PROFILES OF SWE PIONEERS

ORAL HISTORY PROJECT

Gloria Brooks Reinish Interview

May 22, 2003

Teaneck, New Jersey

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Gloria Brooks Reinish

Gloria Brooks Reinish was the first woman to receive an undergraduate degree, a master's degree (both in electrical engineering), and a doctorate (in bioengineering) from Columbia University. She began her career in industry, working for Bell Labs and Sperry Gyroscope. Reinish turned to academia while completing her Ph.D. and began teaching both electrical and biomedical engineering at Fairleigh Dickinson University in 1961, becoming a full professor in 1976. She served as the first woman chairperson of the electrical engineering department and as chair of the bioengineering program for a number of years in the 1970s and 1980s. Reinish is a life member of IEEE and a Fellow of the Society of Women Engineers.

In her 2003 Profiles of SWE Pioneers Oral History Project interview, Reinish discussed her experiences as an undergraduate at Cooper Union; as an undergraduate and later a graduate student at Columbia University; her early work at Bell Labs and Sperry Gyroscope Company; returning to school to complete a master's degree and a Doctorate in Biomedical Engineering; her contributions to the field of engineering education, including starting and growing an online engineering education program; and her experiences with SWE.

- July 2016

INTERVIEW WITH DR. GLORIA BROOKS REINISH, MAY 22, 2003

LK: It is Thursday, May 22nd, 2003. This is an interview with Dr. Gloria Brooks Reinish for the Society of Women Engineers Oral History Project. And the interviewer is Lauren Kata, for the Society of Women Engineers. We are in Teaneck, New Jersey, on the campus of Fairleigh Dickinson University. And first of all, I just want to thank you for participating in this.

GR: Oh, you're very welcome.

LK: So can we begin by establishing your date of birth?

GR: I was born July 23rd, 1925.

LK: And where were you born?

GR: Brooklyn.

LK: And can you describe your early childhood and your family background, please?

GR: Well, I guess it was pretty much -- what shall I say -- ordinary, usual, typical. I don't know how to describe it, that's funny. I went to a public school. I took the courses that girls were supposed to take, like sewing and cooking, when the boys took science and shop. And that was what everybody did. It never occurred to me that there was anything unfair about it. Although, I guess at times it kind of bothered me a little, because I wasn't really too thrilled with the cooking course, and the boys were building nice things in shop. And the science course seemed more interesting than the sewing. But that's the way it was.

LK: Were you an only child?

GR: Yes.

LK: And what were your parents' names?

GR: My mother was Celia and my father was Julius. And they were not in any kind of technical or mathematical fields or anything like that. But my mother was a very unusual woman. She was very much ahead of her time, and she was very much of an individualist, so that it never bothered her to be doing things differently than other people. I mean, when I first mentioned engineering, she was very supportive.

LK: Oh, great. Did you spend most of your childhood in Brooklyn?

GR: Yes, all of it. We lived near Manhattan Beach, which was a -- well, I learned to play tennis and things like that. And it was a nice -- almost being at a resort kind of place.

LK: Do you recall, other than enjoying science and math, experiences with technology when you were growing up?

GR: I think I once got a hold of a screwdriver and tried to experiment unscrewing things and got a shock when I tried it on a socket. (Laughs) But other than that, no, I was not really very mechanically inclined.

LK: And what were some of your favorite courses in school, do you remember?

GR: Yes, math. I loved math. I think one of the things I liked so much about math was that there was no question about the answer. If you got the right answer, that was it. Whereas other

things, like story writing, it was up to whether the teacher liked your story. And I think I preferred the -- something that was more definite and more specific.

LK: Can you talk about how you first decided that you wanted to become an engineer or go into engineering?

GR: Well, actually, I thought I wanted to be a mathematician when I was in high school. I mean, I loved math. And I was on the math team. I assumed I was going to be a mathematician, probably a math teacher. And then one of my teammates graduated and went on to engineering school, and he came back and was telling us about it. And I sort of thought engineering was a trade. I didn't know that it was a profession. But then as he started telling us about engineering, it sounded really interesting.

And he had gone to Cooper Union. They gave a scholarship there. But he was telling us about this wonderful scholarship, where you not only get free tuition, but got money besides. Money was very tight in those days, so this sounded incredible. Because there weren't -- actually, there weren't as many opportunities for women as men. I mean, they had things like the Pulitzer Scholarship at Columbia, that was for men only, and there were many things that were for men only.

But this, amazingly, was open to women. So I thought I'd give it a try and see, well, first of all, whether I could get into Cooper Union, because getting into the school without a

scholarship, that was like a scholarship, because you had free tuition. And it was entirely based on an entrance exam, most of which was kind of an aptitude test. So I thought I would try out for it and see. And if I hadn't gotten in, I was not going to try to be an engineer, because I figured if I wasn't cut out to do really well in it, this was not a good idea.

LK: But was it always a given that you would stay in New York?

GR: Well, if I was going to go out of town, I would have to have some really good scholarship help, because that would have been expensive.

LK: How did your teachers in high school respond when they found out that's what you were--

GR: Well, actually, I had two very good teachers, one for math and one for physics. And they had both been electrical engineers, as a matter of fact, before they became teachers.

