Ralph Fravel and Robert "Bob" Fretz
Narrators,
with comments by Christian Jensen

Kristen Reynolds
The Bakken Museum
Interviewer

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Ralph Fravel	-RF
Bob Fretz	-BF
Kristen Reynolds	-KR
Christian Jensen	-CJ

BF: 00:00:07 It went commercial. One was the "House Ear" based on the House Ear Institute. And the other one was based on a husband-and-wife team out of Vienna, Austria.

RF: We called them "the Vienna Project."

BF: I'm trying to separate these a little bit [Motions to cochlear implants on table and in boxes off screen]. This is mine that I had [Holds up a tan speech processor unit], and it goes together with this [Holds up implantable receiver]. We have more of the one that went with the Vienna Group, that's this [Lifts black speech processor unit with connected tan wires and transmitter out of white box]. This combination goes here too [Moves a thin white box with two different implantable receivers] … This would be the actual implant [Points to thin white box with two implantable receivers] and it would be worn outside your head like this. [Holds black speech processor unit and moves the attached tan transmitter to head above the ear]. You could see the ear parts to support it [Shows tan electrode]. It was worn here [Moves electrode to ear to mimic its placement in the ear canal].

RF: [Lifts white wire with transmitter and electrode]. This is the microphone on the ear part [Points to microphone on the electrode] and the magnetic attachment [Points to transmitter].

BF:		Here's the earlier version with the epoxy. [Points to epoxy implantable receiver in thin white box]. Like how the early pacemakers were done with epoxy. And then later a ceramic part. [Points to white ceramic transmitter in thin white box]. Is the magnet still there?
RF:		No, there's no magnet there. [Attempts to attach transmitter to the white ceramic implantable receiver that Bob Fretz motioned to earlier].
BF:		How about in this one? This was one I had. [Reaches to a box off screen and attempts to attach different implantable receivers to the transmitter Ralph Fravel is holding]. Oh, there's no magnet. That needs to be screwed down a little more. [Points to the transmitter Ralph Fravel is holding and laughs. Grabs another stimulator/receiver] …Does it stick here? Oh, there [Magnet in the stimulator/receiver sticks to the transmitter Ralph Fravel is holding].
RF:		That one sticks. Oh, you had that turned into a pill button? [Laughs]. Good.
BF:		Yeah, a little bell button [Laughs]. Alright, this is a little bit of the hardware that both Ralph and I were involved in the development of. I'm sorry, do you want to start here?
KR:	00:01:46	No, no, no. This is good. I was just curious what you all were looking at because you just got in there.
RF:	00:01:51	I haven't seen a lot of this for a long time. And it brings back memories of all the different times we had to work on these.
BF:		It might make sense for some of the discussion to describe some of the parts because of the hardware. People would wear a processing device outside along with a microphone and then a part that would go external worn back here and underneath the skin would be a part like this and it would have the receiving part. And then there would be electrodes that would go into the cochlear. And the cochlear is about this size, so you can see it's little. So that's the hardware that is involved in this whole thing.
KR:	00:02:35	Okay, thank you for sharing that. I had no idea. Are you ready to get started?

CJ: Yep, I'm rolling.

KR: Alright, well thank you both for coming today. We are going to jump right in. If you need a break or if there's a question that you don't want to answer, let me know and we'll move on. No harm, no foul. I'll start with you Bob, and then we'll move through. One of the things that we're curious about is your early life and culture and how you became interested in the work you did.

BF: 00:03:17 I started as an electrical engineer and went to the east coast. Cornell was my undergraduate and then I went to Columbia in New York City and worked at the Bell Laboratories. They were a big organization involved in telecommunications. I got interested in working in biomedical engineering. So, I quit, and went back to get a master's degree in bioengineering in Michigan and then started to look for work. I went down to the office at the school to see who might have bought it. 3M. I said, well gee, it didn't sound like a company would want a bioengineer. But I applied, and came up here, recently married, in January and got hit by one of those minus fifteen-degree windchill days and said, "what have I done?" People must eat cream buckshot for breakfast around here to survive this place. But I settled in and ended up with 3M who, at the time, wanted to do medical devices.

KR: 00:04:22 Can you talk a little bit more about your time at Cornell? You said you went to Cornell. Can you talk a little bit more about your time there and how that impacted your studies?

BF: 00:04:35 This was a time when schools got rid of a lot of engineers early on. So, I worked hard as an undergraduate. That basic engineering was pretty important in the stuff we're talking about. As you're exploring these new territories, you fall back to knowing the basics of engineering well. I think that served me well.

RF: I remember you talking about working at Bell Labs and being with some of the brightest people you had ever worked with.

BF: Yeah. Good companies since then have PhDs. Bell Labs had Nobel Prize people working at the place, so they were

high-level people, but [3M] seemed more exciting. You were a west coast guy?

RF: 00:05:34 I'm going to start very young. First, I come from a family with no history of college, but I always knew I wanted to go into technical stuff. And when I was about eleven or twelve, I was visiting my aunt in Minnesota from California and I was working at a workbench and I just had this, I'll call it an idea. I want to make something that makes blind people see again. I have no idea what, but I know there must be some machine that could do that. So that kind of fostered an interest. And I ended up coming to the University of Minnesota and went through electrical engineering there, which was a lot of fun. I enjoyed it, learned a lot. And then I went into the Air Force, and during my Air Force years I had an opportunity. I was assigned to southern California to go back to graduate school, which I did. And when I got out of the service, I finished at University of Southern California, which had a brand-new program in biomedical engineering. And because it was a brand-new program, they would take almost anybody into the program, including me [All laugh].

BF: I don't know about that.

RF: I graduated in biomedical engineering and came back to Minnesota. My wife and I moved back. And I had a job at Control Data before leaving to go into the service. I was going to go back to Control Data, but they were slow at finding an offer and I, in the meantime, was hired onto 3M. I interviewed and hired on; I think I was probably one of the first biomedical engineers that was there. And I began thinking that maybe I can work on this thing that helps blindness. I didn't know, but it was in the back of my mind. So that's kind of how it started.

KR: 00:07:23 Why blindness?

RF: 00:07:24 I have no idea. I have no history of blindness or deafness in my family. The eye really interested me. Images were important to me. Video type of stuff was important. The eye seemed more important than the ear at that time, but I missed it by about that much [Holds hand to face to show distance between the eye and the ear].

KR: 00:07:45 Around when were you in graduate school in California?

RF: 00:07:53 I graduated in 1972. I started when I was in the Air Force. I got out of the Air Force in January of 1972 and finished my master's degree that summer.

KR: 00:08:06 Cornell was graduate school for you?

BF: 00:08:07 No, Cornell was starting for me. I ended up at the University of Michigan and around 1977, a little bit later for me. Slow learner [Both laugh]. The person that was my boss was Ralph here. He was my boss at the time. And I came up here and I said, this guy, I could work for this guy.

RF: Best engineer we had on the staff too [Motions to BF].

KR: 00:08:35 Did you hire him directly?

BF: 00:08:38 Yes.

RF: I was part of the interviewing and hiring team, yes.

BF: You were my boss at the time.

RF: I was a new supervisor and that was my first shot at managing people.

BF: I didn't know that [Both laugh].

RF: Yeah, you would've maybe changed your opinion.

KR: 00:08:58 So, in this role where you hired, Bob, what was your title? What was your role?

RF: 00:09:10 Supervisor of Electronics. As I remember, it was a new supervisory position. 3M has a technical ladder and a management ladder, and there are equal opportunities in both. And I had been on the technical side doing development work on other projects up to that time. And then around the time Bob joined, I was made supervisor of a group that was working on an electrosurgical unit. And so that was my title at the time.

KR: 00:09:36 And when you were hired, do you remember what your title was?

BF: 00:09:39 I don't remember.

