

PROJECT: GENETIC ENGINEERING AND SOCIETY HISTORY PROJECT
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[Matthew Booker]: Thank you from the GES Center and Karina where are you from these days? Also the GES Center?

[Karina Todd]: I'm still at IGERT so not quite the GES Center.

[M.B.]: The IGERT, okay. And we're here at Hunt Library. It's August 30th, 2016, and we're with Scott Johnson. Could you tell us your name, your institution, and your job title?

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[Scott Johnson]: Okay, my name is Scott Johnson. I am with the North Carolina Biotechnology Center. And I'm the vice president of agricultural biotechnology for the Center. The Center is a nonprofit. It's primarily funded by the state of North Carolina to do technology-based economic development for the state of North Carolina. And of course, my role is focusing on agriculture.

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[M.B.]: And so in a day to day sense, what do you do? How does that look?

[S.J.]: Well, it's very—it's varied. We first of all for tech-based economic development it's really important to follow the technology and the status of the projects and where opportunities are either to help move forward innovation or to help companies capitalize on that information—innovation and create jobs. Ultimately our metric is creating a job.

So day to day what I do is I make sure that we're engaging in the community and adding value by providing opportunities for dialogue, networking, information exchange, connections with opportunities. We do a lot of counseling with entrepreneurs who are looking for resources and advice on getting a business started. Who they should work with. What are the steps?

And then we have groups within the center who are specialists in providing financial support. Grants to North Carolina academic institutions and loans to entrepreneurial activity. So we don't have big loans or big grants, but we tend to focus on areas where there are gaps to move things forward into the commercial world which is what we're all about.

[M.B.]: So that's a series of ideas or knowledge that you have to have in order to operate in all of those different arenas. Did you imagine yourself having that combination of skill sets when

you were a kid? What did you want to be when you grew up I guess is what I wanted to ask you?

[S.J.]: Well, I really didn't know much other than agriculture and medicine. I grew up in a small rural community that my father was the fourth or fifth generation of Johnson's who were there, and I came along. It was his hometown. Because of WWII, he became a Doc. He went into what he called the V-12 program at the time and was a college student when he got drafted, and the government knew that it could be a long war. They needed professionals. They were training doctors and lawyers and engineers and that sort of thing. He got into a program in medicine. So he spent most of WWII going to school and then had to go back into the service when Korea heated up and so he went back in the service and stayed in the service as a reserve officer until Korea—or until Vietnam started heating up and then he said enough is enough. So in the interim, he got trained as a physician, went back to his hometown and started a private practice.

However, we always lived on the family farm. He was the only son. He had five sons. We raised our own beef cattle. We had some crops. We rented part of the land as well. So we grew up in an agricultural environment. And most of our peers that we grew up with were the same generation that we were but the next generation of the same names. Go to our high school you see the same names generation after generation after generation, not unlike any other small rural agricultural-based town.

So I was kind of an outlier because I didn't follow my dad's profession. And I didn't stay in town in agriculture. I went to corporate agriculture. And never really thought of doing anything other than some sort of research and innovation in agriculture. I went to UC Davis. I originally thought that I would become an extension academic. I wanted to work in the extension service. Looked at them as fount of knowledge in our local community and teachers. But as I went through my academic career I got tracked into the business side of things. And so I left the academic world and transitioned, went to business school. Ended up on the commercial side of things. So that was many years ago.

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[M.B.]: So you went to school at Davis as an undergrad and then you did your MBA at Stanislaus, right?

[S.J.]: Right.

[M.B.]: So I'm from California too.

[S.J.]: Oh, there you go.

[M.B.]: Were you from about in-between?

[S.J.]: I was from Turlock.

[M.B.]: Okay. Turlock.

[S.J.]: Yeah, where—that's where our hometown is, that's where the Johnson's have been since the 1870s. So we've got a small family farm. Almonds now and my brothers and I own it, and my nephew farms it. So yeah, you know we grew up, always—the only school I ever applied to was Davis. And so I was lucky I got in. It's harder to get in now probably couldn't.

[M.B.]: So you—a small town like that has a powerful magnetic pull to come back. How'd you—where did you go after you did your degrees and how and what drove you? What pushed you into those fields?

[S.J.]: Well, at first I was going to go up to Idaho to continue. I finished my undergrad at Davis and then I spent a year—I had a girlfriend who was a year behind me, and so I spent a year working in the entomology department as a technician. And then I was accepted to a graduate program at the University of Idaho in Moscow, Idaho, and she was accepted to a graduate program at the University of Puget Sound in Tacoma, Washington. So we had never been to either of the places when we—and so we got married, packed up a pickup with what we owned and drove up north, checked out Moscow, Idaho and went over to Tacoma, Washington and never left Tacoma. And I called the professor and said I'm not going to show up in Moscow. It's prettier over here. And that was about the only bridge in my career I ever really burned. He wasn't too happy about it.

But it was the right thing to do. I had enough exposure on the academic side to know I didn't have the discipline to do that and it was not really—I loved the idea of teaching, but I didn't like the idea of being constrained within that—at least the way I saw that academic environment. So I took a job in Tacoma while my wife was going through grad school and then I had—while I was a technician at UC Davis I had taken a pest control advisor license. I think it was the second year they were required in California.

So I had a license to be a pest control advisor and to sell chemicals, and so I went back into California, and I went to work for a company that really had a focus on hiring people and training them. And training them because they felt that they needed an influx of new blood. They had a group of shareholders. It wasn't a big company, but they had shareholders who had worked together for 20 years and what I appreciated about what they did for me was that they had five different offices that they operated out of. Mostly in central California from about Los Banos to well, they had a Sacramento office who went all the way up to Chico and almost to Redding. To Sutter Buttes area.

And so they had a training program which I was really intrigued with because I could see the whole diversity of California agriculture and so I spent time in each of their offices, learned what they did, how they worked with farmers, what products fit what crops. They made me do everything from delivering and loading trucks to scouting fields and ultimately once they were satisfied I was ready to write recommendations and work with farmers they gave me a territory. And I went to work selling chemicals and other things. But in the context of California that required a license and a prescription for every application and every sale that we made. I felt I was in a very technical field that I was doing some things.

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One of the things I was really proud of during that time was that I felt that I was trained in the new integrated pest management techniques and understanding a little bit broader scope than just the chemistry. The impacts of the chemistry on the populations of the pests as well as the good insects and that sort of thing. And so I had a client who was an old Delmonte farm that—well, they had 4,500 acres of production. They had 26 different crops in their crop plan the last year I worked with them. But they had about 1,800 acres of peaches at the time I was working with them and over a course of about four years using IPM techniques I got rid of what—all use of miticides by using my knowledge of what chemicals to use at what time. Pheromone traps and that sort of thing. So I got to apply some of what I had learned, and that was kind of cool.

But I had gone as far as I was going to go with that company. So along the way, I got my MBA. I had three kids. Needed to move up the ladder and I joined a multinational Rhone Poulenc [French global company].

[M.B.]: So you got this training in entomology, and then IPM which is—this is the late 70s, early 80s?

[S.J.]: It was the early 70s.

[M.B.]: Early 70s. So you're really at the forefront of that tech—that approach.

[S.J.]: Right. Uh huh.