My math teacher, actually, was a very good influence, because the only reason I took physics in high school was because he encouraged me to, because he said, "Oh, you like math so much, you're going to love physics." And my guidance counselor had been worse than useless, because I had taken the first year of elementary biology, then for the second year of science there was a choice of advanced biology, chemistry or physics. And I asked his advice, and he said, "Oh, all the girls take advanced biology, so that's what you should take." And that was unfortunate,

because -- luckily I got the physics in because my math teacher told me I needed it. But I never did take high school chemistry, which was unfortunate. I then suffered for it in college; it was difficult.

LK: So you did go on to Cooper Union, correct?

GR: Yes. I got in. Well, the first thing was, I got in, and so I thought, "Well, I'll try it and see if I like it." And as it turned out, they had just gone to a trimester schedule because of the war, so they started in the summer. And so I figured I could just try it out over the summer, and if I didn't like it, I could switch back and I was going to go to possibly Brooklyn College, or wherever.

And then after I was there, I got the scholarship, one of these cash money scholarships besides. So then I figured, "Well, that's it. This must be the right field for me."

LK: How did your family react to that?

GR: Oh, my parents were very supportive. They thought it was a great idea. As I said, everybody else -- I think one of the things that also got me more determined to do it was when I mentioned the possibility of studying engineering, people looked at me as though I was crazy, and they said, "Oh, you'll never get a job." And I think it just made me more determined. Before that, they used to say things like, "Oh, it's too bad you're a woman. You would have made a good engineer."

(Laughter)

GR: But women just didn't take engineering. That was not being done.

LK: What was the atmosphere like during the time that you were at Cooper Union?

GR: Interesting. (Laughs) I was the only girl in my class. And the professors were okay. There was no problem. But there was one really pest student who was constantly trying to get attention by making my life difficult. (Laughs) He would try to chase after me and corner me and try to kiss me. And he did all sorts of stupid things, like he put a live mouse in my pocketbook one time.

(Laughter)

LK: Oh, no. How about your instructors?

GR: Well, they were pretty good. Actually, it's funny, at Cooper Union, the professors were wonderful. We had some instructors who were not so wonderful, but I don't think it really mattered too much that I was a woman. Well, what did matter more was that I was not really prepared for some of the courses. Like they had a very high level course of drafting and descriptive geometry, which the male students were much better prepared for because they came from technical high schools and had these courses in high school, which I had lacked. So that was a problem.

LK: How did you handle that?

GR: I had to work very hard. I bought an extra drawing

board and T-square, which I kept at home, and worked, because I couldn't finish my drafting plates in the time we were given in school, and I got tired of lugging the drafting supplies on the subway back and forth. (Laughs) So I just had to work very hard. Oh, and some of them were really bad. The tracings we had to do in India ink, and that was very difficult for me. That was the hardest, the drafting courses. Now, of course, we don't -- well, electrical engineering students don't even take drafting. But civil engineering students who do, use computers. It's wonderful. We just use computers. Ahh! Would that I had had a computer program do it for me! (Laughs)

LK: Wow. Did you know right away what discipline of engineering you wanted to pursue, or did that come later?

GR: No. Well, I had to choose one of them before I entered. But I didn't -- the choices at that time were electrical, mechanical, civil and chemical. I mean, there are many others, of course, now, there are industrial, and bioengineering and so on. But those were the four that were offered at Cooper Union. I didn't care for chemistry, probably because of my lack of high school chemistry, it kind of soured me on it. I didn't feel that I was terribly mechanical, so I was not too interested in mechanical engineering. Civil engineering seemed -- it didn't appeal to me too much somehow, so electrical seemed more -- I didn't really know, I guess it was almost a guess. But it worked out right.

LK: So can you talk about how you went from Cooper Union to Columbia?

GR: Yeah. What happened was, I was at Cooper Union for the freshman and sophomore years. And then during the sophomore year -- this was in the middle of the war -- they announced that they were going to convert to training Army students, and they were just going to run the freshman and sophomore years as a training program for Army students. So they were going to phase out their four-year program. And the seniors, of course, were finishing, the juniors were going to be given another year, the freshmen would be kept for one more year to finish their sophomore year. And my class, the sophomores, were going to be thrown out at the end of the year.

So this really upset us terribly. But their attitude was, "Well, you're all going to drafted anyway, so it doesn't matter." Of course, I wasn't being to be drafted. And we had a few students who were very young, prodigies, and they weren't going to be drafted. But that didn't matter to them.

In fact, it's funny, I remember now, we formed a little group and had the nerve to actually go to the director and appeal to him and tell him that we were going to be in a rather serious predicament. And he was furious that we had the audacity to question anything that they had decided to do. (Laughs)

And we were very -- I mean, it wasn't like the later years, you know, when students exerted their rights. We were very laid

back about it all, I mean, very polite. But he said, "Oh, if you came to a boss in industry and dared to do that, you'd get thrown out of the office. How dare..." -- you know, he was really very... Anyway, the plan fell through, eventually, and they decided we could stay. But by that time I had already been accepted at several other schools and got a scholarship at Columbia, and was sort of soured on Cooper Union because of the way they were treating us, so I took the scholarship at Columbia.

