodiodes in the front end, for that purpose.

They're also protection diodes. Yeah. So the idea came, okay, that's where we're going to go. We've got to read this out faster than film. We can't do it in two hours. Can't do it in two minutes, because the film is two-minute cycle, although the chemistry that they use to—that's not—you have to get exposure and all that. So that's a bad thing, right.

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So we've got—long story short, I got a TFT [?] from Lothar had his connection in Xerox. So Xerox Park in California, they were able to—and Lawrence [00:23:09] was from there too, I think, he worked with Xerox. So there's a big Xerox connection. And if you go back an issue and look, there were people at Kodak and Xerox that started doing direct conversion of—or actually tried to, but failed, because selenium is a beast that you have to tame, right. It's not stable. So we got lucky for that, because they would be the front-runner on this, but they gave up on the technology.

So we use a two inch by two inch TFT array to do our first direct conversion of X-ray. So obviously, the engineering behind that, I was the software guy, the hardware guy and all that. And the other kid, George Robinson, was the mechanical guy that was coating the selenium in the station, in the experimental station. So I actually built a system that we used to demo[?]. So that's where we did that, to give demonstration to the film groups. So this digital radiography was initiated to sell more films. It's not ironic.

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So DuPont sell more films. And DuPont was selling laser film and X-ray films. And X-ray films are higher—Everyone has a similar performance and specs. But a laser film was better than Fuji or Kodak. Their optical density was higher. We were able to achieve up to 2.8 optic density, when Fuji—No, no, no, we achieved 3-point-something in laser film. They were only going up to 2.5 or something like that. So anyway, I worked in also at Eagle Run on the laser camera and all that stuff.

Yeah. By the way, if you want to stop me at some point you can, because I'll just keep going. Yeah. So that's my initial part of DuPont, and my education at the time. In fact, you know, when

I mentioned GTE, the guy who interviewed me made me sign up at Drexel. And he told me, “Whatever you do, make sure you finish your degree.” But Cornell didn’t listen. I went there and stsrted going to the guidance counselor, and was taking all the EE courses they have, and all their physics. So when that was done, what else do I take? You know. The history and stuff I didn’t. I could read history if I need to learn it. I wasn’t going to pay.

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And that’s part of the problem I find with colleges and degrees. Electrical engineering you should do four years of electrical engineering, and maybe a couple months of the other stuff. And if you’ve got to do the other stuff, that’s what you should be doing for four years. And I could see that here. I can—any one of these PhDs as far as thinking. Because of my broad technical knowledge. It’s not like I didn’t go to school. Just Cornell didn’t fit into the template. I track my own reality, which is good. That’s what made me what I am. So, you know. I just brought that up to throw that in there.

The human touch was a big deal, actually. I mentioned that I got fired from one of my jobs when I was a cook, because I went to visit Ann. I started telling you that. And the guy told me—It was Christmastime. I was doing Camden County College. And he said, “Stay here in Christmas, don’t go. Don’t go. I need you for the Christmas rush.” And he said, “If you go, don’t come back.” So I went, and I came back. [laughter] And he fired me. [laughter] It’s the first time I've ever been fired from a job, and my last time.

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And I'm lucky to only have two major jobs in my career. What I didn’t mention in New York, when I came here at 13, by 14 I was delivering newspaper in the Bronx. When I took over, the guy’s route that I took over, he went and collected the money before I took it over. And I didn’t know. So it made me look like I'm a scammer. So I went to collect the money of my week, of my first week on the job, and the guy—some guy, I remember, he had dots[?], big white guy, grabbed me. And he slammed me against the wall. And he says, “You mother f*er, you're trying to rip me off?” I'm like, “What do you mean? What do you mean?” He says, “I paid—Someone

else collected the money. And you're coming?" And I'm like, "Oh, I don't know. I'm new." And he let me go.

And then we became friends. He actually ended up giving me a jacket that I wore for a long time. It was something that he had. It was nice. He didn't wear it. And he realized that I needed some warmth. I'll never forget that. But the guy realized that I was honest, I was a good kid. The other kid was—I can't see how they do that stuff. That's one of my other things. I was told that I'm honest to a fault in my review here. I don't lie about anything, on purpose. And it's a good thing to have.

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I think the universe reveals itself to those who can handle it. And that's probably why I see things. The things that popped in my head is not from a book in most cases. So it's hard for people to accept that, because they're supposed to know, and they don't. And I'm not supposed to know, and I do. So that's a conflict in the hierarchy. Yeah. Was that concise enough? You had enough of that question? Can you tell me a little bit about your early life and education? So yeah, that's my Cornell—If you look up my email when I replied to you, one of my adages are the things that are on the bottom was, "Education does not prepare you for life. Life is education itself." That's true. I don't know if you read that, one of the things below.

And the other one was about the man in the arena. That's powerful. So I put those there for a reason. When I put that there, COVID was just coming around. And we were reacting like the world is going to end. And no, if we all just pay attention, and listen to one another, and use the key word—one of my key words there is love. And I truly believe that we're not going to be on this planet and go to heaven. Heaven is not after you're dead. I'm telling you, we learn to love each other, and our consciousness is right beyond where we are today, where physics is limited because of hate. Okay. When we start learning how to love one another. Why you develop weapons to destroy life, to destroy planets. Heaven is a constellation. To go to heaven, your consciousness has to rise so we can defeat time and space, with our physical thinking. Consciousness is capable of doing that. And we limited it with hate. And I actually believe that.

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And that's one of—If I ever write a book, I want to write about these things for our species. We're going to be here for another million years where we're heading. So we want to leave this rock and go to heaven to interstellar, constellation travel, inter-galactical travel, which I'm pretty sure we have done if we were allowed to stay, accelerated our consciousness without interruption, we will get there. And we have been there before, but we got interrupted. We probably interrupted ourselves, or nature interrupts us. We don't know all the truths. And like I said, we see things the way they're supposed to be, not the way they are.

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And I think we have been here for millions of years, not 6,000 years like religion teaches us, or just a thousand years, like archaeology teaches us. I think it's the cycles are so advanced that you'd be amazed. And your consciousness just gets reset, that's all.

Q: So it seems like you've always been interested, or at least very talented for mathematics and engineering. So did you always have it as a goal in your mind to apply this knowledge and interest to healthcare?

A: Yeah. You know, it's interesting that you asked that, because I can remember—So I left Jamaica at 13. I was in—The grade I was in, I was advanced. So whatever it was, I remember we were playing outside. And the topic came up in our artwork [?] class. "What do you guys want to be?" And I remember saying that I wanted to be a biomedical engineer. But that's not the term that I used. I wanted to do something in medicine, but not doctor, because that's what my sister was. And I didn't think I would like being a doctor. That's what my sister was studying.

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But it was weird that my consciousness at the time, or my deepest thought, pure thinking, was yeah, I want to do something technical but in medicine. But I don't know how I said it back then at my age, what I knew, what I was exposed to. But that wasn't what was in my consciousness. And I had no idea that would come to fruition 30 years later, or 20-some years later, whatever,

how many years later. I was 13 and I got my first job in this field. I was 20-something. And the point is, I don't remember.

So, you know, the fact that, when my sisters were in college, and I used to just pick their books up and read it, chemistry book. So I knew a lot more than I was supposed to, just from reading. I have a true belief that, once you learn how to read, and do some basic math, you could teach yourself almost anything, especially today with the internet. You know, once you are capable of learning, teaching yourself, that is the most powerful tool, is your mind, okay. It's not the books.

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And then my thing is, that once you start believing in something, you're not limited in your thinking, because it's absolute. So everything I hear, I take it as information. I think it's piece of the puzzle. And I always try to fulfill the rest of the puzzle. And that's how I think. And I can remember, you know, TVs and stuff that we'd take for granted here when I was a kid, there wasn't much of that in Jamaica. But when my father finally got one from America, it was a black and white. And I remember him getting mad at me because I took it apart, and put it back, and it didn't work. And he was pissed. He was angry.

And I eventually got it to work. I remember learning about tubes. And, for some reason, I don't know how I knew that, that tube, there was something wrong with it. Maybe because it got tarnished from heat, or whatever it was. So it turns out, it was a tube that was bad. And I was able to get a tube back then, because one of my cousins was into the HI-FI systems. And they built it from tubes. They built their own amplifiers, believe it or not. And they were powerful sound fire[?], right. Reggae music grew from all of that stuff.

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So it ended up, so I was really, really interested in electronics. I had no idea that it would become something that I would continue to do. Like I mentioned to you, that Jay once asked about, how do you think about the scenario I told you, was when Jay bought the technology, and we tried to go into mammography, the first couple of—So this is one of the things, one of the spins where whatever—for some reason, I was the only person that was doing so-called redox sequencing,

which I still do. For some reason, other people, because it's not something you can read in a book. You've got to go in the lab, and look for clues, and then go down the rabbit holes, and then bring it out. And everyone that's doing the selenium detector in the world adopt some of my algorithms that I've created.