[M.B.]: And. But how did you get into biotechnology? What drew you into that?

[S.J.]: Well that came—it's interesting because I never thought I would be getting into that area and didn't have any awareness of it to tell you the truth. But when I joined Rhone Poulenc they wanted somebody from the West who knew specialty crops because they had a number of chemical products that they were going to be introducing over the short term into those markets. And so I was hired. They moved me back to Princeton, New Jersey where their headquarters were, and I became a product manager for fungicides and insecticides that go into those western specialty markets.

I did that for a couple years but over a period of time the company changed very rapidly too. They were growing rapidly. They purchased Union Carbide. I think in fact I made a note of it that in four years or in five years I have four promotions. So I went from junior product manager to a product manager to a business unit manager to ultimately got into business development.

And when I got into the business development I started to get into more than just the chemical side of things. And started to get into the strategy that the company was implementing. And this would have been about 1992-93 that timeframe. And my very first exposure to what the company was doing in biotechnology was in France.

And when we went to a manager's meeting in France, and we had presentations by not just our own scientists who were working in agriculture biotechnology but scientists even from other companies who were looking at this new technology and talking about enabling processes that allow these traits to be put into plants and commercialized. And so that was a very interesting time because there was a lot of excitement in Europe about genetically modified crops. There was a lot of academics that were working in it, and all of the big European companies were working in that area as well. And we were pretty collegial about it. I mean we patented our technology and protected it. However, the basic science, the systems, and stuff were openly discussed at that time. And shared at various conferences and stuff.

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So I had a lot of contact because of my role in business development with my European colleagues, and I went over quite frequently to Europe which is where our biotech at that time was headquartered. And we had some very early and very interesting biotech traits that came out of the effort. We worked with Calgene in Davis California, and we had some of the earliest herbicide-tolerant traits that were commercialized. We had a fairly significant effort in some agronomic traits like stress tolerance to both heat and cold. Drought tolerance, that sort of thing. I mean even back then we were working in those areas, and those are just now getting commercialized.

But it was a pretty exciting time, and it was a vision that we from the chemical industry had of another tool in our portfolio and a way that we can apply the current science to our commercial effort. But also doing it in a way that fit our background I guess as much as anything else. We always felt that we were more technically trained than our predecessors and our bosses at the time. And so we were encouraged to learn.

I mean in fact, the company they put me in a program at INSEAD at Fontainebleau, France that exposed me to entrepreneurial training and thinking. I spent about eight weeks in Europe looking at some of the applications of both biotechnology and some of the work we were doing being done around plants and just understanding the plants and their reaction to both chemicals and to trait stuff. So I'm not a scientist, but they were very—at least at that time they were very interested in their commercial people understanding the science and what was going on. So it was a real dynamic time. A great time to be part of the industry.

[M.B.]:

So you said a couple of things that I'd like to pursue because I think they raise an interesting point. One is that you said you were really proud that when you were working with a farmer with acreage that you had been able to reduce the use of miticides in particular.

And the other is you described this energy this interest around biotechnology—around traits that might replace the use of sprays or the use of chemicals. Why was there—why you think people were so interested in that? Why were you proud to reduce the use of sprays in the 1970s? What was the—if they were functional sprays why replace them?

[S.J.]: Well, that's a great question. Our industry really took off after WWII. And it was driven by chemistry. And most of the big innovations came during the 50s and 60s in the chemistry world. There were very few new families of chemicals that have come after the early 70s. And so I was of the generation that was dealing with products that were relatively old. My products that I happened to have been hired for as a marketing person were some of the newer ones. Some of the fungicides and insecticides that were coming. But like the herbicides, we still have products out there that are being used that were discovered in the early 50s.

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So the glamour on that side of it was more around reducing your production costs and being more efficient in the formulation and the delivery of the product. And not necessarily of coming out with a whole new wave of interesting technologies.

So the one thing that attracted me in the industry was that we recognized with the advent of higher regulatory standard with the EPA which came online and was authorized in '72 by '73, '74 they were already implementing what we live with today in our regulatory process. So it then created these regulatory hurdles that we knew we were going to have to meet and it required those of us who were managing projects. And in my company, the marketing folks were also the ones that were the project managers of the new technologies. Once it had been decided it was going to get commercialized.

So we were moving for—we had an awareness that we had to be pretty aware of alternatives. How it fit in a new regulatory environment so it was very different than previous generations and we felt that we were trained a little bit differently as well. I've always felt that way. So that was the exciting time.

It was also an exciting time because there were a number of different companies. You felt that you always had opportunities. I think one time I looked back, and there were more than 25 companies when I first got in the chemical business that was actually doing screening chemicals to register them as pesticides. I mean today there's about six that do that.

And so there was—it was a whole wave of innovation that was—that we felt we were a part of and that biotech was just another tool that we—we hadn't figured out how we were going to make any money at it. But our vision at least initially was if it's something that's going to be offered to the farmer and where we were going to go with it, then we've got a role in it because that's what we do. So that changed as things moved on and things got—and biotech especially got commercialized.

[M.B.]: Well let me ask you to define a term because this word biotech is a rich word and I think it might mean different things to different people. What did you think biotech was in that period the early 1990s?

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[S.J.]: In that period, I was actually inserting genetic material into the genome for a particular result. I mean that's how I would have defined biotech in the early to mid-90s. And it was all about I've got a toxin that I can express through the plant, and I can kill a bug who eats the plant, and before he damages it too much he gets killed, and the plant is protected. Or I've got a mechanism that I can put into the genome which makes it resistant to herbicides so that the plant stays while all the weeds around it get killed even though I'm spraying something that in a normal environment would kill the plant. So in that timeframe, it was a pretty narrow definition of what biotechnology was. And I mean the scientific terms were basically we were looking at recombinant DNA technologies and if you ask me today it's a much different definition.

[M.B.]: Well, I ask today.

[S.J.]: Okay.

[M.B.]: How do you think that term has changed?

[S.J.]: Well, I think that term has changed because to me now biotechnology is a broader understanding of biomes and the intersection of biomes and that can be environment, climate, soil, plant, animal. I think all of that it's a much broader definition. What within our current understanding of the biological systems and the biomes that exist impact our desires for products and food, fuel, and clothing? And how can we apply that technology to a—so I think that's my definition now is when I say biotechnology I'm thinking much broader and I'm thinking—I'm still thinking in a commercial sense. I'm still thinking that biotechnology has a point that it has a point of taking good science and understanding to achieve an end result. And that is a much broader vision that I have today than I had when we were just inserting something that made the plant do what we wanted it to do.

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[M.B.]: So were there critical moments in the evolution of that change for you? Were there moments when you changed from thinking of it as this mechanism, this fairly mechanical process of inserting genes for a particular purpose—inserting elements for a particular purpose to this broader sense of biome that you have now?

[S.J.]: Yeah, I think—

[M.B.]: Were there waypoints or markers?

[S.J.]: Yeah, there's a couple of things that really hit me. When the first biotech commercialized crops hit the marketplace, there was a huge disruption in what had occurred in the ag input industry. And the reason was economic basically. You had a transfer of revenue and value from a chemical to a seed and you had a pioneering company Monsanto who changed the whole offering that existed at the farm level by saying we now have technology which will allow you to use this chemistry but you need to pay for it Mr. Farmer and you do it through a license that you sign directly with us for our patents on this. Then

you can buy our chemical and use it on that technology for your purposes which was herbicide tolerance, Round Up Ready. Soybeans was the first one.