LK: And what was your experience at Columbia like?

GR: Well, I enjoyed it much more than Cooper Union. Actually, when I was at Cooper Union, I thought this was the greatest place because it was very rigorous and all. But I realized afterwards, when I got to Columbia, that a lot of the work that we did was kind of make-work kind of thing. I mean, it was tough, but it wasn't necessarily productive. At Columbia the professors were better, and I learned at least as much, if not more. And I didn't really have to kill myself nearly as much. I just found out it a lot easier. The professors at Columbia -- I had some really wonderful professors there, and I enjoyed it. I was able to live a normal life again. (Laughs)

At Cooper Union, it was really very, very difficult. I had no social life. I mean, we had three semesters a year, and the week between semesters, I had one week in which I could go out on dates and things like that, but the rest of the year was really rough.

LK: And were you affiliated directly with Columbia, or was there like a joint engineering program?

GR: No. That was interesting, because Columbia Engineering School voted to take in women just that year, probably because of the war. Prior to that, they did not accept women. The only place women could go was Barnard. Columbia College did not take women. And so when I came in, I was a junior, so I was able to go directly into the engineering school. But any other women engineering students had to either start at Barnard or transfer in from another school, because the college did not take women until years later.

LK: That's interesting. Were you the only female student?

GR: Yes, I was the only one.

LK: Was that experience different at Columbia than it was at Cooper Union?

GR: Not exactly. Well, I still had -- I mean the professors were fine. Except oh, I had one, I remember, a mechanical engineering professor who was telling us about a lab that we were going to have to take. And he said, "It's a real dirty lab, and you're going to have to wear overalls." And then he pointed to me and said, "And that includes you."

(Laughter)

LK: How did you feel about that?

GR: Oh, it was just part of the -- you know, I sort of -- I think it was not unexpected, shall I say? I mean, things like

this didn't faze me. I sort of expected it.

But again, there was one student who was very immature, and got his kicks by making my life difficult. So his -- oh, he would do things like if I was leaning over to -- we had a fluid mechanics lab, and I was reading an instrument, and there was water, he poured some ice water down my neck as I was bending over. (Laughs) Anything, you know, just to get a laugh from the guys. The other thing he would do was as soon as he saw me coming, he would start either telling dirty jokes or using bad language.

And so I thought the thing to do was just ignore it, and so I just ignored it. So he would escalate it, and I still tried to just ignore it. I thought, "I can't go complain to anybody. I'm a big girl. I should be able to handle this." But he just kept getting worse and worse. And finally I went to the head of the department and told him what was going on. And oh, he said -- he was furious. He said, "This will not happen again." And it didn't happen again. (Laughs) I don't know what he did, but he put an end to it very quickly.

LK: During this time, were you involved in any student engineering organizations? Were there any (Inaudible)--

GR: Well, we had a student chapter of what was then the American Institute of Electrical Engineers. We had Tau Beta Pi, which was the engineering honorary. But that's another story. Tau Beta Pi, in those days, did not accept women. They had a so-

called women's badge, which -- I'm wearing it someplace. Oh, here it is [points to her lapel]. This was the women's badge.

LK: Here, I'll zoom in so we can take a look at it. Oh, there it is.

(Laughter)

GR: This was their symbol, which the men would get a key. And I couldn't have a key, because I couldn't be a real member. Oh, this was funny. They had an initiation, which involved getting autographs. They would go around and get everyone on campus who was a member of Tau Beta Pi to autograph this thing. And the guys thought that it wasn't fair that I shouldn't be included in this. Even though they weren't supposed to let me do it, but they gave me the certificate to have everyone sign.

And one of the members on campus was the then dean of the engineering school, it was Dean Finch -- who later became a good friend of mine -- but I had heard that he had voted against it when Columbia voted to take in women in the engineering school. I don't know if he was the only one, but he had voted against it. I had heard about that. But anyway, when I came to him for his autograph on this, he looked it over and looked and said, "You know, I voted against taking women engineering students." (Laughs) And so I didn't really know what to say to that. I said, "Well, I hope you've changed your mind." (Laughs) He didn't answer.

But as I say, he was okay. We, in later years, he was my

friend. But yeah, that was the prevailing attitude.

LK: Wow. And was there any kind of like a women's network or a women's engineering group?

GR: There weren't enough women for there to be anything like that, no.

LK: At Columbia. What about in the local New York area?

GR: Not at that time -- at least not that I knew of. Although, shortly after that, there was a group that started. I think that was -- let's see, I was at Cooper Union '42 and '43. Then I was at Columbia from '43 to '45. And I guess it was around when I graduated that there started this group, which was actually the initial formation of the Society of Women Engineers, although we didn't charter it, we didn't officially start it. But we did start meeting.

LK: Where would you meet?

GR: In New York, in a restaurant, whatever.

LK: And was it mostly students or was it (Inaudible)--

GR: No. These were engineers that -- we were graduates. I don't know how we found each other. (Laughs) It was very informal. I mean, we didn't have a lot of members.

LK: Why was that important to meet with other women at that time?