RF: It was a technical role. You were on the T-3 or T-4 scale.

BF: 3M was good at that. I think that they gave respect for their engineers. That was useful for me, and it was learning time, which they encouraged. Since then, I've spoken to young engineers that way. Pushing engineers to try things.

RF: Do you remember the fifteen percent rule?

BF: Yeah, you're supposed to spend fifteen percent of your time on other projects. Of course, that fifteen percent usually was from 4:30 PM to 5:30 PM in the afternoon. But still there was opportunity. And I've been at companies since then who would be very against that. The idea that you should be looking at something that interests you. I think it's valuable. They would say protect the company, which I thought at the time, was very odd.

00:10:46 But since then, I think it's a good thing. By that they mean, remember the reputation of your company. So, for example, don't worry about spending $200 to get something done faster. $200 is cheap to 3M, but their reputation is not. If you were to make promises that you couldn't keep or mistreat somebody, that's very serious. So, be careful about that. But engage in exploring and get out. And you encouraged that, even before the cochlear implant. To get out and spend some time. You made me go to an operating room and see an open-heart surgery when I was first at the company. Well, here's a scheduled thing. You're in the operating room, behave yourself.

RF: And you bring up a good point, Bob. Something I've learned later as very important, which at the time, it just seemed like part of the culture. That is, we were the R&D [Research and Development] group. We were development people, but we were encouraged to spend time with our salespeople, sometimes in the sales field, with our marketing department. Other groups, and I'll mention this maybe later, that became key to one of the real significant inventions, not in cochlear implants, but another part. A key thing I found since leaving the company and being at other companies, where they banned our R&D group from talking to anyone in sales. So, it was a whole different culture that 3M had at that time.

KR: 00:12:19 How was witnessing an open-heart surgery for you?

BF: 00:12:28 Well, it was maybe a good preparation because, as we'll talk here now, getting into the cochlear implants, it got even more exciting. So maybe it was a good learning experience that I got to witness. As we talk about the cochlear implant project, now you're starting to have to participate. So now we're getting into the next tier.

RF: Because the surgeons didn't know how to do everything.

BF: Yes, they started asking you questions. Looking back, that was minor. You just watched that surgery. But maybe it was a good introduction, at least—how to put on a gown, keep your hands behind your back, and don't touch anything. Those OR nurses are famous. You got to be careful, it's obvious you don't belong here, boy.

RF: "So, who are you and why are you here?"

BF: And you better behave yourself. I worked with a lot of tougher men than you, and they're nowhere to be seen [Laughs]. That's probably a little extreme, but you've got to behave yourself in an OR [operating] room.

RF: Even the fact that us engineers, we took medical terminology courses so we could talk to doctors and nurses, know their jargon and know their language because we had to communicate with em.

KR: 00:13:46 You both went in a direction about your working relationship. Can you talk a little bit more about that and how that developed over the years?

RF: 00:13:58 I'll say I was very excited when Bob joined the group because we needed some good engineers. We had an engineer who had been working on this thing called the Electrosurgical Unit for some time. Bob came in and was immediately applicable in the design of that. But as I said earlier, and I've said this to him personally, he was one of the best engineers I've ever worked with. He has a way of looking at things, engineering problems, as well as things beyond that, outside of that scope to try to figure out how best to go forward with a project. And ask questions that I, as management, had to answer that were important for getting the unit and project directed, if you will.

BF: It was a great relationship—and I've said this to him, many Times—he was a wonderful boss. I've said this also to young engineers. My dad gave me advice, he didn't give me too much career advice. But he did say, work for somebody who respects you. No matter how glamorous the job is. If you and your boss don't have mutual respect, it won't go well. And if six months goes by and you are loggerheads with your boss, you ought to think of one or both of you are probably in the wrong place. And so, I felt quite supported by Ralph and that was wonderful.

RF: 00:15:36 You did come in at a time when there was a big transition. A lot of transitions happened within 3M because 3M in the mid-seventies roughly, you came in around 1977 or in that timeframe, 3M was looking at a lot of different businesses to invest in and to expand into. And not all of them made it. In fact, we were in business exactly at that time, that ultimately did not make it. Technologically, it was the best product on the market. We can get into this later, but it didn't fit the general scope of how 3M made money. And so, it didn't work. For Bob's and my career, and the whole time we worked together, we were in an investment business unit. Not a 3M division, not a going unit that management knew was going to be there for years. We were an investment business. And we always lived with a sort of Damocles over our head. Are we going to make it? And as a result, we had a stick-together attitude in the whole team. That whole team of people really knew the same thing, and we had to exist in that environment.

KR: 00:17:01 On that topic, of being in this investment space and concerned about whether you would make it, can you talk about some of the failures that you might have experienced on your way to developing [the cochlear implant]?

RF: 00:17:15 This? [Points to cochlear implant on table]. We only have an hour or two [Both laugh].

KR: 00:17:20 The most memorable, then.

BF: 00:17:21 Well maybe we should back up a little bit. It might make sense to give a little bit of this history of us and where we worked, particularly at the House Ear Institute in these groups, because some of that would be a good background. Let me back up a little bit.

RF: Could I start on that? Because I preceded Bob. You joined in 1977. Around that time, I was asked by our lab director, Bill Coyne. They wanted to do some pioneering work. They knew implants for the ear were something. So, I spent a fair amount of time looking around the industry. I visited Dr. Robert White at Stanford, which was running a new nascent cochlear implant program. We got involved with Dr. Robin Michelson and Michael Merzenich at the University of California San Francisco.

00:18:24 That was the early work. I visited Professor Chouard in France, who was one of the early European [surgeons to implant a cochlear device] to try to get a feel for what cochlear implants were doing. And we didn't form a program until Electrosurgery left. We sold that off. And then we focused on cochlear implants, right?

BF: Around 1978?

RF: 1978 probably. Around 1979 things got moving. And that was a pivotal moment because, as you mentioned, the House Ear Institute is in Los Angeles, California, headed by the House brothers. They were preeminent in what's called Neurotology surgery. And they were doing cochlear implants at the time. And that's where we first really got involved. So, you might want to add to that.

BF: I'll give you a story I thought was interesting and stuck with me all these years. 3M was interested in this, and they assigned Robert [Bob] Oliveira to head up the group that we showed the picture of. And they asked him to investigate this.

00:19:41 So, he goes out to the House Ear Institute, they're at a clinic in almost downtown Los Angeles. And one of the things that you'll hear us talk about is all these questions, especially early on about the system. How should the surgery be done? How many electrodes? Where should they be put? What about the training? What about the selection of people? These are all these questions. How should you make it? How do you make it reliable? Is it safe? All these questions. And so, he is a great real scientist, goes out and at the clinic they introduce him to Darlene. Do you remember Darlene?

RF: Oh yeah, Darlene Fragale.

BD: Darlene's probably forty years old and she's one of the first fifteen patients. And the House Ear Institute was using it, they had this implant, and then you had to attach the outside part to your glasses. Because there was no way to attach it.

RF: 00:20:41 Or an air mold with a wire on it that you bent around.

BF: And then they had the external processor part. That was about eight inches long and metal. It had two nine-volt batteries in it, and it was bright blue. Thanks. And they wanted, the House Ear Institute said 3M, you've got all this stuff to make us a smaller external unit. Well Oliveira said, "Well, why should we invest in the smaller unit when we got all these other questions? Why shouldn't we put the things in?" And Darlene looks at him and says, "Dr. Oliveira, tell me where you should put this big thing? Where should I put that when I'm wearing a strapless gown?" And that stuck with me over the years. Well, a couple of things [stuck out]. One of em is that they eventually wanted an engineer to do that. And they picked me [Laughs].

00:21:37 So, I came up with this. I was the guy to design this device that was much smaller.

RF: Flesh-toned and fits in a strapless gown.