[00:34:03]
So one of the things that I did was, when I was in Germany, with a company called Maher[?] Electronics, doing crystallography, with our gen rad [?] which is what the mammo [?] panel's predecessor. And when I came back, we had a new VP. And two of the people I was working with, John Robinson, Bran Raddricks [?], went to the VP and says, "Oh, we could do what Cornell is doing," trying to defeat me. "He's just playing with the high voltage lights on the gates[?]." So Peter assigned them to it. And they couldn't do—they didn't know what they were doing. So the mammo panels that we shipped in the field came back. There's still something in our test protocol now called Blooming test, which is, the pixels will bloom and they couldn't get rid of them. And then it looks like cancer, so you couldn't sell that.

So one of the other guys that rise up in our company was Jing[?], [00:34:52] Jing, whatever, China, Asian gentleman, PhD physicist. He remember when Jay bought the company, he was coming down here, I was the guy that he sees in the lab at night. So, he went to, so the guy that benched me was Peter Sultan[?]. He didn't know better. And Jing went to Jay Stein. And Jack Cummins at the time was the CEO, and then [00:35:15] that we need Cornell back on that [?] to fix this, because he had a hunch also. So, [00:35:23] and I solved it. And that was, you know—

[00:35:26]
So how I solved it was, like I said, going in the lab, doing an experiment, and figure it out. And Jay, that's when Jay came and asked—We had a conversation earlier, before you started recording, that assembling all the scientists that were supposed to solve this in the room, with Cornell Williams, an engineer, another PhD scientist. Well, in most people's book, I'm a scientist. In the DuPont days, they used to tell me, "Your work come out of PhD environment." In fact, the first RSNA , in '95, they have a video of me up there with the title "Cornell Williams,

PhD."

And that came out when Sue Linderman[?] was the CEO when Sterling bought us. First thing she did was a diversity workshop. She took us out to Rehoboth[?] Beach. And we were white male, white female, black male, and black female, that was advancing, teaching diversity. And the reason why she did that was, she looked in Silicon Valley and says, "Oh, these people that are breaking through technologies, they aren't diverse." Diversity was key. So that was very, very powerful, to go there and rise up in that.

[00:36:33]
But, to get back to what Jay asked, Jay said, you know—Basically later on, Jing told me that. I was angry at something, and I was saying, "Blah, blah, blah, blah, blah." And he says, "What are you talking about? There wouldn't be any f*ing company if it wasn't for you." And I was like, "Wow." And then Jay actually came down in the room, and he asked them, "Any of you actually think about what Cornell did to solve a problem?" And they said, "No, not in a million years, blah, blah, blah, blah." And he turned to me, and I said—He asked me, "Do you know? How did you think of that?" And I'm like, "How do I think of that? Hmm." And I lied, basically. I said, "You know, I was reading something in physics, and it gave me a clue." But I just made it up, because how do I tell him, "I don't know." [laughter]

People ask me, "I don't know. It just came. It's something." And that's weird. Like things just come to me, bam and it's clear." And you know, in my sleep or awake. It's weird. So anyway, that's how I got into the field was by chance. I like doing electronics. I pursued it. When I went to Camden County College, I did the electrical electronics, it was AAS. Yeah, whatever, electrical electronics, whatever, and was application not just pure science, not just pure math. On the [00:37:58] oscilloscopes, solder irons and electronic components. That enables me to get a job at GTE.

[00:38:03]
And very soon, oh, when I went to—I told you the guy, Ben Coates made me sign up with Drexel. And that was good, because I learned a lot of applying advanced math, which I already

knew by nature, to some of the math that I did at Drexel other engineers never seen. Drexel used to be one of the top engineering schools at the time when I went there. And that's why Ben Coates wanted me to go there. The teachers were usually professors from actual industries that are top in their field. And so I learned, like you know, some of the stuff I was doing, a partial fraction [?] expansion, was doing signal processing way beyond where people do normal colleges.

[00:38:44]
And those are the things that I like, went there for all the technology, advanced math, and all that stuff. And here I am now, with a AAS. I started pursuing multiple degrees. But I ended up doing the same thing. I went to Rutgers, took all their computer science, and then stopped. It was like 30 or 40 something degrees from there. When UMUC started doing—Later in my life, I figured, oh, I'd better get this piece of paper. Because Lothar and everybody said, "You better get that."

And then something, I was doing it, I was doing history at UMUC. I finished requirements [?]. But something dawned on me. I was like, can you imagine what I've contributed, without that paper? How many kids are out there like me, with something to offer, but don't have that piece of paper? And they will not get an interview without it. I got my interview because of my experience, and because when the guy was interviewing me, I knew more than him. And he was conscious enough to not let his ego push me away, or my race, because I faced a lot of that.

You see me walking with a beard, and you know, well obviously, I wear a tie and suit when I go for a job interview. But I didn't believe in shaving my beard. I've had a beard since I was 13. So, I'm lucky to have got the job there at DuPont. And the other job that I did, and those guys, they needed someone cheap, and with knowledge, and I fit that mold. So, I got that job in the '80s. It may sound far-fetched, but it's true. I mean, so I laugh, but it's actually real.

[00:40:12]
So the fact that, you know—I don't know if it runs in the family, the fact that my sister, my mom and three of my sisters are RNs, and my oldest sister is a doctor. So here I am in the medical

field, but indirectly, so to speak. But somehow nature has a plan for you, it's going to get fulfilled, one way or the other.

Q: So, what I'm curious about, with improving and developing new technologies, which do you think might be more important, developing something new, or improving what you already have? Or are they both equal, in which case, why?

[00:40:52]
A: I think they're both important. And the reason is, they're both targeting customers. And the end result is for the customers. And in this case, if they're both saving lives, they're both important. So with this newer or sustaining—So I worked, in fact, on my goals and objective. Sustaining is one of my things. In the field, the FEs, when they run out of options and people, they come to me. They come to me, and we don't solve it, it's not going to be solved. And that's the obvious notion around people. And that's, I feel very proud of that.

So yeah, sustaining is important, because you're in there saving lives. And you've got to do that. And you need new one to bring it beyond where you are. In fact, it's going to lead into one of your—where we did 3D instead of 2D. It's new, but it's necessary to find more cancers. And if you understand what it did, you know, if you look at mammography for example, they compress the breast. There are several reasons for that, right. It's to hold the breast steady so you could see microcalcification, which is the precancer bone deposit in the blood. When the cancer starts, and metastasizes, it reaches for the blood. And the blood will follow the blood flow, where the microcalcification particles of bone in the blood, where they conglomerate from the cancer, sucking it. So that's what we look for. That's what screening is, looking for micro. A sign of blood of cancer development is calcification.

[00:42:22]
So that. When they're holding still is to keep it so it doesn't vibrate, and then also helps to spread it out, so you use less dose to penetrate. Because it separates and it's thinner. But also to remove the tissues out of the way, so they're not overlapped. So those are three things that the

mammography with film, even digital and 2D mammography did, was to compress the breast to get better image.

So what 3D mammography did, which is new, so they're both important. Because what's there now is what's helping people to save lives, finding cancers. And the new modality, which improves upon that, is going to make you see more cancers. So yes, they're both important. The old is sustainable, it’s doing the job now. To do the job better, you learn from the old. So that’s why they're both important, if you think about it in that light. So yeah. The question was, what the—could you repeat the question again?

Q: Yeah. So sorry, I seemed to have a little typo in the version I sent you. Which is more important to you, developing new technology, or improving what you already have? Or, if they're on equal footing, can you say why that is?

[00:43:44]
A: Okay, right. So I did—I basically did that, right? They are there. In this case, because they both save lives. And the old one teaches you how to do the new one, what’s missing. What are the weak points, right. Like overlap tissues, 3D would be better, right. And yeah. So we ended up pursuing that, right. I can see that we are almost an hour in. So I'm going to start talking less per question, so you could get through them.

Q: All right. So when you create or invent something new, do you always start off with a particular goal in mind? Or does the goal sometimes develop as you're working?

[00:44:28]
A: So yeah. So depends, right. So in the industry, ideas come in our industry, in our company, the ideas typically come from Jay Stein, currently, right. So you have an idea, and you will talk to—I'm in one of those groups where we brainstorm once a week, and solve problems. I'm still in that group. In fact it’s today at 1:15. And then you have an idea. We go off. I’m an engineer. We go off and see if it’s even feasible. We’ll think about it long enough and wide enough. Once we know it’s feasible, we go in the lab.