GR: Well, I guess so we wouldn't feel like such freaks. (Laughter)

GR: You know, you got to feeling, "I'm the only one." And

then it was so wonderful to meet another one. Oh, and I remember that we did get to meet Lillian Gilbreth, which was very exciting.

LK: What was that setting? How did you meet her?

GR: Well, she came to one of our meetings. And you know, she was 'the' role model.

LK: So you knew about her before joining SWE -- not joining SWE, but before meeting with other women?

GR: I guess about the same time. This goes way back, as I said. This was around '45.

LK: And so attending these get-togethers and talking with other women was meaningful for you?

GR: Oh, yes. I guess this was sort of an eye opener: There are women engineers! You're not the only one!

LK: So you graduated as the first female engineering graduate from Columbia in 1945?

GR: Right.

LK: And can you describe your work history from there?

GR: Well, I had a number of job offers, probably because of the war. You know, I had been prepared for lots of discrimination. Everyone said, "You're not going to get a job." So I was delighted by the fact that I was -- well, I graduated second highest in the class, so that helped, too, I guess. And Columbia had a good reputation. But I was quite annoyed by the fact that Bell Labs, which was a prestigious place to work, offered me a job as a TA, that's a technical assistant. In those

days they only had two categories of employees, MTS, which was member of technical staff, and the TA, which was technical assistant.

And engineers were normally hired as members of technical staff, but this was male engineers. They didn't have any female engineers. But they were hiring some mathematicians and physicists who were female, and they were giving them the status of technical assistant rather than member of technical staff. So this is what they offered me, is technical assistant. And I was absolutely indignant. I said, "I wouldn't consider it." And they said, "Well, what's the difference what the name -- what's the difference in the name? The work is going to be -- the work is the same and the pay is the same." And I said, "Look, I wouldn't care if you paid me more, I'm not" -- absolutely, I turned it down, said I won't consider it. So then they offered me member of technical staff, which I took.

LK: How did you know that that line of demarcation existed?

GR: You know, that's funny. I was just thinking about that as I was talking, and I don't remember how I knew that. I guess I must have known someone who worked there -- no, I didn't know anyone who actually -- I don't remember how I knew, but I had somehow found out.

LK: So how was your experience working for Bell Labs?

GR: It was good, basically. I had a very bright boss who was quite helpful. And actually, I was working with a technical

assistant (Laughs) who was an excellent engineer, really. She was -- I forget if her degree was in math or physics, but she was very bright. We became very good friends. And so I enjoyed working there.

But then when the war ended, we were doing radar work. When the war ended, they went back to doing telephone work, and I went on to Sperry Gyroscope Company, which was out on Long Island. That was a really good move for me. I made more money. And also I discovered something. My boss there was competent, but he wasn't as brilliant as my boss had been at Bell Labs, and I discovered that I could figure things out almost as well as he could.

When I was at Bell Labs I had this feeling that my boss knew everything, and I didn't -- I would just go and ask him -- any time I was puzzled about something, I would just ask him, and he would come up with a wonderful explanation for it. I'd say, "Why is it doing this?" And he'd say, "Well…," and he'd give me a wonderful theory. And then he would go on and say, "But if that's true, then if we make this change, it should do this." And so we would try that, and it didn't, it would do just the opposite. And he would immediately be able to come up with an equally good theory for why it was doing the opposite. And I was just bowled over by all of this. I mean, this was my first job. I was nineteen years old. And I just almost -- well, I was sort of in awe of him. He went on to be the leader of the Telstar Project.

He was really very, very sharp. So it sort of gave me a bit of an inferiority complex. Although, I guess he could say he was a mentor. I mean, he was quite good. But I was a little over-awed by him.

But then when I went to Sperry, as I said, my boss was competent, but he wasn't overwhelmingly so. I mean, I could think of things that he didn't think of. So I began to get a little more confidence, myself.

LK: Were you the only woman working at Sperry at that time, do you recall?

GR: We had women who were -- there was a woman mathematician. We also became good friends. We had women draftsmen. No women engineers, though.

And at Sperry, I enjoyed working there. I got a patent while I was there. Let's see, what else did I do?

LK: Well, during the time you were working at Sperry, you also were taking graduate courses, weren't you?

GR: Oh, yes, yes. (Laughs)

LK: Can you talk about how you managed that and what you--

GR: Well, that is funny. When I graduated from Columbia with a bachelor's degree, I thought, "That's it. I'm never going back to school. It's great to not have to open a book again. I'm finished." Six months later I was back taking a course at night because I realized that I needed a masters degree.

LK: Why was that?

GR: Well, everything I had learned in school was really obsolete when I came to what I was doing at work. I mean, for example, we learned DC circuits, AC circuits, that's it. When I started working, everything was pulse circuits. So I discovered that all of the material that I really needed was being taught in graduate school, because the undergraduate program was lagging behind.

So I started taking courses at night, which was not easy, because I was commuting from -- I was living in Manhattan Beach, Brooklyn, commuting to work in Manhattan, and then commuting to school further up in Manhattan. So it wasn't too easy, but it wasn't bad. Anyway, I was doing that.