And so that was a complete change, and it started—that was an awareness that we all had, ooh, we've got to connect to the seed now. We're no longer going through a distribution channel which was pretty pure on the chemistry side, and frankly, we had offered even before Monsanto had their tech fees, Rhone Poulenc who I was working for. In fact, my team by then I was—I'd moved from business development to head of marketing, and within my team, we had project management again where the projects were herbicide tolerant cotton. And it was called BXN cotton. And in December of 1994, we got deregulated for BXN cotton. Our partner in that endeavor was Calgene who owned Stoneville Pedigreed Seed who was the cotton seed company.

And so we had an agreement that we more or less as the big company paid for most of the science that got us to the end point to put the trait into the seed but once we got down to promoting the system Stoneville sold the seed, and we sold the chemical, and we made our margin on our chemical. They made their margin on the seed, and we were two different entities. But we had a marketing agreement.

What Monsanto did was take the value of the herbicide technology knowing that their chemical was soon to go off patent and they were going to have lots of competition. They moved the patent protection and the value to the seed through these tech fees and the chemical prices went way down in the generic world that they existed very shortly after introducing the tech fee. But they were capturing the value off of the license for their technology.

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And it was such innovative technology that most farmers could adopt it. I mean they—it reduced their cost, it made ease of production and increase their yields so dramatically by controlling weeds the way they did with an herbicide-tolerant technology that they were willing to sign these tech fees, watch their seed price go up but ultimately they were more efficient. They spent less money in production, and they got bigger production.

So our model was simply more acres to treat. Their model was we're going to capture the value off of the trade because we have a patent position there which is going to extend beyond our patent position on the chemical. And that was a big innovation, and from an awareness standpoint, it all of a sudden said wow, this stuff we have to connect to the seed.

Rhone Poulenc went out and purchased Callahan Seed and a couple of other smaller companies. But we didn't make the huge strategic investments like DuPont did by purchasing Pioneer/Dow Chemical purchased Mycogen which was a biotech company that had trades but they were already in. They also bought a couple of seed companies along the way. And of course, Monsanto purchased a number of different companies including Holden's Pedigreed Seed which was the largest foundation seed company in the corn business.

So very rapidly after 1995 and certainly by the year 2000 you had a consolidation of the seed companies in the major commodity crops. And that includes cotton. Cotton, corn, soybeans and canola. Those crops the big companies all purchased the seed assets and started to connect the offering to the farmer of biotechnology chemicals and seed.

And it really changed our perception of what we were doing and where we were capturing value. And what our position was and how we communicated, so it was that to me one of the big things.

And there was a second incident that really broadened my understanding of biotechnology. And that was by this time we were in the late 90s. Consolidation continued and Rhone Poulenc and Horst merged. Horst, an old German company Rhone Poulenc, an old French company, they—we became half French half German. They put the headquarters in Strasbourg, which was neutral territory and so they—we merged into Aventis Crop Science was what it was called in late 1999, and by mid-2000 we ran into an incident that really came from a project that Agreevo or Hertz had done previously which was called StarLink corn. It was a biotech trait that provided European corn borer control, and it had been registered for use in the sale of the commodity into the animal market but not into the human food market.

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And Agreevo in 1999 and then Aventis in 2000 had offered the seed through seed partners, mostly Garst] seed at the time to farmers and we had agreed with the EPA that we would have a stewardship program where the farmers would say up front I understand this seed and the commodity that comes off of this plant needs to go to animal markets, not human markets.

However, in 2000 it was discovered that there was StarLink proteins in human food in taco shells. And that created a huge crisis for our company. And it also created awareness on my part because by this time I was head of North American Ag—of biotechnology. So I was the senior guy when this crisis hit. And I hadn't been a part of the project, but I was a part of the issue. And so you get appointed to a new position you feel oh wow, I'm a big time executive and then within less than about four months I'm dealing with a potential that could actually take our whole company down with liability.

So the next two years I basically did—most of my world was dealing with the StarLink crisis. And the board in Strasbourg had immediately responded to the issue by contracting with a manager who had experience in crisis management and working through really nasty issues, and so they hired him and I—he came to North America. I became the manager in charge of dealing with complaints beyond the farmer and then another manager handled everybody at the farm level and then we started solving our issue complaint by complaint.

On the farm side, it was a negotiated program with the USDA the regulatory body in this case. And it was simply a marketing program to direct the farmers to animal use. It also

required virtually 100 percent of corn production from 2000 through almost 2005 was tested for Starlink residual. And if it tested positive it had to go in the animal use. And there was a team that took care of that.

My team took care of everything beyond the farmer, so we dealt with elevators. We dealt with food companies. We dealt with some of the big companies. Kraft, Pepsi, things like that. Cargill, Conagra and then my staff typically would deal with all the independent elevators who had some StarLink in their system.

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What I learned and why I bring this up as a learning, was that agricultural biotechnology if you change the genetics of a plant or an animal for a single product, in this case, kill a bug you're also changing about five or six or seven different products along the way. Multiple products come out of a plant. Multiple products come out of an animal and never really had that right. The realization until that point.

If you go through a mill and they're selling oil, starch, flour, a number—grit, grains. You name it there was five of six different products that they're selling. They all have their own balancing act that they have to do. They have their own markets. They have—and if you disrupt one market, you're going to impact the others. And so from that point on from 2000 on I started to find biotechnology very differently.

I through a crisis had to learn that there's a very broad impact on what you do and what you're expressing because we're so—things are so complex in that business. So that—and then moving on as things moved on I—Bayer purchased Aventis. They didn't purchase the Starlink thing. So that was kept within the Aventis Sanofi umbrella which was the pharmaceutical side of the business. They created a separate company called Starlink Logistics. I stayed with Bayer. I became the general manager of their corn and soybean biotechnology seed and trait assets and then Bayer sold off those assets. I moved back into the chemical business for a short time and then I was invited to leave. So I left Bayer about 12 years ago now. And I got into the entrepreneurial world.

Part of—one of companies that I started and worked as the president for about six years was a novel crop feedstock business for industrial products and renewable fuels. And we were a spinout from an ag biotech startup, and so I got into that startup entrepreneurial world but still in biotechnology. But very different. By then we were—it was more about (?) rather than products for the farmer or for the—it was looking at the end-use industrial product. Not food. We were dealing with nonfood. We didn't want to get the food versus fuel debate, and we were just looking at industrial products including fuel. And we were looking for attributes and products that were—could be efficiently competitive to petroleum which we were trying to replace. And so I did that for a while until I joined the biotech center. All those experiences has broadened my understanding of what I—the world that I was in.

[M.B.]:

That range of experiences strikes me as unusual. It sounds like you'd have to be there. Have to go through the experience for example with Starlink one of the—a very controversial moment, right in the history of genetically modified foods.

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[S.J.]: It was. It was.

[M.B.]: Do you think that that range of experiences has found in regulatory authorities in other places in industry in places like the biotech center? I mean is there a—is that a shared experience or do people tend to come at the story of biotechnology and agriculture from a particular window?