So there's a path for development and technology, we have something Hologic calls IDI, it’s insight driven innovation. So, and they have phases, one, two—And that’s going to be important, it’s one of your other questions, a future question, I guess. So yeah. So the idea is, there’s a need, for example, in mammography, there was a need to do digital mammography. Once we started doing digital mammography, there was a need to do 3D. But there was a need to have more visualization of their pathologies [?], not necessarily 3D, whatever that may be.

[00:45:53]
The easiest way to do that is to increase the dose, but that’s unethical. So you have to keep the same dose, but see more information. So 3D makes sense in that case. So what prompts us to do new things is usually a need in the existing technology, a deficiency. And it’s typically around image quality, necessarily, or image information. And because I'm in imaging, right. So the ideas will come from a need. And typically, Jay is very—is a genius. And he’s very—at his age, I aspire to be like him. I want to be still working and using my mind to do good when I'm in my 70s, if I live that long, hopefully.

So yeah. So it comes from Jay. It comes down to R&D. R&D will work on it. Then the so-called IDI phases where 1A is [00:46:44] see what there are. It’s less stuff. I'm not into marketing. So 1A is planning and developing requirements. Two is design and verification. Three is validation is transfer, which is transferring to manufacturing. And four is post-market surveillance. So those are all, before the product is done and commercialized, all those things have to be done. And before you exit one phase to the next, and you have to complete one.

[00:47:09]
So the ideation phase is not in this, it’s not a phase, it’s phase zero. Jay’s ideas, a lot of them now, are my ideas and what I do. And we talk about what I do, and I mentioned redox sequence, [00:47:24] mammography system, the redox sequence. I’ll wait until you get to those questions, because I don’t want to overload the questions. And I'm going to let you go to the next questions, since the time.

Q: All right. I hate to have to take a couple seconds, but I need to take a quick break to get some water, because I am just fighting an urge to cough right now.

A: Okay, go ahead, please.

Q: I'll be right back.

A: -- Multiple channels, and you know—Are you taping yet?

Q: Yep. We're back.

A: Okay.

Q: Okay. So what's the technology behind the breast tomosynthesis? Well, hold on. Let me back up a little bit. 3D mammography and breast tomosynthesis, are they basically the same? Or are they actually two different things?

[00:48:14]
A: They're the same things. So 3D is—Tomosynthesis is synthetic tomography, like CT is a computer tomography. So you could think of it as a mini CT, 3D. Okay.

Q: Okay. So as this was being developed, was it all new technology? Or is it pretty firmly based on the same tech that powered 2D?

A: Yeah, it's the same technology that powered 2D, except this is an advanced mathematics to reconstruct. You ever heard of something called ray [?] tracing?

Q: Yeah.

[00:48:45]

A: So instead of doing one image or one projection, we do multiple projections at multiple angles. And then basically use a mathematical reconstruction to get a volume out of it. So it's ray tracing to get the depth. And if a ray goes through, and you know what it is here, and another one here, you could construct from mathematics that what it would be here. So that's what we call slices. So we do multiple images, and then take that because if it's like a stereotype, if you have two views, you could generate a pinpoint. So a similar concept. So where it came from is CT, basically, which is concept of ray tracing.

So it's not a new concept, it's a new application for mammography instead of just a 2D, where the things we talked about earlier, the tissue overlap, you could see underneath there, the tissue, you don't need to press it to do this anymore. But we still compress it, because of movement within the patient motion, you know, their heartbeat, and the fact that we want to do a lower dose. Because if it's thinner, we're going to have to start at a higher entrance dose. Dose is what gets absorbed in the breast, right. It's not the one that leads.

[00:49:58]
So you want to do enough, you have to come up with a technique where there's enough to go through the breast, but also enough to get absorbed, so you can get information. So there's things that you're seeing is the one that absorb the X-ray. And it's different than its neighbors, right.

Q: Right. So that's interesting, that it's—I've never had it explained to me as ray tracing. And that's really interesting to me, because one of the big late-breaking developments in home entertainment with video gaming, in 2020, was graphics cards for home use, that have ray tracing.

A: Yes, yes, yes. And speaking of graphic cards, I mean, so my first computer class was using a PDP AE, whatever it was, was punch cards. So I went from punch cards, at Camden County College, when I was there, we did Assembly language, it was a little cash register to tape. There was no big monitor or CRT on that, on them. And we used to talk about graphic computing was a big deal. And what you guys take—what we take for granted today, you can go back then and look. So GPUs came later, to accelerate mathematical algorithms and stuff.

[00:51:14]
Yeah, so yeah. So graphic cards in the gaming industry is actually driving a lot of our advanced technology and microprocessors and image processing, part of computing, and all these things, this is driven by gaming. So it’s amazing.

Q: It is. I think that there's oral history collecting to be done there too, especially right now, given that everything is in such short supply.

A: Yeah, yeah. Actually, that’s definite. Yeah, I agree. I agree. I give you oral history in the ‘80s until now. So I've been there from day one to now. Can you imagine?

Q: Yeah, to go from punch cards.

[00:51:53]
A: From punch cards until now, yeah. And I've always been doing innovative stuff in there. And the fact that I thought of it as a ray tracing, like I do a lot of abstraction. I remember telling my kid that kinetic energy is light. They didn’t know that. They don’t tell you that in school. Energy in its kinetic form is always in form of light, electromagnetic radiation, right. And most people—I remember interviewing one of our physicists. And I asked him, “Tell me the four fundamental forces.” He had no clue. He’s a physicist, PhD. I’ll tell you what they are. It’s the atom, the strong and weak nucleus, those are two of the forces, gravity, and electromagnetic radiation.

So when they interact with each other, the result is matter. So when I teach myself, if you can understand those four things, and how they interact, that’s all physics is. And then, in order to go beyond those four fundamental forces, to go to space, we need to understand other forces that are around us, that we’re not conscious of, or sensitive to. So those are the—I just gave you a little history of physics. It’s all the forces that already interact, and the atoms, which the electromagnetic radiation holds it together, and the nuclear forces hold the nucleus together.

[00:53:04]
So think about that for a minute. The nucleus in the middle, the proton and neutron. And around it, you have the electrons, which is the forces there is electromagnetic radiation. So most of the forces that we know in the universe are embedded in the atom, except for gravity, which is the universal force. There you go.

Q: So I must admit, I do have some difficulty keeping up with that. I was a straight C student in math and physics. I excelled more in the history, social studies.

A: Okay. So it takes—keep in mind that if we all think the same way, we will never move off. We will be flat. So it takes different strokes for different folks. All of those cylinders and names [00:53:48] Maybe different think timings, right. So you're just as important, because you're a history and English major to write this down, things down. That’s what you're good for. And then we teach in school, it’s coming from books, right? It’s English. You got to learn that.. So that’s important, right. So yeah.

[00:54:04]
And what I was saying at the break, make it simple, it’s the atom—the smaller things that you can't see are the most powerful. Look at the virus today. You can't see it. I remember talking to an Indian lady when I was teaching them physics in DuPont. She ended up getting her PhD, and I still didn’t get mine. And I asked her about religion. And she said—which I’ll never forget. So in those things, spirits, germs are spirits. Think about that for a minute. And then we can think of celestial things we can't see. So a germ and a microbe, a virus, these are spiritual things. We can't see them, but they're here forever. That’s interesting to think about. And your own system, your immune system is made up of multiple of these microorganisms or spirits.

So there are different ways to look at things. And unfortunately, if you break out of what we’ve taught in the western world—for example, matriarchal society. Women ran the world at one point. The first god that we've found was a goddess from the [00:55:05], with breasts, nurturing. And the only reason why that exists is because Alexander didn’t conquer India, so they have written history, oral—I mean written history that goes back hundreds of thousands of years. The rest of them were burnt or destroyed. So you can only go back 6,000 years, or whatever. But you'd be amazed at, you know, whatever. I'm getting off topic here. Sorry.

Q: So I'm jumping through my questions a little bit.

A: That's good. You got to get this done.

Q: I know Hologic, before getting into mammography and women's health, also did bone densitometry. Did you ever work on any of those machines, too?

[00:55:42]
A: Yeah, well indirectly. So currently, obviously, they still exist. And now, the group that I report into R&D, we are reorganizing something we call Center of Excellence. And this becomes an EE group, so we get to look at all these things. So we are working on—Actually, we did a feasibility technology. So the chip that they use now is, they do dual energy. So there is a—And they do two pulses. One high energy and one low energy, take the difference, and normalize them over the distribution of the X-ray response, whatever they call it, KAH [?]. They take one above and one below, so on.