BF: A couple things of this story that stuck over the years. One of them is, and you'll hear us talk about the scrappy, scrappy courage and toughness of the patients. When I've read the history of the cochlear implant, I have yet to read one that mentions the name of the patients. And they deserve more credit. Because they are the ones who are being put under the knife by people who don't know what they're doing. I mean, they're trying, but they're the ones putting their head down on that surgery thing.

RF: Early on it was many times.

BF: Many times, they're getting drilled in the side of their head and a bunch of electrodes stuck in there. And they're courageous and they're also, they don't want to be defined by their deafness.

	00:22:40	Darlene doesn't want to be defined by that. She's not a deaf person. She's a person who happens to be deaf, who wants to get out there. And over the years, that's stuck with me, and I've tried to pass that on to the other engineers that I meet. That it's super important for you to do the details of your job correctly. To worry about the connector here [motions to cochlear implant], which is surprisingly unreliable. But at the end of the day, your job is to get Darlene dressed up and off to the party. That's what you're trying to do. So anyway, so I also bring that up because Dr. House said, "Well, it's fine for 3M to support me and give me all these things, but I want an engineer on site here.
RF:		Bob was the first engineer.
BF:	00:23:38	I was the first one and you were the second one.
RF:		And Kipp Laid [sp?] was the third. That liaison between the company and the group, it was very important. And that's how you came to all of this.
BF:		I was out there for only nine months, but I wanted to bring that background because some of the mistakes and relationships come out of that partnership. And being on site at a clinic was important in that regard. And Ralph, how long were you there? You were there a little longer.
RF:		About a year.
RF:		A little over a year.
BF:		About a year. So okay, I didn't want to dodge the question, but I'll give you a little background of what Ralph and I will talk about. We were 3M employees all the time, but we were on site at the clinic. It was often in that context that the failures that I talk about, some of them, came from that era.
	00:24:35	I came back and continued development on this and other projects. But you did too. You were out there.
RF:		My family moved out.
BF:		And you worked on this thing.
RF:		In fact, speaking of Darlene Fragale, Bob mentioned that

the external unit—the transmitter we called it—was attached either on the glasses, or if they didn't wear glasses, it would be an ear mold with a wire that came out and attached. And it was always kind of funky. And probably the first thing I got to work on when I was at the House Ear Institute was a concept of magnetically attaching the two together and working out the details of how you keep it on, but not so much on that it causes compression failure. And Darlene Fragale was one of my first subjects.

BF: Really?

RF: I would go around, and she'd lay her head down and I would pull things off and measure the skin thickness and work on that. I think there were three patients there. So, it was the hands-on, which we couldn't have gotten back at 3M. But at the House Ear Institute, they were just across the hallway, and we got to work with them.

BF: That had a big impact on my engineering. Probably one of the biggest, because typically engineers, I mean they go into engineering because we do things. You take apart your sister's bike when you're little, you know?

00:26:01 You tend to be that kind of person in general. But this idea then of the expectation that you would go up and take somebody's hair and push it out of the way, and gently do these things. To touch people was certainly uncomfortable. But also, it pushed you in a deeper sense. Do you want to talk about that?

RF: Oh, I never had experiences at 3M like we had there. There was a woman that came in that needed some work on her implant. It turned out that she was Hasidic Jewish, and she could not have another man in the room with her besides from her husband until the husband gave her the ability to do that. And Lori Eisenberg was working on this patient, who was also Jewish, and she understood all these cultural things. And so, she arranged for me to be in the room, and they were talking Yiddish [Both laugh].

00:26:55 I didn't understand the thing and I never would've had that experience at 3M. That's the thing. Or funny stories, like we worked with the House Ear Institute, who also had nuns that worked in the clinic. Sister Mark, she's a panic.

BF: Yeah, here's her picture. I got this from 3M, Sister Mark.

RF: Oh, there she is. Sister Mark. She was a panic. We always played cards at noontime. And I remember one time we're sitting around, and she had her cochlear implant processor up on the table and somebody got dealt a bad card hand or something and he said, "oh bleep." And she said, "Oh, sometimes you hear things you don't want to hear with these." She did, yep. So just experiences like that. You knew you were doing something for somebody who couldn't hear anyway.

BF: 00:27:51 Well, Sister Mark, she's close because there was a convent right next door… That's why she was so available.

KR: Next door to the house?

BF: Next door to the clinic… I'm going to get to your question at least. I'm not trying to skip the scary things or failures. So, I'm doing some experiments with her. You put this external part on, but I wasn't connecting it up to the microphone. I was going to connect it up to some signal generator. And so, I was doing this experiment and I remember asking her if I was going to turn it up.

RF: You start low, and you go up.

BF: And you go up little bit up more because they have a narrow dynamic range compared to normal hearing. And she said, "Oh, it's just real quiet." And I kept thinking, I seem to be turning it up a little more than I needed to. And apparently what was happening was a partial connection in the wiring. And so, I was going like this and moving and suddenly the connection was made, and it got to full strength. And she ripped it off, it's called a habit, and threw it away. Oh, it still gives me the willies. Apparently, there was no permanent damage. She seemed to be fine afterwards. But boy, it still sticks in my mind how close I was to damaging the one poor woman.

RF: When you begin working with the people that are actually using the product, you get that chance to do it. Then you get those kinds of things that really influence you. That's scary.

BF: That also led to some interesting things. Ralph, you mentioned a little bit, one of the early failures was the leads would break.

RF: 00:29:51 We had epoxy coated units to begin with and epoxy does allow moisture to get in with time. And it's not hermetically sealed. It does not seal up water and moisture completely. So, you'll see ceramic designs and there's this titanium unit here, which was our first attempt. The titanium allowed radio signals to pass through, but it could be sealed hermetically. And you probably can't see it, but there's a very fine wire right up here, which is the only feed through that comes from the electronics to the outside world to get it to the ear. And that little, teeny wire there, we didn't know it, but it was susceptible to breakage because of something called a hydrogen embrittlement. And as a lead moves, maybe during surgical implant or when somebody's pressing on it, it would break. It did break. And it broke during a time in the program when we had moved from only adults into a selected number of surgeons doing children.

00:30:54 That was very controversial. But there were a number of House Ear Institute trained surgeons that began doing for children. And Dr. Charlie Luetje in Kansas City was one of the early adopters of that. He had the first failure of this unit in a child. So, it took us a few months to figure the problem out, get around it, make a new unit, and we sent one down to Kansas City to do what's called a revision surgery where they opened the surgery up, take the old one out, put the new one in. And Dr. Leche invited me to come down. I was working in the technical support at that time to do that and to look at the implant, check it out, and then be part of the surgery of the implant. And then afterwards he said, "I'd like you to stay with me."

00:31:45 So, I did. The patient recovered in the recovery room and then he said, "Now I'd like you to go in with me and talk to the parents about why this failed and what you've done so it won't fail again." I'll tell you what. This little child in the operating room was only this long. He was small. And then to see him in recovery, they had these big bandages on the cute little heads. The way I would described it is, I felt like I could have walked into the door jamb of a door. When I got done with that, I just felt that small. So anyway, that sort of experience of being there and asking, "What could

we have done? How could we have done it differently? Why didn't we know that?"

BF: "Why didn't [we] foresee this?"

RF: Yeah, why didn't we foresee it? In retrospect, a lot of things are foreseeable. Or seeable.

BF: Why didn't we see that? Why didn't we see that? Well maybe a year earlier, I also was in one of those revision surgeries. Back to your earlier question about being in an OR room, because the doctor, the surgeon, they never gave me much time. He said, "Well tomorrow I'm going to do this thing."