[S.J.]: I think the latter probably more so than the broad experience. There are people that have similar experiences to what I've had. I mean there wasn't only the Starlink incident. There have been other incidents where unapproved traits have been in the marketplace and that sort of thing. But I was always—I'm not a scientist. I was—I have enough background in science to be dangerous. And I was on the commercial side. And I was—from really from 1998 or so on I was pretty much on the general management side. So looking at seeds, looking at traits, looking at businesses that—I mean when I was head of technology—biotechnology for Aventis we had a foundation corn seed business which was a wholly owned entity but I sat on the board of it as the chairman because we owned it. And so it broadened my horizon, but I don't think there are a lot of people that have the type of background I have. The chemical and the—I probably have less business in the true seed and seed breeding side of it although I managed that for many years. I've had seed breeders working for me. I've set up seed breeding laboratories and research farms.

But I didn't come up through that route. I came from the chemical side. So I think in that world it's different and I have never been on the food or food processing side either. My biggest exposure was through Starlink and having to negotiate with food companies. And I think that's important now.

One of the things in my current role that I like to do is to make sure that when we create a dialogue about innovation and the creation of high-tech products in agriculture that we're actually engaging the innovator with the guy who has to protect his brand and adjust to the consumer. And the consumer demands. And make sure that they're converging upon an opportunity. I mean that protects our investment in the entrepreneur, but it also makes an awareness on the part of the food company that this is coming down the pipe.

So we do what we call summits. We have professional forums. We try to get a diverse audience of people that are stakeholders in the whole food value chain to at least understand that these are things that will connect at some point down the line. And for me, it is stimulating because I've had a little bit to do with all of that over my career. And so I think that's a part of it.

[M.B.]: One of the really striking things about agricultural biotech for me and thinking more broadly about technologies is the fact that so much of the process of innovation and of actual production seems invisible to most people. And when they do interact with the technology they do so through the medium of food. And so you get these extraordinary backlashes like after the Starlink case. And in your colloquium you gave a colloquium today to the

GES Center and I think you said you had this great quote where you said your perspective—how you would give your perspective on how GMO became a four-letter word to many people. And I wanted to ask you about that. If you think that there's a relationship between—if I've misstated first of all—

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[S.J.]: No, that's absolute truth.

[M.B.]: And what you think your experience can tell us about this gap between the complexities of the way biotechnologies are used in agriculture on the one hand. And the way that everyday people encounter them via their role as consumers.

[S.J.]: And I think it goes back because in my opinion there's a great deal of misunderstanding of genetically modified organisms at all. And I mean I've read where people have gone to farmers' markets, and they've sat out a table, and they put a petition out, and they said anti-DNA. I'm against DNA. And they have little stickers—and people will actually sign a petition saying I'm anti-DNA. DNA is in every living organism. How are you going to be anti?

But to me that just illustrates the fact that there's something below that, and there's something deeper than that that we have to do and how I arrived at that statement and how GMO's got to be a four-letter word was the fact that we were so naïve in understanding how to communicate the technology and the science of what we were doing and connecting that with the consumer.

We grew up in a world of science. We grew—we believed in science. We knew science. We knew the process. We knew what was going on. And we never until we were actually modifying food and getting into people's stomachs we never thought much about communicating to the consumer. We didn't have to. We were a business-to-business entity. We dealt on a technical level with our customers and didn't have to think about protecting the brand or creating a brand or differentiating our offering from somebody as somebody else's offering. At least at that level. We could do it on the basis of technology or science or data or things like that.

It's a whole different world. And I think that's the main reason. A naïve industry dealing with a technology that all of a sudden became a consumer technology and the awareness was there, and that's how the awareness got there was the other convergence of creating that four-letter word GMO. Which was—you had the growth of new media. There was no internet when I first got into the business. There was controlled media. There was industry media. There was—I mean there was professional media. But all of a sudden somebody with—who in the past might have had a very small voice could create a very large voice that appeared as big and legitimate as other voices.

And I think that convergence of new media and the technology reaching the consumer which was new. And we didn't think anything of it. I understand completely—we made so many mistakes with our early products. We sat there, and we said well we're putting

foreign DNA into your—into the genome of your plant and nothing's going to change for you to trust us. You're still going to get corn; you're still going to get corn chips. You're still going to get soybeans. Farmers are going to make a little bit more money. And the company's going to make a little bit more money. And trust us.

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Your food prices won't go up or—not much. We're making it better for the farmer. It's more—and the best we ever said was well, it's more sustainable. We're dealing with a growing population. But we're asking you to take the risk of foreign technology and your benefit is not very apparent. I think had we brought in technology that had a direct impact on a need at the consumer level GMO wouldn't be a four-letter word. But we didn't. It was part of the value chain. And the consumer didn't feel it. And our naïve understanding of how powerful the consumers' attitudes were created what we have today with GMO.

[M.B.]: How do you think that story is different from the way that consumers responded to pesticides when those came onto the market? Because I'm thinking for consumers also became—small numbers of people at first concerned about pesticide residues on food for example.

[S.J.]: That's right.

[M.B.]: And so there was a sense that companies connected to consumers through the residues that might be left on their food or in their food. There was a lot of uncertainty and ignorance amongst the population about how pesticides worked. Do you think there are any parallels there? Or lessons learned? Or do you see that as a missing opportunity? Or have I got the wrong para—wrong analogy?

[S.J.]: No, I think it is—there is an analogy there. I think you have to go back to a couple of things. I think first of all pesticides and most of the introduction of pesticides and concerns of pesticides. Two things happened that allowed some credible reference to interpret the science for the consumer.

The first on the industry side was the fact the pesticides went through a distribution channel to a local dealer who was a member of the community who interfaced every day with people who may or may not have concerns about pesticides. And so especially in a more rural environment that it was never really a problem. Throughout—even today they're in the rural environment.

That credible reference was parlayed by a faith in the EPA as an institution and their regulatory process. I think that the population all the way through the 90s believed that there was a regulatory process that was helping to protect them and the environment. And there was a lot of communication about how there was a joint effort on the part of people developing new technologies whether academic or industry around managing the pesticide exposure in a different way starting in the 70s with integrated pest management practices. And there was never any integrated ag biotechnology practices.

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So maybe that communication was a little bit more balanced and acceptable to the consumer. But you can't discount the power of one blogger on the internet. And the following that they can get even if it has no credible basis in fact. I think we see that all the time these days. And that was—that's something that I think innovation still has a lot to learn. And the ag tech world has a lot to learn about how to use or manage or respond to that independent blogger who can write well, create a following and appears to have as big and as credible a voice as regulatory officials. As our government. As our neighbor down the street who's in the business.

And it's I think one of the big issues that need to be dealt with. And I think we'll find a way. I really do. I think by looking more broadly, by communicating those intersections or biomes and how they really relate to each other just the simple understanding that every living thing has a 99 percent of the same DNA is step one. So we're only dealing with one percent. But it's a great question I think we're still living through. And we'll see.

[M.B.]: I know both Todd and Virginia have asked some interesting questions in an email conversation we had beforehand and I wanted to give them a chance if they wanted to speak. If they wanted to ask them.