Well, there's a new technology called photon [00:56:18], where it's a basic chip that actually, you do one shot, and it counts. You calibrate it to discern different energies. And it puts them in different buckets, then you leave it out. So you don't have to do two shots. So my group, you know, being scientific and explore silicon photo multiplier. And we put a project together, I was part of that project, to target the bone densitometry. So we ended up getting involved, learning it, the technology. As a matter of fact, we have one of the systems back here. And some engineers in my group are trying to fix the complaints in the field.

[00:56:55]
So yeah. So in reality, I involved from an indirect—not necessarily the bone densitometry in market and the selling of it, but the engineering and development and advancement of it. And one of the things that we are working on now with my projects, and I'm not sure if I could tell

you, but because it's secret stuff, blah, blah. It's bone densitometry, but it's going to target the athletic field. And it's sounding kind of cool. So that's one of my projects, but it's not the legacy bone densitometry for osteoporosis. This is for athletic and fitness and looking at muscles and bone. And I'll give you a little bit there, so when that come out, you'll remember that Cornell worked on it, if you are exposed to that, yeah.

Q: All right. I'll keep an eye on it. So this question is phrased to apply to Hologic. But you can answer it from your own perspective too. So how have you decided what sort of new projects to develop? So what I'm really curious to learn about is how you would identify a need to do something different or better than what you'd done before. Like how do you decide, okay, it's time to iterate or replace X thing for Y thing?

[00:58:08]

A: Okay, so yeah. Typically, there's market research that's phase 4 of a product. That continues even through the life of the product. And you get feedback. Some of our best engineers are customers, well engineers, they don't develop it, but they'll tell you, "Oh, I wish this does this." So you started accumulate these things. One example, for example, we did this firm, which you see that I got the Jay Stein Award, one of the proponents for that, is when we use our direct ray on mammography, direct conversion of X-ray, to image a patient, and then they take that patient to go do biopsy, and they're using a different mammography, different detector, so to speak. They're using the CMOS detector to image on the platinum—something platinum, which was the previous one for the firm. And they couldn't find what they saw on the [00:59:01].

So we replaced—So we needed to have the doctors see what they see when they image a patient, or screen a patient, and they come to do a biopsy or something, they want to see where the cancer is. They couldn't find some of the small things because the detector wasn't good enough. So the technology that we're doing, that DuPont started, direct conversion of X-ray, is the best for—It doesn't destroy the integrity or the fidelity of the information during the detection of it.

[00:59:29]

The direct ones do, because they're using light as the reader like the CR, or like even the technology where they do digital, it's not directly converted to light, then read the light using photo diodes. We convert X-ray light directly to electrical charges using selenium. Selenium band gap allows us to do that. But I'm not going to go into the physics, since you're not into technology like that.

So we ended up doing a technology for the—with the platinum—multitier [?] platinum, and call it firm. And that's the—actually a reason I was [01:00:05]. Our firm was the similar, this biopsy but it was on the standard [01:00:07], which I worked on both. Their firm is what we got the award for. But the a-resistant [?] replaced the multiplier, multitier platinum. But for both of those were down to enables biopsy of our screening device pathology detection, right. So yeah, so some kind of need like that, that drives us to that. Similar to 3D. When we did 3D was to—more information with lower dose. Less recall.

[01:00:38]
Because one of the things, even with the 2D, if it's, you know, you could have false positive, you know, or that's not good, right, recalls. Here you want to identify it right away, and it's got to be precise. So if you look at some of the things that we published, we reduced the recall rate with, stuff like that. And we've accelerated detection percentage. So a lot of good things came out of 3D mammography. So we called it—what do they call it, three dimensions, is one of our product names because of the 3D, the power of 3D.

Trying to keep them short, so I'm cutting myself to the end, so you can keep moving.

Q: Actually, you had said—so I know the explanation might be beyond what I can really get, as someone who is really only good at being a historian. But you had said that selenium is a beast and you need to tame it. Can you elaborate on that a little bit?

[01:01:41]
A: Okay, we're still taming that son-of-a-gun. So selenium, so when I was working at the experiment [?] station, for example, whenever you do any type of imaging, you need a reference.

Anything you do in life you need a reference, a foundation, something to raise my zero. So selenium, apparently, continues to react to charges, dark charges, that you're not seeing—ions and so on and so forth. So it makes it difficult. And then there's artifacts, because it's amorphous selenium. And you coat it, it laminates, it do all these crazy things.

So it took years and years and years to learn how to coat it, using a vacuum with this position[?] we did at the experimental station. And it stays on whatever your deposit are. And then, when you try to use it, you could actually read it out all over the place, because you can't—In medicine, you can't—you have to have a reference and quality control. So selenium was hard to control. We are one of the few people that are doing it today. Others have started and gave up. So my role was to tame it. We developed stuff like the experimental station.

[01:02:55]
One of the things I developed was a motorized desktop with selenium coate, which created ozone scoretrons [?], so we could charge it up, and watch it over time, and study its behavior. And it's got multiple time constants. So it's very hard to understand. It's like most human beings can only do things in linear fashion. But this nonlinear, second order we have a problem with. So we can solve first order easily. We'll just have some second order stuff going on, so you have to solve it empirically[?], which is what I'm good at, right.

So most people gave up on coated selenium. In fact, the way we learned to coat selenium, there was a visiting scientist that we invited. A lot of our technology that we did to get into the markets that's in the east, that's not in the US. For example, TFT. The US government started something—you remember OIS, which to invest in TFT, which they realized, when they went to the Far East and did their research, they were too far behind, and couldn't catch up.

[01:03:54]
So what we did was, get in bed with students, and kind of got our university to get to the—They wanted to do this. And so we brought them here. And it gave us context in the TFT development. We have a scientist from China that tames—that does the xerography coating. And we have some patents in his own, little, portable xerography machine. We invited him here, and he's

actually the one that taught us the temperature, the substrate temperature of the plate, which is what made this thing work today, was important.

In fact, we ended, he ended up going back. He was only—The guy—They invited him here. And I was the only one, because of my nature. They were using him, and I was sorry for him, him and his wife. So me and my wife would take upon ourselves. They just brought him there, and then used him in the lab, and then we were off. We used to take him to Atlantic City, Baltimore Harbor, all over the place, treat them. And they started adopting us like their kids. They were old. When he went back, he wrote me letters in Chinese on one side and English on the other.

[01:04:48]
In fact, he taught me Chinese. I've eaten lunch with him. I know how to say all the parts of the chicken. [Chinese] is wing. [Chinese] is the leg. [Chinese] is the breast. So I know all this stuff. And one of our scientists was a Chinese guy, [01:05:05]. He was like, “My God, man, you learned that from [01:05:10], still remember it.” And I know a lot. I don’t forget any of it. So [01:05:15] is probably there from University of Shanghai, associate professor from Shanghai University. We became friends. I was supposed to visit him, never did. But I ended up going to China for business later on. Unfortunately, he was probably gone. I was in Beijing a few times, and Taiwan, South Korea, and all that. In fact, I came back from South Korea recently with the COVID, the virus. And I think I brought it back with me to the US. Yeah. So that’s how we learned how to coat selenium, from a visiting scientist, and get TFT from a scientist, a dental student from—

The first thing we imaged with the digital conversion was bone, dental, for those people, for those guys, because it was small enough to do dental. I didn’t say any of that before, but that came out, because I was talking about how we got started with the technology and so to speak.

Q: So is that technology still used in dentistry?

[01:06:14]

A: Well, they wouldn't go—we went down a different path. We did general radiography, from our perspective. Yeah, that technology in dentistry, but they're not using direct conversion, they're using indirect. It's easier to make. No one wants to touch selenium. So indirect, like I said before, is taking a different material, like cesium iodide is a scintillator, you [?] convert. Goes from X-rays, and then you can measure that, right. Remember initially when I told you that. The excitation of electrons in their shells, in order for it to get excited, it's proportioned to be excited element particle, photon, depending on how you look at it.

So that's the nature of the indirect versus direct. So the direct is not used in dental. In fact, I went to my dentist, and I was looking at what they were doing. And I was talking to them about doing something for that. And I didn't do it, obviously. Part of the problem there is to get—to make it direct, we're using the electric field to do it. I was the carrier, to carry the charge, when we convert them from photons to electrical charge. It's a high voltage field. You're not going to want to stick that in your mouth, that's the drawback to it.

[01:07:23]
Where the indirect method, you don't need high voltage. You just need a photo diode and use a scintillator. And then it's easier and safer. If there could be a way to like make it safe—I think there could be a way. We don't need as high of a voltage, since we're not [?] looking at the dense part of the body, we could use lower energies, and thinner selenium, so we use lower bias voltage. Those are things that I thought of if I was going to do it. But I'm not going to do it.

Q: So another thing that I'm really curious about is, since you showed me some of those prototypes and parts that you had made for yourself, what's it like translating that to, okay, this is what works. Now we need to figure out how to make it at scale.