00:33:10 The surgeon's timeframes are sort of different than our engineers. He said, you got to come in because I didn't know whether the problem was outside like here or deeper into the cochlear. And so, I would rather just replace the outside part and I won't have to do his extensive surgery. So, "Come in, Mr. Engineer, and bring some equipment and I'll do a partial operation and then you tell me which part is broken." Now I'm into the OR with some volt meters and stuff, and he gets his forceps and cuts this thing out and hands it to me all covered with blood and tissue and says, "Tell me where the problem is?"

RF: "Is this working or not?"

BF: And so, I get this thing and everybody's looking at me and saying, "Okay, you decide." Things got interesting there.

RF: 00:34:06 Mhm. Do you remember the University of Minnesota? This was almost comical, but it worked out fine. They're magnets, so they attract. But if you put the implant in backwards, they fly off.

BF: Oh gosh [Laughs].

RF: And the University of Minnesota unnamed surgeon put one in backwards, even though it says top upside down.

BF: Top upside.

RF: So, we just ended up making em a lot of special exterior units with a magnet turned around too so they worked.

BF: Oh, did you? I remember talking to some parents on that issue too. Anyways, those were tough, tough issues to worry about. The mistakes that you wish you'd have done differently.

RF: Mhm. And what Bob and I have been talking about a lot are the engineering aspects of this cochlear implant—the materials, the hermetic sealing, the electronic design inside. We were the electrical design group, if you will. What's missing from our conversation so far is the growing number of people we [now] recognize we [needed] to have to make this work.

00:35:11 Speech psychology and the audiologist to train people after they got the implant. What sort of training program is needed for that? Material science. What's represented there, Bob had this picture of our group then. That's many people in this group and there are basic scientists outside of the engineering area that are doing electrophysiology work. There were people that began to do speech processing and psychoacoustic work because as we moved from the simple device that we worked on to begin with, called a single channel implant, there became a push to go into multi-channel work. And so, our engineering work really needed the support of many other groups, surgeons, and the whole business.

BF: Yeah, we should talk a little bit about that because you asked, on your questions, a little bit about… conflicts or diversity. Now, I don't remember so much challenge when it came to what we typically think of…in terms of ethnic diversity. There were quite a few Hispanic people out at the House Institute, and quite a bit of Jewish influence and workers. Remember Mark Kaplan?

RF: Oh God.

BF: He was Wonder Forty and international. Most of that was rich and fun. We worked with the Vienna group.

00:37:00 I'll give you examples of that. Their daughter was about the age of our daughter, about four years old. And these people were, well, everybody that you ran into, these are smart people. Ingeborg Hochmair was the first female

engineering professor in Vienna or Austria. Anyway, they came over, it's Halloween. So, we dress up their little four-year-old daughter and take her out to Halloween. They don't have Halloween or trick-or-treat in Austria and take her out to the neighbors. This is Ingeborg Hochmair, she's from Austria. "Oh good, do you want some candy?" [That type of] fun things. We stayed at their house and went to church. I don't understand much German, but I was trying. That pretty much was fun. But back to where I was getting at, was that the interdisciplinary interaction was challenging. I thought that was tougher.

RF: Very much.

BF: Everybody knew that you needed all these groups. You needed the fundamental research people. They didn't know how 30,000 nerves worked together to make a good hearing system. That was still uncertain. You needed the biomaterials people, you needed the clinic people, and you needed an industry. But they all looked at each other as scabs, I think.

00:38:39 It never got openly trouble, but I think there was tension there. For example, the researchers, they're pure. And I exaggerate a little bit, I hope they'll forgive me. But at the clinic, we work with the patients. So, we're the real people out there. And the engineers may be there saying, "Yes, but if you're going to want this to be a product, you have to make it commercial." They all get their money in different ways. The researchers get grants, so they want to publish papers. That's what they want to do and need to do. The House Ear Institute was funded by donations. So, they needed their name out there. They needed donations.

RF: Not any federal. They did not take federal funds.

BF: They didn't want to take federal money. They wanted to get donations, which I talked about a little bit.

00:39:45 And then the industry, you're going to say, "They want to sell a product. They needed this thing FDA [Food and Drug Administration] approved…" We all have this agenda of helping people, but we all see it differently. And that was one of the bigger challenges, I think. Ralph, you want to talk to that at all?

RF: No, I think you're right. Each of those fundamental science areas had their own view and it was hard to get crossover to begin with. And one of the things that really surprised me, and probably Bob at the time, was the deaf community, in some segments of the deaf community, was anti cochlear implant. As an engineer, I thought, what? How can you not want this? Well, we cannot want it, because we have no problem. We are just fine as we are. So that was one of the first things that struck me as different. And I'd say if we're talking a little bit about controversies. One of the first controversies was single channel versus multichannel and getting FDA approval.

KR: 00:41:03 Can you talk about what you mean when you say single versus multi-channel?

RF: Oh yes, I'm sorry. A single-channel device is one where a single wire goes into the cochlea. And that wire may go some distance, but it presents only one signal to all those 30,000 nerves. A multi-channel is one that if you do it right, gets back to the basic scientists that understand the dimensions and the movement of all those little, teeny bones here [Holds up cochlear model]. We're talking about basically a very small part here, that the electrode goes into. A multichannel electrode, if it's done well, goes in without damaging anything and then presents anywhere from eight to twenty-six or twenty-some channels. Individual pieces of information going to those 30,000 nerves, that's a multi-channel. Early on, single channel was the dominant, and really the only, method studied for a long time. And then it began to move into multi-channel.

00:42:13 And that was a big controversy of people saying, you could never do it right with just single channel. You need to have something else. And they started working on that. In the meantime, Dr. House, here's what I was calling a false flag in our work. Bob and I both worked with a cochlear implant subject. She was a college student implanted with a single-channel device. She did exceptionally well. She was probably one of the best, maybe the top two or three that I ever worked.

BF: What was her name?

RF: Kristen Cloud. There's something called open set

discrimination. Which is unaided. [holds paper over mouth]. If you can understand what I'm saying now. you're not lip reading and you're getting just what comes through the implant. She had pretty good open set discrimination and we captured on that. I think because of cases like that, that there were some, we really began to believe that there is potential and promise in this type of implant.

BF: 00:43:21 … The questions or controversies as sort of one of the storylines of the implant. Even earlier, the question was raised whether you should do this at all given the expectations that you might not do that well. So, for example, when we first started, early on when there was only thirteen, there were a lot of questions by particularly the scientific community of whether you ought to be doing this at all… I remember one critic said, "Picture taking the back of your computer off, taking two wires, stuffing those wires in the back there, and plugging them into the wall. Would you expect something good to happen out of this? They argued that you should be using other therapies that are safer and less traumatic.

RF: And you may not damage the cochlea.

BF: And you might not damage for further use. So that was early on, and I think that was answered. We built our report, and the patients themselves answered that. I think they said, "No, this is valuable."

00:44:50 Then there was that multi-channel controversy… That was maybe one of the biggest, at least when I was there. This was 1980 or 1981. You've got a smaller device here, which is pretty good. [holds device]. And you got, as Ralph says, you got a magnet. It could be just plugged on the side here. And Dr. House said, "I think we should consider doing children." Now, his rationale was, so after that time they might have done an eight-year-old maybe, but now we're talking about young. His argument was that children have this window in which they learn auditory things. I mean we all experience it who have our own children or are watching grandchildren. People who are older just don't learn languages like those little ones do.

00:45:50 And he said, "we should consider implanting children and they would have a chance then to make better use of the information that's available." Given that [speech] was often

described as some foreign language that I don't know. It sounds like some speech, but I can't [understand], it's muddled. Okay, so he said we should do that. Well, this was a big thing. You remember that?

RF: Oh, huge.

BF: He was called a criminal. This would be criminal to be doing this. You don't know. There's no stimulation up in the brain on a child. There's nothing like it's ever been done.