And then when I went to Sperry, that was even more complicated because Sperry was out at Long Island, so I was commuting, Brooklyn, Long Island, Manhattan. And then Sperry came up with a very nice program, which was they offered three scholarships a year. This involved -- you got -- you worked half-time, went to school half-time, and got three-quarters salary plus tuition for the school -- for the courses.

So I applied for one of those scholarships and got one. I thought that was great because to me that meant they were not discriminating against women. You know, one of the reasons -- one of the bases for discrimination in those days was people used to say, "Well, a woman is not going to stay in the field, she's going to get married and have children and leave. So an engineer isn't

really able to do anything until they're there maybe six months or whatever, so we can't waste all that time training a woman engineer, because she's not going to stay with us." And that's nonsense, of course, because men left just as often, if not more so, than women, you know, just changing jobs.

LK: And so Sperry was--

GR: But Sperry was not like that, no. They were very good about it. So I got one of the scholarships, and then I was able to complete the masters degree, partly at night and -- well, no, I guess I started doing it all in the daytime then, because I had the two days a week I was at school, and then I worked three days a week. And so I finished the masters degree.

LK: Was the work you were doing at Sperry related to the research you were doing on your masters?

GR: Yeah. Actually, it did help. I remember -- in fact, it's probably the base, which led to my patent. We had developed a ranging system. And it met specs, but we were trying to improve it. There were some errors that we were encountering at short range. And we were trying things.

And it suddenly dawned on me that the thing to do was to analyze this and really just analyze all the circuits in it. Nobody had thought of trying this, they thought it was much too complicated. But I had just taken some courses in Laplace transforms, which, now, I mean, all of our undergraduate students learn this as juniors. But in those days, that was not included

in the undergraduate curriculum, it was a grad course.

And so I sat down and analyzed it and discovered that the errors that we had were inherent in the system we were using. And we had gotten it as good as it could be, and so we stopped fooling around trying to improve it. But instead, that gave me the idea of trying to develop a different system, which wouldn't have these errors. And so I came up with an idea, which eventually led to my patent. The system that I originally started this on was a radar system for the Army, which was too far along to make the change, but it was good enough. As I said, it did meet our specs. But then we had a Navy system, which we were starting, and we used my new design for that.

LK: Oh, that must have been exciting.

GR: Yeah, it was. That was really very exciting.

LK: Can you talk a little bit about some of the other work projects that you were involved in at Sperry, and what you enjoyed about working there?

GR: Let's see. Oh, well, actually, going back to Bell Labs, there was something very exciting that I remembered. This was one of the most exciting things for me. I had designed a little piece of a radar system, and my boss took me to the Western Electric Plant where they were -- after we had designed, and had gotten this through all of the testing and so on, and it was going into production, and there was an assembly line where there were, oh, maybe a hundred women sitting and soldering in the compound and

assembling this little unit. And that was my baby, the little unit that I had designed! And I saw all of these people building it, and that was a great thrill.

LK: And it was mostly women working on it?

GR: Yes. Well, it was wartime. The menial jobs were all being done by women. Rosie the Riveter kind of stuff.

But I was thrilled to see everybody building my little unit. That was a real thrill. Actually, both there and at Sperry, I found the part of the job -- the part that was exciting, that was fun, was getting the idea and getting it to work. But then what would be really boring was maybe I'd spend a few weeks or a month in that initial phase of design and getting it to work, and then came the really tedious testing of all kinds of things. You know, the equipment that was designed to the Army had to pass all sorts of tests for vibration and temperature variation and so on. And that got very boring.

LK: And it could be tedious.

GR: Right. That wasn't fun.

LK: The next question I have is: Did you know or were you surprised when you started working, the types of work that as an engineer you were doing, or was it what you expected when you were in engineering school? Do you understand what I'm asking?

GR: That's an interesting question. I don't know what I expected (Laughs) when I was in engineering school. I didn't really know what engineers did, so I don't know whether to say I

was surprised or not, because I didn't really know what I was going to be doing. I think when I said, "I'm going to be an engineer," I didn't really know what I was talking about, (Laughs) in a way.

Well, actually, what I learned in school was just background. I mean, it would be very difficult for me to go back and find what I actually learned and how I used it other than that graduate school course in Laplace transforms, and some of my other courses in grad school. But my undergraduate courses were more background, I didn't really use them in industry. And I was in R&D, in research and development. I imagine that the people who worked in production or various other aspects of engineering probably used their undergraduate courses even less.

LK: That was a time period when there were a lot of rapid advances in electronics were taking place?

GR: Yes, because we were going into all of these high frequency pulse applications, and the curriculum in school was just not keeping up with it -- in electrical engineering.

LK: Was it exciting to be part of the field at that time, or did you -- is that something you recognized in hindsight? Were you aware at the time you were enrolled?

GR: No. I think I was -- well, even when I was still in school, I remember we had one very good professor at Columbia, Dr. Ragazini (phonetic), and he was doing all of these things. He was working with the -- he was doing war work, he was doing all of

this. And this was when I was in graduate school. And he told us that much of what he was doing was classified, and so he couldn't teach it to us. But what he was teaching us -- he said some of what he was giving us was classified, but he wasn't telling us which, so that we couldn't (Laughs) -- as long as we didn't know exactly which parts of it were being used in classified things that it would be okay. But he was keeping us as up to date as he could.