[01:08:11]
A: Yeah. So like—yeah. So some of the things I walked you through earlier about this xerography play [?], going from that eight hours to six hours, so time drives you to needing, getting faster. So what technology could give us similar information, what in a timely manner. So that drives us to the TFT, and I'll talk about some of the things we talked about. I played a

role in that. And then, once you get beyond that stage, what's next? Next it will be to package it. How do you package this thing? You know. How do you—But before you package it, you have to discern how to get the information.

And one of the things I didn't tell you was the first pixel that we did, I might have said it, was a piece of aluminum. Put some selenium on it, on a wire from the back of the selenium went int the oscilloscope. Put it in X-ray, shoot it, and then see how it responds. That was the first nucleation of this technology. All the other stuff I told you was caveat for that. But that was how primitive it was at that point. So we go from that to, oh yeah, we could do that.

[01:09:14]
So next, it's feasible. That's feasible. So, each step is feasibility. You could detect the light, that's information. Oh, once we can detect the light, how do we put it in a way that we could use it for information? We didn't know whether we were going to do breasts, it for radiography. That was what films were used for. So we were in a box at that point, right. So once we got out of that, it was Jay Stein's vision to use the technology to do mammography.

Our vision was to do something initially to sell film. So we were going to do something in the digital domain. That's where this thing came in. So one thing drives the other, right. And once you start to go from concept to development to the productization, you have multiple steps. And that's what we talk about, the inside-driven innovation process and steps. It's a mature process, evolution of manufactured for product. Did I that answer that?

Q: Yeah, yeah. So when you have all of these new things, new ideas, new technologies, what's it like to convince other people that they work, that this is going to be the next, better step?

[01:10:22]
A: Next thing? Okay. So the commercialization process starts with the idea, that once you get to the point, obviously, we have a product that we know that we have to convince someone that this is a product. And obviously, the market that we target is informed. And one of the key things that you have to do is FDA clearance, right. So once you got FDA clearance, then you can start

going out and marketing it, or commercialize it. There's two types. There's a 510K, and what they call a PMA. So either one of those, if you can meet one of those—Once you get past FDA, which you're aware of, then you have to convince the field. In a way, that you typically get done.

But first—let's use mammography as an example. Our first big—So we go to the university, so they could publish the technology, right. So this is where you get buy-in, right. So, for example, MQSA, Medical College of Radiology. The MIS [?] Trial—I don't know if you've heard that word before—was a big trial with digital mammography to replace films. It was 2D back then. And that showed improvement. So once it can show that the efficacy that you could improve upon something that exists, that was already FDA approved, that makes it—it becomes easier. And friction goes away. You could get it into the commercial arena sooner, or practically, if you will. So once you get over FDA, and then the marketing people do their marketing research, that yeah, customers will buy this.

[01:11:57]
So then investment comes into to go into mass production, and so on and so forth. So those are steps that—detailed steps I won't go into because we're running long on time here. So hopefully that gives you some insight.

Q: Absolutely. So have you ever worked on anything that ultimately didn't come to fruition?

A: Many things, yeah. Yeah. If you think about it, the teleradiography didn't come to fruition in the [01:12:28] right. It never—It made it to a product, but it never got adopted in the commercial environment. That silicon multiplier, silicon photo multiplier, when we did a few years back, never made it. The group didn't want to look at it, because we weren't centralized enough. Because you have these silos, right. There was Hologic, you have the bone group, you have the mammography group, you have these different groups, right. So that didn't come then.

[01:12:58]
But it's coming around now, for a different target, right. Yeah, so that didn't make it. It's a bunch of things, like the one I started with, the human touch computer products, reverse

engineering, Apple computer. We never made it to market, you know. But we got a lot of accolades from Apple and other people about how advanced that was. So that was one of the first things that didn't make it to market that I've worked on, or didn't come to fruition.

I have a bunch of patents. Yet those are not necessarily—didn't make it to fruition. They just didn't catch up to time yet. Eventually, someone will work on most of them. Like one of my recent patents that I signed last week, was to do something to track the focus [01:13:41]. But nobody—We have all these images and artifacts, and no one knows what to do about it. So what I did was, I used a target in the beam path. We do something called a game map, which is like a memory thing. So that memorized those targets, and then focused that shifts, projects it to a different space.

[01:13:54]
So what the map does, what the game map does, tries to correct, it tries to normalize each pixel to all its neighbors. So it takes that object that was there, trying to compensate for it. So it's [01:14:05]. So where the object is, is lower, attenuated lower signal, where it was becomes higher signal. So I got to binomial response, so I put two targets in the beam, and look at the shift in the horizontal and the vertical, and the math to find out the vertical, the actual resultant vectors. So there's two vectors. So, you do vector math to do this.

So I found out a way we could do this, to correct the game map, or it led me to—So this is the development of thinking. The initial thinking there was to do the game map to correct it, and then shift again that digitally. What I was doing, we have this new concept that we're working on, you know, a new product that's coming out. It's called—It's not our product. It's not our concept. It's technology that exists using a magnet to move the electron, in a vac [?], X-ray generated. You have a vacuum and an electron beam, cathode. These ions get accelerated to anode and when it strikes the anode, which creates X-ray.

[01:14:56]
So X-ray is basically acceleration or deceleration of electrons. So this is how, when it hits the anode, the metal, there are different types of anodes. And the type of anode that you pick, you

want one that can sustain heat. So you want a molecule that have a lot of protons—I mean an atom, like tungsten for example. The number of protons is to sustain heat. So you pick the material, so that's the driving design and criteria is to have something that won't burn up or the ion beam will break through.

So yes, that's generating X-rays, you know, when it projects. So what I did, using those concept of magnets, I know what my vectors are. I said it depends. I said, use three or more—two or more magnets to be shifted. So we have something called an AC, advanced—automatic exposure control. So we fire small pulse at first to measure the breast density, and then use to automatically set the technique [?] for the breast to optimize the X-ray without overdosing the patient to get the same information. We look at the densest part, and then optimized energy to go through that.

[01:16:03]
So that pulse I'm using to look at those targets, and shift it before we finalize the final pulse. It's not in the system yet, but I could see that happening in the future. It's a lot to take on now. We have one magnet for this application for something else, what we call focus [01:16:21] learn. When you're doing tomo, the 3D thing, we move into the focal source, the focus plane [?] is the X-ray source. It's that ion beam I told you about, that is actually the focus plane. So if it depends on the rate that you're moving it, it's going to have a blur. Like remember in physics, you have this thing called the Doppler effects. If I put your finger like this, you could see it. If I start moving it real fast, you don't see it, right. It's kind of blurry. But you want to see it. You don't want it to blur.

So what we do is, using the magnet, the beat this thing is moving, we deflect it back when projecting that pulse. So it makes the beam look still so we could see it. So that's the beam deflecting. We call it—We've got a bunch of names for it. It's called a guided beam, interface, that I'm working on the software. And then they got the guided beam—the beam deflector, whatever.

[01:17:06]

So if you use more than one of those, on a known angle, you know where the beam was, and where it should be based upon your game [?] memory. So that's one pen. But how do I go from this to that to that? People always say, "How do you think of that?" you know. You know, and the fact that no one ever done that, and we all see it every day, those are things I can't explain, you know. So that, I worked on it. It's not in fruition, but it's in the patent. And Hologic owns it. In the future they'll work on it, FX-ray's a modality.

The reason why X-ray modality is important for screening, if you look at the spectrum for all the imaging modality, you have magnetic resonance is way over here. Ultrasound is way over here. Because their wave length is smaller, so X-ray is very high frequency, very short wave length. So that gives it the—You can see—don't forget, the things that you're going to see is a function of, in this case, the spark [?] size, the detector aperture that you use. The resolution can't go. You can't see anything that's bigger than them—I mean that's smaller than them.

[01:18:08]
So the whole thing of using, you know—reading the—my thought of the process there when south. [laughter] I was going on the path of correcting it. And we're never going to use that, blah, blah, blah, magnetic. So using four magnets that has not quite been done. But still, if you could do one you could do two. If you do three, you could do three. Now it's a matter of constraint of the size of the vacuum or the heat dissipation. But I don't think these magnets—it's just a magnetic field. It's not going to create—It's not the X-ray. The heat is generated in creating the X-rays. 99 percent of the energy that's generated from that is lost heat. Only one percent is used as X-rays. Isn't that amazing? So that's that.

I'll let you go, because I'm sure you have a lot of questions left.

Q: Well quite often, I have my list in front of me. And quite often, as I ask one question, your answers are so thorough they cover two or three.