00:46:30 It was very controversial, but he got approval to do it. I was there during that time. Little Tracy was her name. She was two years old, a victim of meningitis. Had recovered from meningitis but had lost her [hearing]. And it was heartbreaking. She had started to have a little bit of speech. And then of course, the way you learn speech is when you hear yourself. When she became deaf, she stopped speaking. So, here's her parents saying, "Okay, I've got a deaf child now, but should I get an implant?" Rough decision.

RF: There's a distinction. When a person becomes deaf, they're either prelingually deaf, in other words, they have not learned language yet. Or they're postlingually deaf. They've already got, at age 30 they get a problem, and now they have in their brain the imprint of language… And to begin with, I believe only indications for implant in adults were postlingual deafness.

00:47:34 And they eventually began to move into prelingual deafness. And you have adults who are prelingually deaf. But then children, they're all prelingually deaf. I think Dr. House was right in trying to get something there. There was an episode that really made me see some of the value. We tend to think of hearing is like you and I are hearing right now, we can understand. We get all the sounds. And in my mind as an early engineer, I'm thinking that's what we're going for. What we found to begin with is the following. If you imagine a videotape of a face and they're recording something, they're just reciting. It was called the rainbow passage. Remember that?

BF: Yup, mhm.

RF: And you listen to it, and you can see it perfectly. And you can read the lips and you can read all the words perfectly. Now you take that same thing, and you turn the audio off, and you just get lip movement. A good lip reader could get some of that. But now you add back sound, but you severely limit the bandwidth of it. A friend of ours said, it's kind of like what you hear through a motel wall [mimics muffled speech].

00:48:49 It's amazing if you just listen to that sound without the lips, you don't get anything, you can't hear it. But if you get the lips and that muffled sound, all of a sudden, it's like, "Whoa, I can understand that." And so that fed the fact that even though we're only getting some information in view, it's what makes it comfortable for them to be in a conversation and to understand what's going on, even though it's very limited. Remember that episode or that time?

BF: Well, yes. And back to that addresses a little bit, the earlier things, even though they couldn't identify the early ones, actual speech without added aid. They argued that this was still valuable. And one of the stories that I remember was a postlingual deaf woman. She was a soft-spoken woman, and she told the story of how she was shopping. She had a shopping cart, and she was in a grocery store.

00:49:50 In retrospect, she didn't realize that she was blocking the aisle with her shopping cart. And someone behind her asked her to move. "Excuse me ma'am," the person behind her apparently said. And then repeated, "Excuse me, ma'am." Well, of course this person behind her then felt that this was the rudest person and then ran her over, shoved her out of the way. She was hurt by that. But having then the cochlear implant would allow her to respond to those kinds of things and feel more comfortable going out in the world, being out there because of having this [cochlear implant]. I think that was one of the convincing arguments for even limited success. You made a better one, [gestures to Ralph]. But there were also just these environmental things that were still of value.

RF: 00:50:51 Or misconceptions that deaf people live with. Kristen Cloud told a story of being with her father.

BF: Oh yeah, tell me! That's a good one.

RF: She was maybe sixteen or something at the time.

BF: [Laughs], that's a good story!

RF: They were out someplace where there were horses, and the horse came up to the fence and went [Mimics horse noise]. And at that time, she didn't have a cochlear implant, so she signs to her dad, "What did the horse say?" And her dad signed, "The horse didn't say anything, horses don't talk." And she said, "Well, yes, horses talk. I saw his lips move." "Animals don't talk." "Well, yes, they do. I see you talk to our dog and the dog talks back." She had the concept that animals talked. Wow, what a different world.

BF: Talking back to little Tracy and the two-year-old. Fortunately, I mean, she did good. And you can still see, you can get on the internet, you can see a story about little Tracy. But, oh, it was scary.

00:51:54 I don't know if you have any little people in your family maybe? Maybe. Anyway, a two-year-old with big bandage on the side of her head all, oh. Then she came into the lab, and of course, she picked up everything. [Laughs], woah…wait a moment. But it was scary for a little while. She would ignore it, the sound. We thought, geez is something wrong? And it was scary. But then the excitement of seeing her eventually on her own, a little two-year-old in the morning, she would get up and put it on herself because she wanted that input. And now of course, it's a wonderful thing. I just had a friend who said his niece's daughter has two cochlear implants and she just gets up in the morning and puts em on and they're her ears and off she goes...

00:51:54 Ralph, I don't know if you the same way, but it makes feel good that we were fortunate that it was successful and that these kids now are, it's standard. What at the time was controversial, frightening and scary is now standard. You go down to the Mayo Clinic and get a cochlear implant and it's considered a standard, almost just regular therapy for deafness.

KR: 00:53:41 Is it rare for you all to see the impact of your work that

immediately? You said that when you were at the House Ear Institute and you got to see patients and work with patients. Is it rare for engineers to have that kind of experience?

RF: 00:53:59 I think so, yeah.

RF: Can I give an example of one thing I referenced earlier? That 3M pushed and allowed engineers, salespeople and marketing people to talk together. And it's an unrelated product, it's not cochlear implants. But Bob and I are both wearing hearing aids that are ones that he [motions to Bob] helped develop. In fact, they came as a development, and they now constitute most hearing aids made because Bob, one of the basic scientists, and one of our salespeople talked together. And they got this idea, and it never would've happened if they hadn't gotten those three people together. And because of that, Bob made a little, teeny handmade model.

00:55:03 He was always great at that. Here's another thing, you need to not model things on the computer. You need to make a sample out of it. Modeling on computers is fine but make a sample if you can of the real thing.

BF: Agreed. Prototype it.

RF: Prototype it. And his sample looked so ugly [Both laugh]. Shrimp tube and everything. But it proved the concept of this thing. And we called it the shrimp because it looked like a shrimp. But the main point of that story is it happened because salespeople and basic scientists and development engineers got together.

BF: Why is there a resistance to that route, do you think?

RF: And I mentioned the company, I won't name the company, but the company that acquired the business and I ended up working for, I oversaw the development effort at the time. Their sales manager, their vice president of sales said, your people will not talk to my people.

BF: Really?

RF: You just won't do it.

BF: Why is there that resistance to it? What do you think?

RF: We called it silo-ing, remember?

BF: Yeah. And it's still, I ran into it in later business too and kind of fought back against it. But I don't know why that is. Because it is a natural comfort with your own group. Back to this I interdisciplinary kind of challenge…the fact that Dr. House wanted an engineer on this…

00:56:43 I'll give you three things that helped. When we raised the issue of interdisciplinary conflict, what helps that, and I'll say one of the things was what Dr. House did was to say, "I want an engineer onsite." And so suddenly you're in with a bunch of other people you're having lunch with, and you go out afterwards and have pizza, and then you start to see a little bit of their story. Then they don't seem like such unreasonable people as they do if you stayed in your silo. The other thing that I thought deserves a little bit of credit is, if it doesn't get much, the National Institute for Health. In the United States, the National Institute for Health, at some prompting of congressmen, say, "How is this going to help the American public who's paying taxes for these things?"

00:57:43 And they have pushed in the hearing sciences to work together. They say, "If you're a good conference, you've got to invite em all." If you want a grant, even if you're a researcher, it's best if you have this grant and show some industry that you want to work with or how this is going to be a product. I think surprisingly, we usually don't think highly often of these government organizations, but I think they have helped push people together. Now, I don't know why also there isn't more of it because it's some ways the richest part. It's also the most uncomfortable, but it's the richest part of our engineering. Would you agree, Ralph? I don't know of, I have here 1982, a letter. "Dear Bob, I recently tried out a new stimulator made by 3M. I was very impressed with it." And she goes on. She also says, "Congratulations on your new daughter. Take care. P.S., Wasn't it worth all those weekends?" So, not many engineers get a thank you from somebody who's using your product, but I've saved it all for forty years. Saved that all. Don't show us how many of em I get [Both laugh].