[Virginia Ferris] Thank you. You cover a lot of the questions that I initially had. I'm curious if along the course of your career there were any influences or mentors that really impacted you or colleagues that you worked with that really formed your way of thinking and working?

[S.J.]: Yeah, that's an excellent question and yes. There really are several people along the way. First I said at least in the colloquium I've been a tax paying citizen for more than 50 years. I'll show you my social security because I got a—as a fruit picker and even preteen years you still paid taxes. But the farmer that we worked for [ph 00:54:26 Carl Muller] was a UC Davis graduate. Proud of that. Very innovative. Had a big farm, big dairy. Many different crops and he could work all of us under the table. However, what impressed me about him was he constantly for those of us who worked for him encouraged us to question to understand the science and to go to Davis. He was a big alum. So that was the number one thing.

[00:55:05]

Here was a successful farmer who is like most successful farmers I know. They're inquisitive, they're innovators, they're great business people. And they're constantly looking for a way to improve their process. And in addition to that, Carl was a teacher. And so he—I know there were several of us who he mentored into the high tech ag world and I've always appreciated that.

There was a professor at Davis an entomology, an economic entomology that influenced me. We had a practice. We were a very small undergraduate department and a very large graduate department, and we had a practice of world tests.

So at first I was very intimidated by it because you work hard and then you have to go sit with the professor and everything was oral. After a while I learned that was great because I could—if he knew that I knew the subject matter he would change the question enough so that I would answer it right. And if it had been a written test I would have gotten it wrong. So, in particular, he was an influence on me.

And then moving on there have—I had a colleague who was a little bit ahead of me on the career path. I mean we'd been peers for a while, and he'd move up and then I'd move up, and then he'd move up and so on. And he told me two things which really influenced me. He said you're not paid to look behind. You're paid to look ahead. So he always challenged me to look ahead. And so that meant I had to over the years I had to be much broader in where I was looking and understanding the impacts of that.

And the second thing was a little bit more corporate which was Scott don't [meant to say do] listen to the flight attendant. What? What do you mean listen to the flight attendant? He said what do they tell you when you get on the plane? What's the first thing they tell you? Put the oxygen on yourself first then you can help somebody else. That was my downfall. I always helped everybody else and sort of left myself out to get invited to leave. And so—but I had a great [inaudible 00:57:48] and it didn't hurt me. So he's an individual.

And then I think just coming from a pretty academic family and a pretty competitive family. My brothers and I were all athletes. Don't look at me now. But look at me 30 years ago. They—we were pretty competitive. We all—all five of the Johnson boys got doctorates or graduate degrees of some kind. We've all been successful in our fields. We've all been very still very competitive. And so I think that environment of needing to know was something that influenced me a lot.

[00:58:41]

But I've been on the business side. I'm not a scientist. I have to go with the flow. I'm not—I've also learned that things don't move forward if you always take a position and defend it to death. That in the real world—in the commercial world there are different perspectives that are just as valid as yours and what you try to do is find the best course or make some course if you need to change but that's one of the problems I've had with academics.

Your training as an academic is do your research, take a position and defend it. And always defend it. Which is why they are terrible if they're on your home owner's association or something like that. Forget it. They don't know how to reach a compromise. So I'm speaking to academics. So anyway I get off track.

But those are some of the influences that I think helped do it. Truly believe that it's a very exciting time right now with some of the new tools in biotechnology just coming out of the laboratories. Some of the gene-editing tools. The ability to look at the genome and express the genome in a different way using these tools in a more rapid way that may or may not be able to be done through natural breeding or looking for mutations.

But to have that understanding to move it forward is going to create a whole new world of innovation. And I think that the industry and society is going to be a little bit more sophisticated in understanding how those things should be commercialized. I definitely know the industry is going to be much more sensitive to making sure before they make the huge investment to commercialize an innovation that they're going to be looking at that marketplace that we never did when we started out in the early ag biotech days.

[01:01:02]

[Todd Kuiken] I have two questions I think that were spurred from your talk at the colloquium. One of which I asked you at the colloquium. I'd like to talk a little bit more about is this influence of corporate dollars at the university setting. We're seeing more and more universities shifting away from public funds and more and more influence at least in terms of names on buildings and the funding dollars that are funding some of the basic research that will create these new genomic technologies. And if you could talk about what you think that influence means particularly from the public standpoint in terms of trust. Of trusting who is an independent voice to be able to have that dialogue.

And the second question is about what you raised in your colloquium too is the consolidation of these seed companies particularly amongst the germ lines of the seeds and whether you think may be create in essence a biosecurity problem going down the line if you're reducing the number of actual breeds of plants that are available. But also with the new genomic tools in terms of being able to potentially attack those lines if we have nothing to replace them.

[S.J.]: Okay, well I'll deal with the public and private money on innovation first. I think one of the most fantastic public policies that ever existed in any government in any country was the creation of land-grant universities in the United States. I think that the mission and the idea of cutting-edge technology being created for the good of a country or a society and that information being available publicly has served our country well and is a model that many countries wish they had created many years ago.

What concerns me as a product of that system is the decrease of public funding and the increase of private funding into basic research. And I think that's a concern that we ought to have when you have basic innovations which impact many different things managed—funded by and managed by private entities and pre-negotiated in terms of what can be said about it or not. I think there's some risk to certainly undermining the mission.

Now I'll correct you on one thing though I don't think big companies are really interested in putting their name on buildings. That's for the egotists and the narcissist billionaires who want to put their name on a building. Big companies are interested in the science. They can go anywhere in the world and put their money if it's good science. So some of where you do see some big companies funding buildings bricks and mortar I can almost guarantee you can find someone who's an alum or who made the decision purportedly to help out their alma mater.

But big companies are interested in the technology and how to use it and where to get it. So they're interested—they'll—very happily endow an academic chair. If it's in an area that

they're interested in. They'll very happily give—I mean I used to be in charge of a lot of money. Hundreds of thousands of dollars of grants going into academic research. And we would very very carefully make sure number one that we pre-negotiated any intellectual property that came out of that. The patents that came out of that we would have rights to. Even if we shared the rights with the university, there would be some commercial value there, and we would have a preferred position if we were going to fund the research. So that is something I think it then puts a governor on the ability to share that information and that information sharing is controlled by somebody with a vested interest in the innovation. And while there's nothing wrong with that you need some balance on the public side.

And that sort of opens up the door to the other discussion you had about food security and biosecurity and that sort of thing. What I've watched in the biotech industry as we connected the technology with the seed and as we have created these very complex offerings of stacked trades with an elite hybrid corn, soybeans, canola, cotton the number of companies that are capable to do that commercialization and create and move forward this product have declined.

[01:06:46]

As a result, you got very few companies. I mean this probably dated at this point but I looked into it about 19 or 2012 or 13 when I was running another business and looking at corn and soybeans and at that time we felt that there were only 12 corn companies that had true differentiated germ plasma parental lines of the hybrids that were being introduced into what essentially is a quarter of the United States agricultural production every year. And to me, that's a good security risk.