LK: So how long did you stay at Sperry?

GR: I was there for five years. And I left only because I was going to have a baby. In and those days -- I mean, it was bad enough being the only woman engineer at a place, but I couldn't even dream of coming in being obviously pregnant, so I left when I started to show.

LK: What year were you married, and what was your husband -- what does your husband do?

GR: I was married in 1948. That was when I got my masters degree. I was working at Sperry then. Oh, in fact, I could have gone on -- they asked me if I wanted to continue for a doctorate, they would have continued the scholarship. And like an absolute fool I said no. But at that time I was more interested in preparing -- getting married and setting up an apartment and so on, and so I wasn't really interested in going back to school again. So that was my second dropout. I felt like I was a dropout several times. I mean, after I got my bachelor's degree I

dropped out and was back in six months. And then when I got the masters, I dropped out for considerably longer. But that's another story I'll get to later.

But anyway, my husband was a chemical engineer. And we didn't meet in anything engineering. We met at a resort in the Poconos. He was from Philadelphia and I was from Brooklyn. I guess it was sort of halfway.

(Laughter)

GR: Let's see. Yeah, I left Sperry in 1951. And my first child was born that summer, Nancy. And in fact, there's a little story with that. I have pictures of Nancy when she was a baby teething on a slide rule.

(Laughter)

GR: I had a little cheap slide rule that I let her play with. So I don't know if that had any influence or not, but she's an engineer now.

LK: And so can you talk about how your work or your career progressed from that time period, and then--

GR: Well, when I first retired, it was kind of a shock, because I felt a great loss of identity. Being home with a baby was -- I mean, I loved my baby and I liked being home with her, but it was kind of a letdown after a while, you know. And actually, my husband was going to school then at nights, he was doing a masters degree at night, so I was home alone all day and all night, with a baby, you know. And the winter got really

dreadful. We were kind of -- cabin fever. I mean, it was just such an effort to get a baby all dressed to go out in the snow (Laughs) that I just didn't bother. So I was beginning to get very restless and very -- what shall I say -- discontent. So I decided to take some courses again.

LK: What year was this?

GR: This was -- let's see, I guess it was in '51, '52. And so I had no real goal in mind, particularly, but I just wanted to get out to do something a little bit interesting. And my mother was available to babysit, so I started taking -- I took a course at Columbia engineering school again. I went back there, and I took a few courses. And then they said, "Well, would you like to go for a Ph.D.?" And I said, "Oh, I guess so." (Laughs) So I was enrolled in the Ph.D. program. Actually, the Doctor of Engineering Science. It's the same as the Ph.D., but the engineering school uses Doctor of Engineering Science degree. And so I was not terribly motivated because I didn't really know what I was going to do, whether I would ever go back into the field or what, but I was taking these courses.

But then I dropped out another time, and that was because my father became ill, he died of cancer. My mother went to work, so I didn't have a babysitter anymore. And as I said, I didn't really know what I was going to be doing with these courses, if anything, so I stopped going.

LK: Was there any kind of literature or any meetings that

you can recall? Was there ever any talk about, you know, re-entry programs for engineers at the time?

GR: None, none. For a time there, I was actually completely out of the field when I quit school. I guess I read my journals. I was still a member of the IEEE [Institute of Electrical and Electronics Engineers]. I guess by then the AIEE and IRE had merged. I was originally a member of each of them, and then they merged to form IEEE. So I did get the journals. But as far as whether I would ever get back in or when, I was not really tuned to that. I had a second child, and I was a homemaker, a full-time mother, taking care of my babies.

LK: And so how did you come to re-enter the field, and when did that happen?

GR: Well, that wasn't for quite a while. Actually, what happened was eventually we left Brooklyn, we moved to New Jersey. And I had another baby. So now I had Nancy, my oldest one, and Julie, my middle one, and Jim, my baby. And I started getting restless again. (Laughs) And by this time I knew that I had to do something because I was not happy just being home. I had done some volunteer work and things like that, but that was not really satisfying.

So I decided I would try -- I thought maybe I would go back to my original idea of teaching math. And I thought I would try substitute, teaching math. So I tried. I taught math and physics in -- I was amazed at how I was called so frequently. I guess

they didn't have too many math and physics subs, because I gave my name into a few high schools, and they started calling me. Nobody ever checked my credentials, and that amazed me. (Laughs) But then I found out that there was such a thing as a license for substitute teaching as well as a license, which I was going to start preparing for, to teach in a high school. And I needed some education courses. I had taken one course in methods of math teaching when I started all this, and I had some psychology courses that were going to count, but I would need some more.

So I was putting my stuff together. I finally got some of the papers which were still at my mother's house, and some that were buried in various nooks and crannies, and I finally got it all together to submit to the Board of Education, or whatever, and see what I would need, what courses I would need for certification.

Now, while I was doing that, I thought, well, there was a university not far away. I was living in Bergen County. And so I sent a letter to Fairleigh Dickinson with my credentials. And I remember this was around sometime in October of -- I guess this was in 1961 or '[6]2, and I was thinking in terms of the following year starting to do something.