A: Okay. [laughter]

Q: Kind of what I try to go for, because it looks intimidating, because I hand you three pieces of paper. And it's just like, no, we'll get a lot more done than you think.

[01:19:20]
A: Yeah, I saw that in one of your questions, somewhat related. So the answers that I gave covered both. I kind of saw that when I mentioned the treating mammography and all that stuff. But anyway—

Q: So what's it been like to be at Hologic, and I guess, since DuPont spun off, your thing? And it was Sterling and direct radiography, what's it been like to have to deal with so much change, and then as you become part of Hologic, such massive growth over the course of your career too, then?

[01:19:55]
A: Yeah. So there's pluses and minuses, obviously. The pluses are, I'm doing the same thing. I'm not—I didn't have to go look for a job, even though a lot of times I thought I would have to. [laughter] So those are the pluses that I'm not jumping ship and doing something new. Minuses, that you got to relearn the people that you know. Because what comes with growth is change, right. And one of the things that we change out is our upper management, and CEOs, and so on. They come and go, right. The only one that remains is Jay Stein. He is co-founder of Hologic. So that's one sustainable part of the growth.

In fact, we have grown so big that we have—like you say that we open up the stock market every first of October, for Breast Cancer Month. That's one thing we adopted in 2016, the S&P 500 Index, which is bit powerful. So the direct ray wasn't ever going to—well, probably got there as quick as we did, but what makes Hologic take off, obviously was the 3D mammography. Then we ended then, this organic growth, the stuff we did internally. The other stuff, what makes it so big so fast, is purchasing other the companies, right, the portfolio, to develop a large portfolio, so we can get buyout. That was the concept there, to make us so big that no one would buy us, except for Carl Ichan, who came in one time. He targets things. He buy a lot of share and have a lot of say. And he got rid of our CEOs, and [01:21:29], which actually turns out to be a good thing, because we grew. And we're still here.

[01:21:35]
So for me, personally, yeah, I'm lucky to people, because I'm different. I'm noticeable. So right away, people know who I was, and I became part of a lot of committees. And I have to write the culture statement for the new group that came in on the MacMillan [?]. Steve MacMillan was still here, which you saw in the picture of when we went to do the NASDAQ thing. So I was one of the persons that almost everyone knew from the upper level. Everyone knew me right away, because I'm, I guess, unique.

So I just ride with it. In the early days, it was harder not having a degree, getting small pay. But once the different management come in, they started looking at performance, not degrees. And people actually held me back, because I didn't know it. But I could do the work. I'm doing it. And they'd, "Yeah, you don't have a degree." But I have more credits than you in the technology that you're working on. And it's not obvious to the rest of the world, but because I don't have a degree doesn't mean more than someone with one.

[01:22:42]
In fact, I see a lot of times when I interview people, and scientists, they don't know anything. They just learned, right. Knowledge comes from someone's mind, not from the book. You learn, abstract someone else's reality. Most of what we learned is Einstein's abstraction of this reality in physics, right. So in order to abstract your own, you've got to be able to have confidence in your own thought process, where it's not in the book. Or that you abstract that and project to others. And I seem to be able to do that, and people recognize it.

So it was easy for me, compared to other people, going through. And the fact that I'm working on something that unique, the only that's doing this thing I told you about, the controls, the gantries [?] – sequence that extracts the charge from the selenium. It's not easy. You've got to learn how to tame that beast. Part of it is the algorithm I used to stroke it, to control the charge states. Years and years in the lab. It took me 20 years to figure out how to get rid of ghost [?]. And it turns out to be something that's not—you can't do force it. You have to prevent it. It's a very long. time constants up for that, turns out, after 20 years, is in hours. So whatever you do with the electric field, you can't let it sit static for hours, because it polarizes the charges. And then, when you get new charges, that's still trying to hold them, they don't go away.

[01:23:55]
So the way we got rid of ghosting was my algorithm, I keep the electric field at zero when we're not using it. But I turn it out. There's some caveat to that. I had to keep pulsing it. But there's the same thing we call AEC, that's the path of QC function, where when you want to get it tender, for example, like in the [01:24:12] binary system and failed, because the time between exposures. So I had to map the electric field to subtract that off. So you need to control that. You have to understand that.

[01:24:23]
So I had to pulse it even though I wanted the electric field to be zero, but it can't be static zero, right. It's got to be pulsed and refreshed. So that was kind of cool that I was able to do that sort of thing I do, because I'm unique at doing that, because it's not something you read from what you learned in school. You've got to go create it in the lab and abstract your own reality, see things the way they are, not the way they're supposed to be. And that's not easy to do. You've got to be humble to know that you don't know anything. Like Buddha says, a room that's empty, there's room for everything. A room that's full has room for nothing. So I'm that empty room always.

Q: So it sounds like you prefer a perch that's also based on practical experience of getting up there and seeing it.

A: Right, yep. Most of what I do is empirical devise in the lab, because it's like—it doesn't exist in the book, right. Someone has to do it. This is the things that you've got to see. And that's a lot of what I do, is creating it. Almost everything I do is creative. I know some of the software engineers, they will say, "Oh, yeah my read"—I will say, "No, I didn't read the sequences. I''s configuration. One of these advanced engineers say, "Yeah, no one ever opened that code and look at it, because they still try to figure it out," is the way I wrote it. You know, it's not—It's so much, but it's not a real programming and language, it's a meta code that I do in there. And yeah. So I'll just give you an idea for the complexity, what I do, and the uniqueness of what I do. Maybe that's why I still have a job, as long as I do, because they couldn't replace me. When I left GTE, I was told that they couldn't replace me. They hired like seven or eight people. And eventually, went out of business.

Q: So let's talk about some of the recognition that you've gotten over the years. How about the Jay Stein Award?

[01:26:06]
A: Oh yeah. That was pretty cool. That was the first one, right, 2015. I didn't realize it was so far back, when you sent me the thing, and I was doing my research on myself, I said, "Wow. That's 2015." I had to go on DuPont, I mean not DuPont—Hologic website to find it. And so I was selected. It was for the firm [01:26:29], where it's one of the biopsy stages that I told you that we did for getting the mammography, the screening and the diagnostic to be similar in visualization of pathology. So I was selected in the group. And it wasn't just me. But I happened, I was submitted in multiple groups, because I've done so much, the detector group, the firm, group, the [01:26:54] systems level. I was in everything. So my name was submitted. So I had no choice. I was going to get one either way.

[01:26:58]
So the winner gets the award. So you know, I sent the thing to you, in the thing I sent you. The premise for that is written in there, in the preface. And when I went up to Boston, picked that up, and spent the night, that was pretty cool. That was a nice event. It's prestigious, it was coming from Jay Stein. And it was very powerful. I loved that. It's the first major award that I've—Well, I've gotten other awards. But they were like not as prestigious as Jay Stein. I've gotten recognition before, but it wasn't the same level of recognition. I got monetary recognition, not—And this is more, to me is a little bit more important.

Q: Yeah, yeah, it's nice to be recognized for all of your contributions like that over such a time.

[01:27:49]

A: Yeah. That was powerful. But Jay already recognized me personally. He came down here once, and said [01:27:56] He said, “I wanted to personally thank you,” and shook my hand in the hallway. And he didn’t say the second part, which I knew, saving his company, because I knew that later on when Jing told me.

Q: So for you, personally, what’s it like to be part of a team that's responsible for developing these products that do ultimately save lives?

A: Yeah, this is the key part, right. If you think about anything that’s very noble, to know that, you know, Hmm. Wow. What I'm doing is saving lives. And in fact, you know, one thing that I [01:28:37] once—because I played a big role in this technology, more than the accolades that show. But those are there, like you said, a fly on the wall. And the Bible says, “Those who have eyes to see will see, and ears to hear will hear.” So some people saw, like Lothar, and a colleague told me that. Lotar was mentioning. A lot of people thought he was racist. But I have some stories there, that he wasn’t.

[01:29:03]

And remember, like a report, going to school, trying to advance my education, I was going to Drexel. And [01:29:10] saw that report to an Asian guy. And then Lothar is one of them [01:29:14] German. He’s actually racist. So I went to Denny [?]. I needed a check to pay my tuition. And asked Denny for a loan. And he was mumbling and carrying on. And Lothar overheard. And he wrote a check and gave me. And he’s one of the ones who told me that, “Finish your damn degree,” because he see what potential I had. And he didn’t realize that I’m fighting this little war, which I stopped fighting because of my kids, I wanted to get degree first.

And the following semester, I gave him the money back at the end of the semester, because DuPont refund you if you get good grades. And he says, “Oh, aren’t you going to class next semester?” I mean, this is Lothar. And then he asked Denny, who is the good guy. He basically almost shit in my face. He basically said, “No, we’re not sending him.” And they're like, “Are you kidding me?" And then Lotar jumped, and he—I missed it. I could see where he realized that I needed help. And in fact, he invited me to a Bible study one morning, and I went. And I see that he was reaching out to me.