You've got a Midwest where there are only a few companies, and your biodiversity has been narrowed down. You couple that with extending the life cycle of these same hybrids. Before biotechnology was introduced, a hybrid basically, its life cycle was about four or five years. Today you've got 15-year-old hybrids that are out there because they've got all these other stacks on them. They were very expensive to deregulate and while there may have been some innovation to move forward there hasn't been the incentive to move forward because you have to deregulate everything that you go forward.

So there's these expensive regulatory hurdles that you go through. I think it's a concern. And I would love to see policies which address that to protect our genetic diversity. If you add corn and soybeans together, that's almost half of the agricultural production in the United States every year. Just two crops. And it's almost the same dozen companies that own germ plasma in both.

So I would love to see some protection, and we're fortunate we've got the land, the environment, and ways to secure that to protect our ability to grow a crop if we have a catastrophic event on one set of germplasm. We should have a reservoir of elite germplasm with a different genetic line that could be implemented to protect ourselves and I don't see that happening and I think it needs to.

So yeah, that's part of the consequence of biotechnology today. But who's responsible for that? Who's responsible for thinking strategically about where we're going? I mean companies have to think strategically in the timeframe of a project which in ag biotech is pretty long—15-20-year horizon that you're looking at because that's how long it takes you to commercialize things. But still they're not going to look beyond that, and they're certainly not going to look beyond the investment they have to make to get to the end and support their own project.

[M.B.]: I had some big picture questions to ask you unless somebody wants to ask a follow up on those two. Big picture questions about the past and then about the future. Broadly speaking what do you think has driven the work in the field of genetic engineering in agriculture? I mean here's some options, right? The serious proven needs from farmers and consumers. Environmental threats like drought or limited farmland, climate change that we hear about. Structural forces like grants from big foundations that shape university research agendas or as Todd just suggested and you responded to already investments from companies. Financial opportunities. I mean what do you think is really driven agricultural genetic engineering to date?

[S.J.]: To date, I think it's the capability that the big companies have to either improve production or to fill a need at the farm level that nobody else has because it's so expensive or it requires access to market that they have. So it's a very commercial activity in my opinion.

[01:11:37]

An example is when we were within Rhone Poulenc and I was—I had a monthly meeting with our head of research. I was head of marketing and project management and had a monthly meeting with our research guys, and I always appreciated that because he was the first head of research and the last head of research that ever sat down with a marketing guy and said what's the market need and we'll go look for it. Instead, they usually came to me and said here's a great technology there must a market for it.

But anyway he came to me and we were talking about drought tolerance and this was in the era when tech fees were just getting established, and herbicide tolerance was out there, and so he had done his little calculation with his team saying this is what it's going to cost for us to help protect a plant against drought and this is how much we could save in terms of over a five-year period. The cycles are such that there's going to be at least one catastrophe in five years so if we can convince the farmer to invest every year it'll pay off within a five-year period for him to make that investment over five years.

I'm sitting there listening to him, and I said so who's your competition, and he starts going well, it's Monsanto and Syngenta, and Dow and DuPont Pioneer and I sat there and go I think it's the federal crop insurance corporation. And he sort of looked at me and said farmers—100 percent of the farmers buy federal crop insurance. I mean it's a risk management tool. It's cheap. And you're telling me that you're asking a farmer to invest every year in something that may happen once every five years and he doesn't know whether it's going to work or not because he's never experienced it. He's experienced a claim on his crop insurance. He knows it works. He knows they'll pay off. He's got an

insurance base, and he's already buying it so are you going to ask him not to buy the crop insurance and buy your seed?

So anyway what we arrived was, ooh, it's not worth as much as I thought and it's an attribute that may differentiate your germplasm, but it's something that you can't get an absolute value every year out of. And so that's why in my opinion you're seeing drought tolerance in the marketplace. They're not getting tech fees off of it. They're using it to differentiate. My DeKalb hybrid has proven that in a dry year it's a better yielder than in—and you may have a dry year, but otherwise everything is equal. But if you have a drought it maybe has a little bit—that's something a farmer will make a decision on. But not paying a tech fee every year.

[01:14:55]

So I think that's sort of the awareness that we have, but it's also I don't know how I got off on that topic, but it's understanding some of the influences better and I think all of the companies and everybody understands much better the impacts of biotechnology, the value that can be created and I'm hopeful going forward you asked me to look forward I'm hopeful that we're going to take those learnings and the new technology and we're going to find ways to do the wonderful things that can be done with our understanding of genetics and we can really serve the public good and make money at it by taking these technologies, filling the needs for our nutrition, our diversity, our security and make money at it.

And I think that the successful companies in the future are going to know much better than my generation did how to do that. And I think that what they're doing—I gave in the colloquium I said, look I got an MBA and I didn't have to take an ethics course. You get an MBA today you have to take an ethics course.

If you're learning gene editing, if you're handling a gene drive I guarantee that you're exposed somewhere somehow maybe through GES with hey guys wait a minute there's a broader consideration here than just the science that you can do. And I think that's good and I think that the industry on the private side are thinking about that as well. I think if you look at the money that we will see a pendulum come back a little bit in terms of having a credible independent financed from either - for some sort of an industry tax or federal government or something but something which will give some assurances to the public and society that what we're doing has been considered in a broad context for the public. I think that's—I really believe that's going to happen because those dialogues are going on privately in industry, academia, and government. I think somehow it will all come together.

And I'm hopeful for that because it's like—I also said at one point I think the one legacy of the baby boom generation is our understanding that man has an impact on the environment. And if you go to my grandparents they did the infrastructure. My parents, they protected us from tyranny in the world. Maybe our legacy as baby boomers is an understanding that man has an impact on the environment. And maybe the next generation's lasting influence is—we're beginning to understand the power of genetics.

And the good and the bad that can come from it. I think that's—I'm hopeful that's going to happen.

[01:18:41]

[M.B.]: Well, then let me ask you the corollary to that—the flip side of that. If that's your hopeful future for genetic engineering and for biotech, what's your pessimistic or negative? What's your biggest concern?

[S.J.]: My biggest concern is that market forces are going to continue down a path of, an anti-science path, and that they're on the part of policy makers and the public, there's a naïve understanding of where their food comes from and how it can be plentiful and how it can be there on their tables at a reasonable price. And that there will be a hardening of positions that influence policy to the point where we go backward. And we're not able to provide the diversity, the abundance in the world and therefore you're going to do a lot of—food security is the most basic thing.

And a lack of understanding of how we can apply knowledge to ensuring the food security of the future and putting in place policies that are based on either a naïve understanding of science or a political pressure that exists in the moment will create gaps in our ability to provide food security to the point that it creates chaos elsewhere. I think that's my biggest concern.

It's the anti-science, lack of trust of government and policy, the lack of strategic thinking and understanding and the lack of meeting the common ground that's required to have a bountiful supply of food.

The numbers to me are absolutely clear. If we're going to double our population which, it looks like we will by 20 whatever it is 2050 or whatever it is. Nine billion people in 2050. That's the equivalent of today's 11 billion people because we're all getting fatter and eating more calories—empty calories and so on and so forth. You know I mean things will change that way. People are getting more sophisticated, and the good food does and that sort of thing.

And there's also an understanding of the amount of waste that goes on. We grow enough food now for everybody. We just don't get it to where it's needed. That will be part of the solution, but if we're going to really be in an environment, my grandkids are in their—when they're my age where they're having the same bountiful abundance of food I think you gotta put science into the factor. And I'm concerned that it won't be there. And I think that's a big concern.