I got called immediately, much to my amazement. They called me for an interview. And I was hired immediately to teach -- I was offered a course at night, one night a week, a course in electronics. I thought that was perfect. That would be ideal.

The course ran from 8:00 to 10:30. I'd be able to put my children to bed and then come teach. I said, "Oh, that's perfect."

And I still thought we were talking about the next year. It turned out that a part-time instructor had been -- his job had been transferred to another state, and so he had left them in the middle of the semester. And they needed someone to come in right away. And so I was hired to come in in two days. And this was a bit of a shock, because I was -- I had been out of the field, as I said, and transistors had snuck in when I wasn't looking, and so (Laughs) I was a little scared.

But this was too good a chance to turn down, so I rushed to the bookstore, got the book for the course, and started work to prepare my first lecture. And at first I didn't think I could understand one word of it. It looked completely foreign to me. But then I dug out my book. I mean, this was written -- was a revision by the same author. And so I dug out the book I had used at school and discovered, luckily, the chapter we were on was feedback amplifiers, and that hadn't really changed. And it was actually the same book, the same everything. And I thought, well, if I once knew it I guess I can do it again. So that gave me a little more confidence. And so I worked very, very hard and managed to give a decent lecture, I guess.

And that whole semester, I was working very hard. I was really putting in a tremendous amount of time, because I knew that being the first woman to be teaching engineering at the school I

was going to be talked about, and so I didn't want them to say anything bad. And so I would work at every problem before I assigned homework. I didn't just work at the problems that I assigned, but I worked out all the problems to make sure that any questions that anybody asked I'd be able to handle.

LK: So did you really feel pressure?

GR: Well, that was -- it was kind of difficult, because as I said, I was preparing a course for the first time, and having been away from it for so long, I was a little concerned about keeping ahead of the students and maintaining credibility. But actually, it was wonderful, because I found when I was doing the high school subbing that that was horrible. I mean, teaching in a high school is probably okay, but substitute teaching in a high school is no fun at all, because this is supposed to be field day. The kids don't really want to learn anything when they have a sub. So it was very unrewarding.

And then when I came to this class, and these were mature people, most of them, you know, working in industry and trying to complete their degrees at night, it was a revelation to me, because they were so anxious -- most of them were so anxious to learn. And they were very grateful. They realized how hard I was working, and they were extremely grateful. They responded so well that I found this was really what I wanted to do. I just loved teaching and the response that I got from my students. So that was it, I decided that I was never going to go back to industry, that

I was going to go into teaching and research at a university.

(INTERRUPTION IN RECORDING)

LK: This is tape two for our interview with Dr. Gloria Reinish. We ended tape one talking about how you made the transition from industry into engineering education after discovering that you had a love of teaching.

GR: Right.

LK: So can you talk about your career after that point?

GR: Well, at first I just taught one course one night a week. And this was, as I said, very gratifying. It turned out that I got very good response from the students.

And in fact, I had started a club for their wives. I found that many of the students were -- actually, they were married, they had families. And their wives were somewhat resentful of the amount of time that they had to spend going to school and doing homework and not being able to participate in all of the family activities that they wanted them to. So I decided to start a little club for the wives, to try to get them to understand a little more about what their husbands were going through, and how difficult it was, and how important it was to be supportive. And so that was kind of fun, because that was a problem for some of the men. You wouldn't think that their wives would resent their doing something to improve themselves and make life better. But you know, in the immediate problems of wanting them to go shopping or go to the movies, or whatever, and they never had the time,

they were a little less than understanding at times.

I found that I was able to add a course. I started, as I said, with one night a week. Then my youngest child was in nursery school. I started to teach a course in the daytime. And finally I went to full-time teaching. But at that point I realized that if I was ever going to get anywhere as a teacher at a university I needed a Ph.D., and so I went back to school again. (Laughs)

LK: You went back to Columbia?

GR: Back to Columbia. But actually, I did -- although my bachelor's and masters degrees were both in electrical engineering, I decided to do the doctorate in biomedical engineering. One of the reasons being -- well, I had gone to an alumni thing at Columbia, and there was a young professor there who had just started the bioengineering program. And he was so full of enthusiasm, and it just sounded really exciting. And I had sort of been thinking about bioengineering as a good career for the future. In fact, that's what perhaps my daughter might be interested in it. It never -- I hadn't really thought of it for me. But I mentioned to him that I was planning to come back to school to finish work on the doctorate, and he said, "Why don't you do it in bioengineering?"

And wow! I said, "Yeah, why not?" (Laughs) So I decided to do that. And by this time my youngest child was in full-time kindergarten, which meant that if I was ever going to do it, I had

to start. And so I did, I went back to Columbia. And I had to take all kinds of courses that I didn't think I would ever see myself taking, things like organic chemistry, which I hated, physical chemistry, which I loved, bio chemistry, which was so-so, anatomy, which was daagghh! (Laughs) and physiology, which I loved.