[01:30:19]
And people don't see that in him. A lot of times you can't judge a book by the cover. That's true. He's a German white guy that is, you know—I read this book, four agreements or fifth agreement. And that sticks with you, resonate with me, one of things [01:30:34] said that one man's truth is never another man's truth. So don't ever go against what your internal self is telling you. And that's what a lot of us do. Someone will say something about a teacher, and you both have seen the same teacher. The teacher didn't say that to you, so why would you abstract or take and absorb the negative? So saw this to be positive. There's always two sides to every story. And always reach for the positive side. So that's interesting, going up with through the different stages. And it affected me personally.

[01:31:07]
It made me stronger, a lot of this stuff that I went through. So there was no way to fail once I got past a certain point. I just skipped. Don't think about what I'm doing, I'm just doing it. And even when I know that people was looking at my ideas and using them—So I'll tell you a story. This is important, actually. The thing that we use here, one of the things to keep—normalize the selenium, is light. The way we discovered that is in the station, I was upper level faxitron[?] box, that I was doing the X-rays in. And so it's dark in the box, and there's light in the room. And I noticed that every time we image it, the ghost will stay there for weeks.

But whenever I'm doing it, and I open up the—I noticed the intensity and the magnitude of it gets lower whenever I opened the door, so the light is hitting it. So with Denny and [01:31:59] patent it, because I learned the Chinese from [01:32:01], they were going through my notebook, saying, "One, one, is light." So, and then they were basically saying—no, he didn't mention it in this notebook, basically. When they patented it and didn't put me on it. And occurs one resistance.

[01:32:16]

So one of my recent episode where I broke down to my wife, we were at something. And I was going to—we're talking. And I was telling her, "You know, they, whoever they are, made me work, and why should I go in and do it, in front of me sometimes." And I started crying. And she said, "You know what, Cornell? The chicken lays the eggs. Does he know that people are taking it and eating it? He thinks he has thousands of chickens out there. Would he stop laying eggs if he knew that we're eating them?" And I thought about that. That makes sense.

And I started to focus on the negativity. Remember positivity? How my consciousness would shut down? It's the wrong thing. So what I did was ignore it and continue to focus on my consciousness. Just keep going. None of that matters. Just keep going. And the fact that I know that what I'm doing is saving lives, gives some credence to it.

Q: Have you ever met anybody who had a cancer detected by a machine that you helped work on?

[01:33:12]
A: Yeah, that's what I started to mention and Jeff Walker. And that's what I didn't finish. He came to me, and thanked me for his wife got detected by our machine. And the fact that he knew that I was working on it. That's when I mentioned Jeff Walker. I didn't finish that, sorry. That's what happen when you're doing these things, and you get emotional. The emotion is very strong, right. So thinking is started from emotion. What do you think your origin of thought is? Do you know what origin of thought or thoughts come from? It come from somewhere, right?

Q: Right.

A: Well, it comes from vibration. So it's a chemical vibration. And everything in the universe vibrates, nothing can remain static. Remember that. You have to rejuvenate, cycle. It's sustainability of life. That's why we kill—Most of us, our consciousness, is trying to look for geometry, a beginning and an end, periodicity. When the universe begins, there's no beginning, because you can't perceive that consciously, there's no end. Well, if you want to—The closest way to abstract that is look at a circle. There's no beginning of a circle or end. It's a circle. Use that as a preset into the consciousness to think about time relates to space and reality.

[01:34:25]
And then, when I was saying that these four fundamental forces that we have, you need to think out of this and get beyond that. And our consciousness won't go there when it's created using those power to create destructive weapons and nuclear weapon. Going to heaven is not when you're dead. It's here, constellation. So to get there, we need our consciousness is to rise above where it is today. Love is the key, my friend. Don't use your power to build destructive forces. Use it to illuminate or elevate life, okay. And if we start doing that, then our consciousness will rise above.

We might be stuck here for another million years until we learn how to love each other and live together as a species. That's far out thinking. That's how I think. I think in terms of millions of years, not in today and yesterday. So these things are very trivial to me.

Q: So given everything that's happened in your career so far, this is kind of a two-part question that I like to ask as we start to wind down. What are you the most proud of? And is there anything that you would do differently if given the opportunity?

[01:35:36]
A: Yeah. So one of the things, what I'm most proud of—in work, right, not my kids and my wife, let's do some work. Some of the patents. So remember when I said that I doing stuff, and Denny had like a lot of patents and none of them came from me. I'm proud that one time, when I finally recognized that, and I said to Lothar something I was working on, "This patent is I'm getting my name on the patent." And we did. And so I'm proud of the fact that I know that realization, that yeah, there's something, I'm important. I'm not just follower. People recognize what I do. And this is good.

And I started to gain my confidence, you know. And so coming up, I'm proud of the fact that I have a unique way of thinking. And I'm proud of the fact that I have a picture memory, which I didn’t know that I had, because I realize other people don’t see the things I see, as long as I see them, I remember them. I used to get in trouble in meetings because of that. Because they tell a lie last week, and they tell the same lie this week. Whatever.

[01:36:43]
Yeah. So I'm mostly proud of that. What I would do different, however, is get the piece of paper, would break down a lot of barriers. Even though I got there, but it took longer and more painful. But maybe it was necessary for me to see this. Now I strongly believe that governments and the people who run society should know these things, and think about it, that education should be frictionless, whether it’s monetary or facilities or environment, everyone should be educated. It enhance our probability as a society to leave this planet, to go beyond time and space. So that’s what I’ll do different. I’d probably get that piece of paper. Because then it would be easier for people to embrace me. You know, I got lucky to be in the places I work, people see me.

[01:37:35] like two teachers, Mr. Rosen and Mr. Rosen I told you about, they saw something. You know, they didn’t have to see a degree to see that. They saw it in me, by interacting. I was taking this math class. And I knew a lot. So it’s important—It’s not what you know, but what people think you know, what should be what you know. So how do you get—how the government needs to know that? They need to—

[01:37:58]
Remember, there was a commercial, “The mind is a terrible thing to waste.” Can you imagine that I fell by the wayside? I mean a lot of this wouldn’t have been possible. I'm not taking credit for all of it. I played a role, an important role, and irreplaceable [?] role. So that led me to believe that my kids, the most important thing for them, their job is education, to get the piece of paper. And I also taught them about, you know, going beyond that. Like they're in school. I said, “There's nothing wrong with go in a room and to teach yourself outside of what you’re taught in school, and then give you a taste of it.” And they adapt to that. It took a while, but they're beyond now. They're starting to follow in my footstep.

At lunchtime, one of the things I do, make sure I go on the internet and learn something new that I don't know anything about, and use it during lunch. So I continue trying to learn. Life is education, my friend. So yeah. I'm proud of the fact that I'm unique. And once I discovered that, because I thought I was different, and I wanted to be like everyone. So the proudness comes when I started accepting myself. Then it took off. My career actually went—I wasn't angry anymore. I wasn't angry for being in the state that I am. I actually started appreciating it.

[01:39:03]
And it comes off, you know, people can see that. And then things—it's easier to get along. You know, I'm not angry at the world. Because DuPont once sent me to anger management. And what I learned there was, the lady said, "You know what? Martin Luther King was angry." I mean I was the only Black man in the class. But she was saying that, that Martin Luther King, everybody loved him, Black, white, blue, purple. She said, "Martin Luther King, anger, but how he expressed it. When he's talking, it's anger. But he doesn't use violence." And I went, "Ah, hmm." So I could just keep being me, because I can't hate, but I can get angry. And then I turn people off. So those are important.

The artificial—I call it a piece of paper, artificial—I shouldn't knock it, because you do learn in school. But there are a lot of people who do, and get a degree. I went to get an education. There's a difference. Education is a piece of paper. You could have the education without a paper, especially today with the internet. So to me, it's a business. I don't want to call it a [01:40:10]. What do they call it, whatever. It's a business.

[01:40:16]
Like what I said earlier, if you do an EE, EEE, 90 percent, not 25 percent or 20 percent. And then the rest of it is just monetary extraction from people like me, who can't afford it. And without those grants, when Reagan killed the National Direct Student Loan and the BEOG, people like me have no chance. That's what got me into college and got me through junior college, and then going to get a job, to go to a better college. So those are important to me. But I'm a humanitarian. I'm also—I like animals too. I have two dogs. But put it this way. I love everything. Love is the key to our salvation, my friend.

Q: So I think that we have probably covered a lot of the way you might answer this next question. But what sort of advice would you give to someone looking to replicate your career today?