[01:22:17]

[M.B.]: A theme that's run through many of your comments today has had to do implicitly with the way that the public and I know that's a loaded word, but the large body of people in the United States and beyond how they respect or trust the systems that provide them with food. And here I'm thinking of not just the agricultural sector, the industrial sector but also

government and regulatory systems. And so how do you feel about that level of trust in government and in the regulatory structures around agricultural biotech given your experience?

[S.J.]: Yeah, given my experience I have to say that my interaction with our regulatory agencies the professional regulatory people, for the most part, has been very high level, very sophisticated, very understanding of the balance that they're required to do between protecting and understanding the science and fostering innovation for the most part.

What I've seen in more recent years is a little bit more politics playing into that, a little bit more of a resistance to changing processes. Taking a risk as a bureaucrat is another four-letter word. And so it—things move slower as the science is speeding up. And so I think there's a concern there and obviously, as a citizen, I'm concerned that people do not believe in our government systems as they once did.

And that again I see it sort of holistically as somewhat the same thing. An independent blogger can have as powerful a voice as a political party. And I think that that's a concern. But I think that ultimately that too will change. That pendulum will change.

You know when I—I mean there's all kinds of social concerns I have in the division of wealth, the division of knowledge, the opportunity that exists, the diversity that should be there. All of those things I think will be debated. I think that our belief—I think there'll be some big changes in our understanding and respect and trust of the government, but I think it will probably take a crisis or two to get there.

But where my hope comes in is in my career every time I've dealt with the individuals they're competent, they're trained, they're aware. They know what's going on on an individual level. And I think that's where in a crisis we've got to rely on the fact that the right thing will be done ultimately. I really do. But that's a concern. That's a huge concern, and I think we're losing a lot of credibility we once had. And it's getting worse for the people that regulate us.

[01:26:08]

[M.B.]: To follow up that point if you could inform the general public magically—if you could inform them about genetically engineered organisms what would you say to them? Is there one great message or maybe a few small messages that you wish that a general public could understand about GMO's or GEO's?

[S.J.]: Excellent question and I would say that there are—that ultimately there is an understanding on the part of the people that are creating these products that they will not secure a payback for the investment that they're making, putting it into business terms as best I can. But they will not secure a payback unless they can demonstrate that there is value for whatever perceived risk there is. And that's the biggest learning in my career that the biotech industry has had.

I think that that dialogue and that concern starts at the very beginning. At the bench, they're sitting there and saying I've got this great new tool. I can make these products now. What's the risk? What's the benefit? That didn't exist early on. It exists today, and everybody's aware of it.

So when you see products today that are being talked about and introduced at least, there's been a dialogue along the way about what is the impact? How is that going to affect my stomach, my environment, my children, my genetics, my dog? That is something that has really changed in the last 15 years, and I think that's a good thing. So that's the number one thing that there's an awareness today that there didn't use to be.

The second thing I would say is what I just said that there are committed educated people that are there who understand it's their job to challenge the innovation in the context of protecting the population. And they are in most cases that I've experienced as knowledgeable and competent as the guy that's discovering the technology.

So there's that conflict that exists if it's a conflict. There's that challenge that constantly creates hurdles that have to be overcome by the time it gets to the grocery shelf or on the table. So I won't say that there hasn't been some change but that change has been on a broader level. I said it was more politicized. I think that's on a broader level but on the individual level there is a very competent group of people on the regulatory [side] and they're as competent as they are on the private innovation side.

And then finally I would encourage people to consider the academic side and the value, if it needs to be changed, change it. But the value that a mission that provides the ability to transfer knowledge funded by the public for the public is an important element of technology innovation. And right now we need to take a look at that pretty seriously. I think that that's pendulum is a little bit out of whack. So I think those three things would be what I would say.

[01:30:48]

[T.K.]: Can I follow up on that?

[S.J.]: Sure.

[T.K.]: So there's been this growing movement, and people call it different names whether it's do it yourself biology movement, there's more and more community biotech labs that are opening in various communities. I'm wondering what your thoughts are in terms of those types of scenarios that has, in essence, the access to this technology which for a number of years seemed to be—or at least the perception was that it was locked away in Monsanto or Dell and how this new democratization potentially of this technology might be able to change people's perceptions of it if they can actually get their hands dirty with it so to speak.

[S.J.]: Yeah, you know I think that that—first of all, I fully support that. I think innovation tinkerers who've always brought innovation even if it's in genetics. But I think that type of thing is

very basic. It will move the basic understanding of genetics and science forward a bit, but in terms of commercial process, I think there's enough checks and balances and hurdles that will exist that you're never going to have some mad scientist who rents a lab bench for a while and totally contaminates an environment. I really don't believe that could happen.

[01:32:20]

[T.K.]: Yeah, I wasn't necessarily talking about the doomsday scenario. More about actually being able to bring in the public say into one of these spaces and do a transformation so in essence they understand exactly what you mean when you are asked well, how do you define a GMO? And this might be an opportunity to actually show them—

[cross talk]

[S.J.]: I fully support that. In fact, one of the programs we have at the biotech center is exactly that. We call it industry in the classroom. And what we do is we bring STEM teachers of middle and high school into a continuing education environment. We don't do the curriculum. We don't do the teaching. We have professional people that do that academics who are trained trainers. The trainers for the teachers but we support the curriculum in a way that provides some hands-on capability for them to understand the basic biotechnology that they're hearing about.

And we've done this for about five years now, and we know we've touched a hundred counties in training teachers in the state. Every county in the state we've had a teacher from—we've tracked what was your attitude about GMO's before you walked in the door, what's your attitude after you walk in the door. It's not a brainwashing session. You're a stem teacher; you're here to teach science. This is science.

And then we also bring in industry and we actually take them on a tour of some of the laboratories that exist around here within our companies. And they get to talk to the scientists, and they say, "These are real people. They have kids, and they send them to middle and high school, and they're educated the same way I was." I think that type of initiative and what you're saying can only be good. It can only be good. So in that context more power to it.

I mean we're trying to motivate some developers to do exactly that. Provide very short term ad hoc space as you're putting together an incubator so that people that just need the equipment for a short period of time can go in there. They have an idea, let's go do it and then let us walk out of it. Instead of tying them down to \$46 a square foot for five years.

So that's—I think would be great. And I think you'll find innovations come out of it that were really good. Products that come out of it are going to be managed through the system.

[01:35:25]

[V.F.]: I'm wondering if you could talk a little bit about where we are right now in North Carolina and especially from your perspective being with a biotechnology center now. How has this area become such a hub and how it ties into the work of where we are specifically right now at NC State as a Land Grant university with the history of innovation and agriculture. How has this area become what it is from your—

[S.J.]: That's a great question that I like to answer. And the reason I like to answer is that we in North Carolina have a—we have a resource that is tremendous in terms of—we grow 80 different commercial crops. There's only two other states that have as many crops that are grown commercially in North Carolina. That's Florida and California. Even Texas doesn't have as many crops growing as we grow here in North Carolina. So we—and the reason we have that is we have the diversity of soil, the diversity of climate that bodes well to that.