BF: But it's because you work directly with them.

RF: Mhm.

KR: 00:59:08 That's really beautiful. How did you continue the interdisciplinarity of the work you all did? You'd mentioned it was a little bit difficult to work with people from so many different disciplines. How did you all work together to sort of break down those barriers between disciplines to come up with solutions to problems?

RF: 00:59:34 I'll just offer something. I don't know if it's true or not, but you find what drives that discipline. And it's just like in sales, good salespeople don't sell a product. They sell a solution. They find out what the user needs and then they solve that problem for em. It's the same here. You find out what the discipline needs to succeed and what they're doing, and then you offer a solution to em. It might not be the perfect solution. You might not know the way, but at least you understand what they need and you kind of work with em on that. I guess how I would phrase it.

BF: What was your question again, please?

KR: 01:00:20 How did you figure out ways to break down the barriers between disciplines to work together to find solutions to problems?

BF: 01:00:26 Well, I would say what you said. First of all, go there. Go follow them, go with within sense what's safe. But go see them and listen…Most people want to talk about their job. They get excited to have somebody come in and show an interest in their job. Most people are like that. Maybe not the quarterback of the Vikings, but he gets enough of that. But most people value somebody who comes in respectfully and wants to hear their story. So as much as you can do that… it addresses a little bit your concept of what inspires innovation. I think a conference room is the least innovative place you could work. Stay out of that conference room. I mean, it's needed, but stay out of there. Get out of there.

RF: 01:01:34 Don't put any chairs in it.

BF: Put chairs out of the conference room. For me, back into the clinic, early on I heard that they wanted the implant to be smaller. That's what I heard from the clinic who told their boss, who told my boss, who told somebody else, who

wrote and said, “You should make a smaller one.” The surgeon comes in and I’m wrestling with that. He says, “How do I make this thing smaller? Because they also wanted a good coupling between the outside and the inside. But then when I’m talking to Dr. House, he’s also willing to go talk down to the lab person. So, he comes in and we start to talk. He finally realizes that it’s not quite as small as he wants. He wants it thinner. I know enough about physics to know that the coupling is related to the diameter.

01:02:27 If I can get a bigger diameter, thinner and thinner, then this is all going to be better. So, by bypassing all this sort of specification documentation thing and actually being connected next to somebody—it’s not a big invention, but it’s how you make a little improvement. If you’re actually sitting next to somebody and addressing what they are worried about. What drives that? What do they really want behind this thing?

RF: That’s a great example. I think to answer your question; how do you get other disciplines involved? Otologic surgery is very precise and very small. [The surgeons] are always in a microscope looking at very small things happening. And as an engineer, you can go in, and you share the microscope and you get to look and see what they’re doing. What I learned is, first of all, seeing it is very useful, but if you can get a surgeon to teach you, and they are natural teachers…

BF: 01:03:29 Really? Oh gee.

RF: If you get a surgeon who thinks you want to know about them, they will talk through the whole procedure, tell you about the surgical tools they need, how they’re doing this, what lighting they need. They just talk. They love it. And I think it goes back to if you can go into any discipline and get them to teach you what they’re doing and what they need, then you’re moving.

BF: What about now, Ralph? What about the other thing, the fun? He didn’t talk about it. Ralph wrote a song about when he was at the House Ear Institute. He plays guitar well. He wrote a song.

RF: The House Ear Institute had private funding. Whenever there was a wealthy person coming to see it, they would put a page out. “Dr. Ready, please call your lab.” and Dr. Ready meant you make sure you’re at your desk working on something.

01:04:24 You leave the card playing room and you get to your desk and when the guest was gone, you would hear a page, “Dr. Clear, please call home.” Well, the song was something about oftentimes they would forget to call Dr. Clear, and we would stay at our desk all day long not knowing that they had left. So, it was a song about that. Just to make fun of it.

BF: Yeah, he wrote it. You played it. Ralph can play guitar. “Dr. Ready, waiting around for Dr. Clear.”

RF: Waiting around for Dr. Clear.

BF: Yeah, that’s right.

RF: That’s an important part of our experience together, is that we had leaders who always tried to arrange fun things. That might be an annual, it might be a semi-annual, but amongst us we had a lot of fun too.

BF: Yeah. I got twenty dollars out of people for swimming out in the ocean.

RF: 01:05:18 We thought you were going to die [Both laugh].

BF: I think we used it to buy a watch for Sister Mark. But you dived off the second story of the House boat…

RF: Yeah, I didn’t get any money for that.

BF: You didn’t get any money for that?

RF: No…

BF: To try to make a connection with the people, the House people put on birthday parties and that again, brought a certain sense of…

RF: Camaraderie, we call it. You need that. And you need to feel that it’s really working.

BF: We lost to Joyce Iley, beat me in racquetball. [Points to person in photo on table]. You arranged that racquetball game. Turned out she was two months pregnant.

KR: Like Serena Williams [All laugh].

RF: 01:06:06 I'd say that that environment within 3M within the group was that we knew there was danger. We wouldn't make it. We trusted each other. There were a few times we didn't trust each other, and I think that was well founded.

BF: [Laughs]. There's a few people…

RF: The biggest problem we ran into internally—in fact you identified it this way, Bob—is between marketing, sales, engineering, or you name it, the different groups you identified. It looks like marketing wants to do engineering's job and engineering wants to do quality's job and quality wants to do marketing. Every department was trying to do somebody else's job until we kind of got that straightened out.

BF: That's not a good sign, that. Why don't you talk a little bit more because you [gestures to Kristen] asked that question about innovation?

01:07:11 I mentioned to get out there and get out of the conference room. You mentioned prototyping. Anytime you can do prototyping, I believe in that. It'll kill a bad project early, which is also healthy. What else would you say that would help innovation? Anything else you want to address?

RF: Well, I think it helps if there's a culture within the organization to value innovation. And part of that is recognizing and appreciating failure.

BF: Now, I would add, because we're here in Minnesota. I think that Minnesota has good culture here in terms of medicine. And maybe it's the Mayo Brothers who showed up here in the prairie, deciding to do something. Those nuns that came in and started hospitals throughout the Minnesota area. A general idea, and it's not universal, is that you ought to do something. You see somebody who's got a need and we ought to do something about it. And it's

somewhat risky, but maybe it comes back to our fundamental beliefs of faith of what we consider right and good. But do something, we should try to help. It's a proper thing to do.

01:08:51 So, I think Minnesota has that here. Would you agree? I don't know if I'm reading into that too much.

RF: What did you say, Bob? I grew up in California, but I'm really a Minnesotan. [Laughs]. I've spent more years here than there. But California, and other places, really have some high-tech innovative stuff going on. And so, they have a culture of that. I think the distinction you're making is that there seems to be, because of this term "medical alley," there seems to be an attitude of investment in that, recognition of it, and development of it. Here we're just as innovative, I think as the West Coast is, and there are certain areas, but it seems to be directed toward medical applications.

BF: Yeah, medical applications. When I went to school in Columbia University, which is right in Manhattan. So, I would go up to Manhattan and get somewhat involved in the big city. That culture. And that culture puts a big emphasis on the arts. So, they see themselves as a center for publishing, theater, and music. There is, of course, strong art culture here… The idea of medical help that's not so strong there as I think it is in Minnesota. It's a good part of Minnesota culture.

KR: 01:10:22 I'd like to ask you one final question. Is there anything that we didn't talk about today that you really wanted to share? Any story?

BF:

01:10:35 Did I? I wrote some notes. Let's see if I wanted to. We talked about the conflicts. I want to mention a little bit of my, I've thought some, particularly since you've raised it about failures…And now if you can correct me if I'm wrong, but if you're going to be in a really innovative area, whatever discipline you're in, that almost definition, there'll be uncertainties a lot.