[01:41:10]
A: That you can just [01:41:11] what I just say. [01:41:14] Yeah. To replicate my thing today, first of all, you have to have confidence in yourself. I remember Marcus Garvey said, "A man with confidence is a winner before they start. A man without confidence is a loser. So don't even begin." So if you have confidence, it's not a matter of can I, it's a matter of win. In fact, I said that to one of my coworkers, a young female engineer. And she wrote it down, and have it on her sticker. She was struggling with some software bug. And I said to her, "Don't worry. Nothing is—There's no such thing as 'can't.' There's a matter of 'when.'" And she believed it. And sure enough, she solved the problem and she came back now.

So that's, you know, if you want to replicate what I've done, first believe in yourself. Don't let anyone tell you you can't do something. Just believe it, and that voice inside of you, not the paranoia voice. There's a different voice. Oh yeah, your voice. No. Just everyone have an internal voice. It's not the psychological, it's not the one I'm talking about, the physical voice, it's your thought. It's your chemical. It's your spirit. It's your soul. It's you.

[01:42:26]
And once you believe in that, you could conquer the world, and make sure you get a piece of paper. Because people see that, before they see you. And then that paper will allow them to see you. So down the path, first thing is confidence. Second is to get buy-in to society, because I didn't. Still don't. But not everyone can be Cornell. And work hard, and believe in yourself. Diligence is, you know, like my work ethics speak for itself. I've been here 30 years, and I've lost multiple vacation because I'm working.

And one thing I wouldn't do any more, and I actually told it to one of the engineers here, because I do give advice about that, is to—Don't sacrifice your family for work. You'll find another job.

You're not going to find that family again. You'll find another family, but it won't be the same thing. So those are the things I would do different, because my first set of kids—Yeah, they love dad. But it's not same interaction. And then I have a second set, because I put more into them than I did into work.

[01:43:22]
So work is not everything, is the other thing, is the advice I'd give. But it's important, it pays the bills. And if you have a career that you love, it's easy to get up in the morning, and can't wait to get to work. Like I used to get up and come to work at four in the morning, because I got an idea. So you know, self-confidence, love what you do. If you don't, go somewhere else. But you need that degree to get you to go somewhere else. So those are the advice I would give. That's short. Do you want me to keep going?

Q: I mean we have two minutes left. That's your time. You can use it however you like.

A: Yeah, yeah. And the other one is, you know, like I'll use the word love. If you learn to love everyone, then it's easy to get along with others. People may see me because I do have that thing when I didn't realize that people didn't see what I see, I was angry. But once I realized that, once I accept myself and realize that I'm different, and it's okay to be different, then wow. So that's why self-confidence, is important. It's to not ever sell yourself short for someone else. And the grass always look greener on the other side, they say. This is probably true. But if you have confidence in yourself, your grass is going to be greener in yourself. So self-confidence is very important.

[01:44:38]
And it's easier said than done. Because if you live as I did, I've already been pushed aside. And the fact that something inside of me made me keep going, I didn't fall by the wayside, like a lot of our younger Black males will do—Black males will do in society, you know, fall by the way side. And they don't realize their potential.

[01:44:58]

So when my sister sent me back to Jamaica, and my mom met me there, some of those kids—their ability, oh my God, they would blow away any one of these PhD scientists. Their thinking process, because that's what we were taught how to do. I don't think they're doing that in Jamaica anymore, because everybody became Americanized. They don't teach you how to think. They want you to—And I struggled to figure out why America was doing that when I came here. And I figured it out, because it was an industrialized society. We were teaching to work in the factories. But by God, the factories left, and we went to other countries. So let's teach them again how to think, you know.

[01:45:28]
And the Japanese, if you read Rand, capitalism, or the entrepreneurs, there's a couple books that talk—Japanese, who are homogenous, they're all doing the same thing. In America we're diverse, and thinking individually. So we rise with R&D. And then the guy figured it out, and started to change. It's the Japanese rise after that. So individual is very, very important. Confidence in self is the key.

Q: All right. And that has taken us to noon exactly, by my watch.

A: Exactly. Yeah, same here. I think the same here.

Q: Do you have anything else you'd like to share today before I turn off the recording?

[01:46:09]
A: Yeah, well most of this stuff I said to you was outside of the abstraction of what we were supposed to talk about. Like when I said about humanity leaving this planet, it's true. We need to stop building nuclear weapons. We need to—There is no need for wars, guns, and all those things. Because it's destroying humanity. If we learn how to love, our consciousness will rise exponentially. And we may be able to defeat space and time. That's one thing.

And actually, because religion doesn't teach you that. And the purpose of religion is multiple of them. It's a way I think was to think about human [01:46:51] species in our worst. If you can imagine, if there was no religion, something bigger than you to fear, we would be barbaric still, in the ways we are, in some ways, because we have all this stuff going on. Look at America. You have racism. What is race? And I like people to know that a race is based on DNA. And it's not your color of your skin or the continent or the country or any of those things. It's bone structure. So the things that you call race, a white guy and a black guy is a joke.

[01:47:20]
And if you look at our DNA, you'd be surprised how hybridized we are. We're the same on a DNA level. Now we are hybridized. At one point, when we were talking about race being different, was not because of your color of your skin, it was because of you have these things in the Bible, Shem, Ham, and Japheth, Mongoloid, Caucasoid, and Negroid, it was the terminology given to people that looked different in the different continents, and those environments, not part of the human species DNA, okay. Those are external survival traits, right. The sun, and the cold, and the nose [?] and all those things we talked, right. So those are not stuff you control. So why would you hate someone for that?

It's easier said than done. But utopian society would not see—So have to say, they should see you as a human being. We're the same first before they see your color or where you come from. And obviously, they put in there to control you and separate you. And religion does that. Government does that. Education does that. But once you start to realize that, you realize that, holy crap. We are the same. We spent—The time we're here, we should enjoy it. You're going to die. You're not going to take any of it with you. The think we are fighting for, we build a nuclear weapon for? It's the thing that you're going to be buried in. How does artificial thing, money, these are artificial wealth. Your wealth is your soul. Your mind. Those are wealth. And how we preserve them and project them is the key to our species' survival.

[01:48:55]
And I would like us, [01:48:56] [noise] and our people when I'm gone, if they hear this, look at the little kids. I mean we all say that, but it's true. Look at what Buddha says, they're empty. The only thing they know how to do is love, until we teach them how to hate. Stop teaching the kids how to hate, God damn it. Teach them how to love, everything. That's our future, the kids.

Children. So it's too late for us, probably. [laughter] We've already been contaminated. When some of us can filter this contamination, we could still rise to the occasion.

Q: All right. Well, thank you for speaking with me today.

A: Yeah. I could sell you one of my rap songs. I actually rap. [laughter] Reggae rap, reggae. But I do everything. Oh, soccer. I told you, when I came to the—One of the things I didn't tell you about Collingswood, was I was playing soccer. And they said—And it was part of the racism that I couldn't play because I was too—They were scouting me because I was so good. And then I was walking over from the night park. I worked at night park for summer. And I played soccer. So, we practiced night school [01:50:03] There was a teacher, I think she was the history teacher, or philosophy, or whatever. She comes to watch a game. And she saw me in plain clothes walking away from a game, ejected. That was part of me back then.

[01:50:16]
And she says, "What happened?" And I told her. And she says, "You need to see a lawyer." I didn't get it then. But what she meant was that I was being—I didn't know, right. And I didn't go home and tell anyone because I was living with my sister at the time, who sent for me. What am I going to tell, her? She probably wouldn't listen. She didn't care. She cared about me, but not the fact that I was playing soccer, she didn't—I didn't have anyone come to watch my soccer game. When I was graduated from high school, it was only my girlfriend and my sister there. And so you know, yeah.

This is good. This is good. This is good for me to let go and talk freely about some of this. It's therapy, my friend. You could go into a new job. [laughter] You could be a—[laughter] You sit there and listen. You learned how to listen. That's a good trait. A lot of people don't know how to do that. And some people are listening to respond. You're listening, I could tell.

Q: Listening to take notes.

A: Yeah, yeah, that's good. And it helps. Thank you.

Q: Yeah, well thank you for sitting down and telling me all about your career here with Hologic. It’ll be a good part of the collection. I'm just trying to get as broad a picture of the whole thing as I can.

A: Well thank you. And what was funny, is I wrote on a lot of things. On each one, [01:51:37] dots under each one of your questions. And I ended up not looking at it at all. The only time I looked is when I started to remember the question. Because the way my mind works, I forget the question in the and the process, because it’s so much to tell when I'm trying to compress it. So yeah. It was all from my heart, my friend.

Q: Cool. Well, thank you again. And I’ll go ahead and shut off the recording now.

END OF INTERVIEW