We also have a history of investing as a public into agriculture and a recognition. It's our number one industry in this state. And so whether it's NC State where we still receive more public money in support—more state money in support of NC State than many other Land Grant colleges around the country. Or the 18—one-eight—18 research farms throughout the state that are jointly managed between the Department of Agriculture and the university system. That's—there isn't another state that has that many public research farms. We are unique when it comes to that. So that's partly why we've created the cluster of agriculture and high-tech agriculture that we have.

It's also tied to—like everything in North Carolina we say especially in the research triangle area it's the university's workforce, the foresight of people in the 40s and 50s who said we want to stop the brain drain and keep it here in North Carolina. Let's create RTP. And let's create research campuses around the state. And go forward.

So I think that's a resource that attracts. It needs to continue to be fostered. It doesn't live without some incentive. Somebody who creates, and that's a concern right now because we're going through a cycle where things are constrained. We're not in many cases as competitive as other states in providing a single voice that's as attractive to agricultural innovators as we once were.

And you couple that with some of the consolidation in the industry. We were pretty top heavy in having big companies, not as many little companies. I think that without additional focus on our community and communicating the outstanding resources that we have here for business and to develop the cluster of high-tech agriculture that it will decline.

[01:39:28]

And so I was very pleased that we've had bond issues that provide more facilities. I've been working with some of even our community colleges who are focusing on genetic engineering and biotechnology in workforce training and making sure that there are people competent to create the products and manufacture the products whether they're pharmaceutical or agriculture or whatever.

We've got a growing cluster of high-tech feed and fuel. And human food too. Mostly right now there's a growing cluster of animal feed. We've gone through a bubble of fuel, but there's still a focus there. We're looking at other industrial products that go along with that. We're recognizing investments in things like bio-defense which is connected to agriculture in many ways. And our big defense industry that we have here in North Carolina, so that's another resource that will help attract deals.

I think the message that I would give is, and that I like to give is we've got the resources, and we've got the infrastructure. We need to keep feeding it from the policy side and the investment side and from the marketing side, we've got to speak with one voice. We've got—we're all in economic development mode. We're all in innovation mode and that sort of thing. It doesn't reside just within NC State or just within RTP. Or just within Kannapolis at the research campus. It's part of the whole, and that's what makes it very attractive and will help foster the growth of our ag tech cluster that we have here.

But there isn't any—there's no place that has as many people employed in high tech agriculture as there is North Carolina. You read about there are more plant scientists than—more Ph.D. plant scientists in St Louis. Well, yeah they're the biggest plant science company. But we also have entomologists, we have plant pathologists, we have—I mean if you look at the numbers generally in high-tech agriculture we're a much bigger cluster than St Louis or Davis or Boston which is another cluster.

And so we may not have—I think our biggest improvement we can make is making sure that all of the stakeholders are speaking with a voice of understanding. Let's take advantage of the great infrastructure, the great resources that we already have. And it will differentiate us. And it does. I mean we've—we are always at the Biotech Center talking to people who know about us, who have—who know the community that we have here and are looking for connections here. And sometimes we have to say well, we don't have the money you're looking for, or I don't have the investors you're looking for, or I don't have the facilities you're looking for. But on the whole, nobody can compete like we can.

[01:43:03]

[M.B.]:

I have two closing questions and Todd and Virginia and Karina this is your chance to throw in one before I do.

All right then well I'm going to—you can still jump in. I'm going to ask the first of them. The first one is if we could interview other interesting people and we hope to, who should we talk to? Who do you think we should be interviewing for this archive so that the public has a sense of the history of genetic engineering in agriculture?

[S.J.]:

Well, yeah. That's a great question. Off the top of my head, I mean you've already interviewed some of the people I would say, but I'll give you ones that you haven't. Rick DeRose at Syngenta. Rick DeRose has as long a tenure in the business as I have except he's been on the science side from day one. And he has from the bench all the way through patent life seen his innovations going through the ups and downs and things. And he's worked for several different companies. Right now he's with Syngenta. But he's a scientist with—who is extremely knowledgeable and has a—would have a very different

perspective than me. But he has a very similar tenure. Let me put it that way. So I would definitely talk to him.

Some of the people that you might want to look at is—there's a brand new faculty member at UNC Flagler Business School. Maura, gosh, I can't remember her last name. She teaches entrepreneurial activities and things like that. She did her dissertation on the entrepreneurial environment that existed in ag-biotechnology from 1975 to 1995. She didn't—she took it right up to the commercialization, but she tracks a lot of the science, the startups, the failures, the people, how they got their financing, what happened with that. I mean it's an interesting story. And she got her Ph.D. doing that. And she's continuing to research that but on the entrepreneurial side of ag biotechnology. And I can look her up when I get back to the office if you don't find her. But she's a new faculty member at Flagler.

[01:46:06]

You know there's a few other people I think Paul Schmidt. I don't know if you know him. He's the CEO of Plant Healthcare, you know, right on Glenwood Avenue. Paul will have a similar background to me. A commercial guy. He comes from Canada. He can bring some perspectives on—I've always respected Canada for a couple of reasons.

One is they don't have the—on the production side their farmers have to be much more—much closer to the marketplace because they don't have the risk tools that we do. They don't have the market factors that we implement to keep our markets more stable. They're more subject to global swings in the marketplace.

They don't have other tools like insurance the way we do and things like that in Canada, so they have to be more flexible. But Paul navigated through several different companies in North America. He comes from Canada, but he certainly has been in North America a long time. He would have a similar background but a different experience I think than what I have.

Who else would I say? Crisis Management, John Westridge. He was the guy that I reported to. I told Fred Gould about John and gave him his contact. He was the guy that cut his teeth on crisis management with things like Aldicarb and ground water and Long Island or Bhopal and MIC and things like that.

[01:47:55]

So the guy's been through crisis management. He was the guy the board contracted with—he had actually retired at the time of the formation of Eventis but I've got a great deal of respect for what he did in saving the company. I wouldn't think to do that. So he would have a perspective. So there's a few names.

[01:48:21]

[M.B.]: I have a last question unless anybody wants to edge in. What questions should I have asked or should we have asked that we didn't ask today? If you could have answered a question, wished we'd asked one, this is your chance to answer that question.

[S.J.]: Well, here's a good one. I have 11 grandchildren. Do I want any of my grandchildren to be involved with agricultural biotechnology when they get into the business? And I would say yes. I would say it's basic, it's stimulating, it touches so many different things. If I had to do it again, I'd do it in a heartbeat. I've never regretted being in the business. I mean—I never thought I was going to be a poison peddler either you know. That's just me. But I think that people need to understand that while we cherish a lifestyle that seems to be associated with agriculture, agriculture is diverse, it's stimulating, it's challenging. It requires very very critical thinking and hard work. And it is so basic to everything that you feel like you haven't wasted your time. And so even though my oldest is 12—so she can start picking fruit like I did. But no, I would say in another six years if you [she] want to study agriculture that would be great. And keep going because there's a wealth of knowledge yet to be found and a lot of good that can be done and it's pretty exciting when you really get down to it. I like it. So, that's the question.

[M.B.]: Thank you.

[S.J.]: It was fun. It was fun.

[01:51:02]