There's a lot you don't know. You just don't know. And now again, looking back on the things people see, as you read about it, you see this sort of natural progression. But

as you pointed out, there were all these dead ends and mistakes, and you just didn't know which the best kind of electrode was to use. And you didn't know whether it made sense to do children. You didn't know about materials and patient selection.

01:11:47 And what about long-term side effects? You hear about side effects of drugs and stuff. You're going to stimulate a child for their whole life. What about possible side effects? How do you know they're not going to be epileptic when they're eighteen? So, how do you prepare for that? I would offer three guidelines, if you will, that I think we did most of them right, but not perfectly. One of em is if you're in this thing, check your motives here. What's driving you here? Are you expecting this thing to get you famous or rich? And it's tempting to get into that. The egos can be big in this area and maybe they have to be, if you're going to take a Dremel tool to somebody's head. Maybe you have to have a pretty good size ego [Laughs].

01:12:40 But what is your motive in this thing? Do you wanting to publish something? So be careful about it. I mean, you deserve to make some money. But anyway, just check that. The second one protects you from the future and regrets, is that you're scrupulously honest. And that's not easy to do. As an example, you want to tell your story to somebody else and you say, "Here's a typical patient." When it's really your best patient [Both laugh]. And you didn't show the ones that didn't…

RF: Who couldn't do so well, you know.

BF: To be thoroughly honest about what you're doing is important, I think. And it comes up when these decisions about this child and the children, whether they should be implanted. What is our role. And our role, I thought was to be that…they would not have unrealistic expectations about what this device will do and what the dangers that are involved.

01:13:51 And last, I think that, again, the House people taught us this, is be careful, be respectful, and care about the people involved. Particularly the patients. You treat them well and work with the failures. If anything was wrong, this is what we're going to try to do. We're not going to abandon you. The House people were quite good, and 3M was good at

this. Don't worry about the $200, again, or whether you're going to stay late or how many hours you put into this project, or some things like that. But boy, you better not mistreat one of those patients. You better show respect for them. And I think that that helps. I dunno, it doesn't solve all the problems. But you [gestures to Ralph] want to add any thoughts about handling these uncertainties and being prepared for…

RF: No, I think you covered that well.

BF: 01:14:58 Okay [Laughs].

RF: You did as usual [Laughs]. I do have one other, overarching thing…I just looked this morning kind of at the history with acquisitions and businesses that 3M has gotten into. My underlying question is why didn't we succeed? Why didn't we succeed in the very technologically advanced electric surgery unit that Bob helped design? That was not a success, not a commercial success. Why didn't we succeed ultimately with all these people doing all this good work in cochlear implants? Why did we not succeed in medical acquisitions that 3M made and ultimately had to sell off, whether they were, again, medical type of soft implants or orthopedic implants? Why did we not succeed? Well, part of the answer to that question, for me, is we actually did. In the cochlear implant area, we didn't lead the company to a useful application of that technology, but I'd say we were the tip of the spear early on.

01:16:16 We took a lot of the questions out of the work that had to be done because we innovated certain paths that got us to a certain point before the business was sold. It now has led to companies, at least three in the world, that have fifth, sixth, seventh generation products that I see in Home Depot.

When I talk to people, I see it on their head. I see it in our church. And there's a lot of pride in that. So, I don't think of us as having failed in that. But to the overarching question, I think it's important to understand, Bob and I talked briefly about this. I think 3M makes things by the mile and sells it by the inch. And you can't do that with a cochlear implant. You can do it with Scotch tape and Ioban drapes and other things, but hardware is a whole different thing. As an example, the Wollensack tape recorder, I don't

think they did so well. But that recording tape probably did very well.

01:17:19 It did not fit into the 3M thinking. Very early in my career, I was engaged right away in the potential acquisition of cardiac pacemaking companies. We worked very hard to look at that. And when it came down to it, I think that executive management just was very nervous about life-support, implant electronics. It wasn't part of the culture. They didn't know about it, and it's scary. They eventually got into orthopedics, which are not life support, that is hardware, but we still eventually sold that business. I think it's important to see how you fit into an organization with a product. The technology that you're developing, is it going to be sustainable? I'd say at this point, as I look back at it, I don't think we were sustainable with the way things were done at 3M at the time.

01:18:14 We gave it our all. I think we did some good stuff, but it didn't work out in the long run. Part of the thing about failure is seeing if you fit in with the business model of the company you're doing it for.

BF: Medical innovation, a lot of innovation, is a little bit like a bicycle race. Most of the race you'd like to be a close second. You've probably heard that maybe other people have said that. And I think that you notice it in this kind of thing. The first guy gets out there and gets a lot of criticism. The FDA looks a lot tougher at him and requires lots of things. And they make mistakes. And it's sometimes easier to stay back a little bit and learn from that, and go a little bit…

RF: Draftable.

BF: Just a little bit, a little bit. So, there's some of that going on too here, I think. Any more questions? Are we done?

KR: I don't have any more questions for you.

RF: I would say one other question that I had to think about was, who would you think of as a mentor during this period of time? And I thought about that.

BF: Oh yeah. What did you come up with?

RF: Well, I didn't come up with anybody right away [All laugh].

BF: 01:19:24 I mean, nobody was like, oh, that's the person. But what I did come up with eventually, two things, Bob, and I wondered in your view. I'd say early on the person was Bob Oliveira. He was an enthusiastic optimist.

BF: Oh yeah, that's true.

RF: Oh golly, golly. That guy would support just about anything you needed to do. And he was a bright PhD. But I think that the real mentor, if I had to look at one in the group, it wouldn't be one. It would be that team.

BF: That team. Here he is. I have a picture…He died just last year, I think. Right here.

RF: Oh yeah. So, there's a picture of Bob.

BF: That's me, even a younger version.

RF: And Bob Oliveira in the time. And Bob, as I said, was enthusiastic. Well connected with upper management. So, we had a pretty direct communication with what was going on. But I'd say that the real mentor came through knowing the right person to go to at the right time and feeling like they were doing a good job.

KR: 01:20:25 Thank you. Thank you both so much. That was really enlightening.

RF: 01:20:31 What did you learn?

KR: 01:20:32 One, I had no idea that there was such…well, I knew that because you're dealing with the brain and you're dealing with the ear, that implants take a lot of work, obviously in a lot of precision. But just even the idea of even the precision and knowing what to ask for. You said that somebody said that they wanted something smaller, but you realize what they really needed was thinner, right? And so, you're thinking about how to shrink the diameter. What you need to do is flatten it. So, even that distinction in precision is interesting to note how important that is. But also, just how far back the conversation about interdisciplinarity has gone.

Because we're still referring to it as siloing. We're still talking about how important it is. I'm an interdisciplinary scholar and still must defend why I approach my work the way I do. And so, it's interesting to see that this was productive. I know you said that it wasn't commercially successful, but the research was successful and part of that was because, as you said, this huge group of people from all these different sectors working together. So, I think it's interesting that we're still having to defend that point, even though it's been proven.

BF: 01:21:42 Is that right? Is that still true?

KR: 01:21:43 Yes, it is. It really is.

BF: 01:21:46 Back to that a little bit. One of my earliest experiences with that was actually at Bell Labs. So, here's a company with a hundred thousand employees, and these are really geeks. I mean….

RF: They play chess in their head, as I remember [Laughs].

BF: I had a colleague; he didn't know how a golf ball worked. He sat at a table and looked at em like they had gone down and bounced up and hit him in the forehead. That's how much of a geek these guys were. I mean, I went skiing with two guys who went to MIT, but he had to be the top graduate at MIT. These were serious geek guys. But that company would send their employees out for two weeks into the field, and it was fascinating. So, I still know how I got trained in how to climb up a telephone pole with those spikes on your things and a big belt.

01:22:38 I could still do that. And they send you out there and you go overspend a day climbing up telephone poles, and another day going into an information operator, and another day and repair.

RF: Hm, so they're good at that.

BF: They were good at that. I mean, a huge company. And again, it was always, everybody wants to hear these guys coming out to see you. So, people were receptive. But that's interesting.

RF: Something you said there, Bob, made me think. I don't

think it's necessarily the value of learning how to climb a telephone pole that helped you in Bell Labs, but it was the commonality of other people who have done it. It builds a bond between you. I did that too! I had to do that. I never climbed a telephone pole after that. But you know what, we're both brothers and we're partners in this.

BF: Yeah, we all went through fire training at 3M.

RF: Yeah, you had put out big fires. I never had to put out a fire, but we all did it. We all did it.

BF: That's interesting. That's still debated.

KR: 01:23:45 Yes. Yes. I think especially for the work that I do in terms of the social study of technology, there's a lot of tension between a humanities-based approach to studying technology versus a more STEM-based approach to it. So yeah, it's hard to navigate that.

BF: 01:24:05 Well because you need both. I mean, it's so important to have both...I talked to one of these people that they hire to help talk to your company about innovation. And he said sometimes, once in a while, I'd get a company and I'd find that when I got there…I was told that I'd be only meeting with the marketing people, or I'd only be meeting with the development people. And either case I wouldn't show up, because I know this is already not good.

RF: Good luck in your work, Kristin, to get that changed.

KR: Thank you.

BF: You're at the University of Minnesota?

KR: 01:24:53 I am in the PhD program in American Studies.

BF: 01:25:00 What's your undergraduate degree in?

KR: 01:25:03 So, I have two undergraduate degrees, one in biology and one in English. That is why I think about science the way I do. I studied in North Carolina before working a little bit and then coming here.

BF: 01:25:18 Okay, so your master's degree is in?

KR: 01:25:21 My master's degree is in English.

BF: 01:25:22 Oh, it's in English? Okay.

KR: 01:25:24 Yeah. And so now this PhD is in American Studies, which is an interdisciplinary program. So, I spent a lot of time in Adrian's department, the one he was in. The history of science, technology, and medicine. I do a lot of work thinking about the philosophy of science and technology, and next year I'm going to be working with an engineer in an AI [artificial intelligence] lab.

BF: 01:25:47 So, what did you do wrong? Or right? [Laughs]

KR: 01:25:50 Actually, speaking of geeks, I'm very geeked about it. It is going to be a great year to learn how engineers think about artificial intelligence and how they think about programming languages so that I can then take that back to unpack what's harmful about AI, why it produces the same sort of outcomes for vulnerable communities, and then think about what needs to shift so that AI can actually be generative and productive for our communities. So that's what I do. And then I could say, because I'm spending this time in this lab, I could at least say, no, I spent time with engineers. I can't have this conversation with you [All laugh].

BF: 01:26:34 …Well, good. That's kind of interesting to see. How big is your program? How many people are there?

KR: 01:26:46 They bring in small cohorts, usually about five to six people. But overall, I think we've probably got about twenty to thirty students in different stages. Some folks, I think maybe three people are graduating this year. One of my friends is graduating this year, so I'm very excited for him. Graduate education at the U, well at least in our program, it's gotten smaller over the years.

BF: Okay, is it?

KR: Yeah, they usually only met four to five people a year.

RF: 01:27:17 We were just commenting as we came over. I have a grandson now, a freshman at the University of Minnesota, and we've gone over to have lunch with him and that sort of thing. And I said to Bob, oh boy, it's different than when

		I was there. I would love to be a student again over there. There are so many amenities, so many beautiful buildings that have got to have a lot of brains in them. It's really something. It's quite a place.
KR:	01:27:37	Mhm, it is.
BF:	01:27:37	I don't know, I would think that the expectation…I don't know the student life, but boy, the expectation for young workers is challenging now. I see my kids and how the challenges that they're facing are tough. I think that, in some ways, that part I wouldn't envy…Trying to work in the world might be tough.
KR:	01:28:16	I think you mentioned earlier something about how 3M encouraged you all to kind of tinker around and look different, it was the fifteen percent rule, I think you said. I don't know that that's encouraged as much these days, really. Which is part of the reason I chose the field that I chose, so that I could play around in different disciplines. But yeah, I think there's a lot of ways that it's harder. It's lovely to hear you talk about how you got to learn at work, instead of being expected to come in and know everything at the outset. So, that curiosity, it's lovely to see you both talk about that and how that impacted your work.
RF:	01:29:00	Yeah, we sure didn't know what we needed to know. We had to go and dig it out and scrap it out and experiment with it.
BF:		So good. I think I have got to tell my story. Thank you for letting me talk, for example, about the patients. I think they stick in my mind. They do that aspect. So, thank you for that. Thank you for the chance and to talk about this in general. I appreciate that.
RF:		Yeah, it brings up old memories.
BF:		Yeah, brings up good memories. These are good people.
RF:		And to your point about gratification of seeing our technology and work. Seriously, I've run into several people now with cochlear implants. I was at a men's breakfast at our church, and I saw five guys at the table in front of me with these hearing aids on that Bob invented. So, yes! It's really a lot of fun.

KR:	01:29:49	That's great. Thank you both so much.
BF:	01:29:54	Who's next?
KR:	01:29:57	Actually, I am trying to schedule time with Dr. Art Erdman. He's also at the U. I don't know if you heard about the "Coventor" that was created in 2020.
BF:	01:30:09	No.
KR:	01:30:10	They call it the COVID–19 ventilator. They shortened it to Coventor. Because so many people were getting sick so rapidly and they didn't have enough ventilators to go around, they created a relatively inexpensive ventilator to produce. I'm working with him to interview him sometime at the end of May, and then some other folks from that team. We're also looking at some of the newer technologies that have been developed.
BF:	01:30:38	That are newer. We didn't talk that much about… I guess we covered enough. I was going to say, Ingeborg Hochmair, she was an interesting character.
KR:	01:30:51	Can you spell her name for me?
BF:	01:30:53	Ingeborg is I N G E B O R G. Hochmair is H O C H M E I R, I believe.
BF:		You can just see what she looked like there. Absolutely. That's her husband. That's me. And that's where we used to work.
KR:		Oh, can you hold up the photo?
BF:		Did you stay with them ever at their houses?
RF:		No, never did.
BF:		I stayed. They moved to Innsbruck [Austria], so they had to have one of these houses that looked like the…
RF:		Here's a picture actually of Erwin and his wife Ingebord...
BF:		So that the cultural thing.

RF: That was 1981.

BF: Those things were fun. Did you ever go to the House Gala?

RF: Oh yes. They had, what was it called? Bob Hope.

BF: Yeah, Bob Hope.

RF: Bob Hope sponsored a gala fundraiser.

BF: Do you know who Bob Hope is? That's the question alright.

KR: Yeah. My family lives in Southern California, so we fly out of the airport sometimes.

RF: I remember Dr. House seated my wife and I at a table. He said, the person next to you has more money than you'll ever want or need. And if you can convince him to invest in our program… [Both laugh].

KR: Did you convince him?

RF: I don't know. He had a deaf daughter, so he had a definite reason for investing in that. And he may have.

BF: Jimmy Stewart was also there.

KR: Oh, I know who Jimmy Stewart is.

BF: And he would say, "Oh, I'd rather be out sailing, but I got to support this cause" And then Bob Hope was kind of old, so he'd kind of get up, he'd kind of get running start, and this was when Ronald Reagan was president and there was move toward conservatism. And Ronald Reagan had a hearing problem. And Bob Hope would get up there and say, "Ronald Reagan sometimes can't hear you when you talk to him, but if you lean to the right, he hears better." [All laugh]. That's the kind of humor that Bob Hope would tell.