So I found this was quite challenging -- very challenging, because then once I completed the courses, I mean, that was bad enough, but the thesis was really a lot of work, because I was doing a thesis that was a combination of theoretical and experimental. And I was doing it at Columbia, so I was going in to Columbia about four days a week. And I was still teaching full time at Fairleigh Dickinson, so I had one full day plus a number of evenings. And I was still taking care of two children at home. By this time Nancy was married. But I had my two younger children at home. And I was still shopping and cooking and taking care of my husband and house.

LK: Wow. How were you able to manage that?

GR: Looking back on it, I haven't a clue! (Laughs) If I had to do it now, I think I'd lose my mind. But I did it. I don't know, I guess you do what you have to do.

LK: So how did you come to your thesis research (Inaudible)?

GR: That was -- we had various -- we had seminars in the bioengineering program at Columbia, and people would come in and talk about what they were doing. And I was looking for a topic.

Actually, the program at Columbia is geared more toward the chemical engineering aspects of bioengineering. You know, bioengineering is very interdisciplinary. You can have electrical engineers, mechanical engineers, civil engineers. Actually, they had a civil engineer who analyzed blood flow the way you would analyze fluid flow, Dr. Skalak. He died, unfortunately.

An all of these disciplines can be drawn on in bioengineering. But as I said, the main research that was going on at Columbia was in the field of chemical engineering, things like artificial kidney research. And so the opportunities for electrical engineers at that time were not as exciting as for chemical engineers.

But there was a seminar that was given by someone from the College of Physicians and Surgeons. He was head of the orthopedic research there. And he was doing work on electrical properties of bone. The idea was that bone grows in response to stress. Everybody had known that, I mean, for a long time. But the theory was that the mechanism for which this occurred was electrical. And so there was a question of perhaps the response -- that you could get this response of inducing bone growth electrically, that is, by electrical stimulation. So a lot of people were interested in this, a lot of orthopedic surgeons.

And there had been some research done on -- some people said that the mechanism was that bone was piezoelectric, that there was a piezoelectric effect. Piezoelectricity is when you stress a

material and it produces a charge. This is like in a phonograph pickup, that's how it works. You know, you have a piezoelectric transducer. And so the question was: Is bone piezoelectric? And a number of investigators said it was, and others said it wasn't. And there was a lot of discussion of this, and there were papers being written in which people were criticizing each other's work as being not correct.

So I thought, hmm, this looks interesting, because these were primarily physicians, physiologists who were doing this research. And I said, "This looks like a good field for an engineer to get into," because some of the arguments that they were exchanging seemed as though they were not very well documented or very well proven. I thought maybe I could get into this and find out what was really going on. So I thought maybe this would make a good topic for my thesis.

And the only problem I had was in finding a thesis advisor, because I couldn't have the orthopedic surgeon, Dr. Bassett [who] was doing this research at the Physicians and Surgeons -- he couldn't be my thesis advisor because he was not sufficiently knowledgeable about the engineering aspects of the work. I needed someone from the engineering school. And no one at the engineering school knew anything about this. So I had to find somebody who was willing to learn about it.

And this is sort of going backwards. I mean, normally, when you do a Ph.D. thesis, you look for an advisor who's doing

research in some field who's willing to take you on as an apprentice. And I was doing it backwards. I had a topic, which I knew more about than my advisor was going to, and I had to find an advisor who was willing to learn about this topic that I was interested in. (Laughs)

So fortunately I found an excellent one. He was a material science professor, Professor Nowick, and he was an outstanding physicist and material science specialist. And so he brought his knowledge of material science in, and I brought my engineering knowledge. And at times we didn't speak the same language exactly, but we eventually learned each other's languages, and so it worked out very well.

Actually, I think bioengineering, that's one of the aims of a bioengineering collaboration, when you have an engineer working in some field of medicine, and the engineer and the medical person or physiologist don't speak the same language. And it's much more difficult to try to teach the medical people engineering than to teach the engineer some physiology and medicine. So that's basically I think the reason that bioengineers are needed in order to have collaborative work done in the fields of engineering and medicine.

So anyway, that was how I got the topic. And then what I thought was going to take maybe a few weeks to do, took a few years. (Laughs) And what I thought was going to take -- be the more difficult parts turned out to be impossible. And one part,

which I thought was going to be relatively difficult turned out to be relatively easy. So when I read my thesis proposal after I was finished, I had a good laugh. But anyway, that was a lot of work. That was really hard.

LK: And especially doing that while you were working and raising your family.

GR: Right, because as I said, I was going into my lab at Columbia about four days a week, and that wasn't always fun.

LK: During this time period, were you able to remain involved in the IEEE, or did that kind of--

GR: The IEEE? Yeah, I guess I was. I was very involved with SWE because I had started a chapter at Fairleigh Dickinson, and that was, I guess -- well, probably just after that. That was when I guess I had finished my thesis then, when I started the SWE chapter.

LK: Can you talk about how you--

GR: Yeah. Actually, we started to have -- when I first started teaching here, I didn't have any women students. And then occasionally I would get one. And then in the '70s, it became -- things got a little better, and I had a nice group of women engineering students. Actually, our first SWE chairman became quite active in SWE after she graduated, Terri [Theresa] Roesch. I think she's still active in SWE. She had come to us from -- she had started at Stevens [Institute of Technology] and then came here, and liked it better here, and wanted to have the networking

with other women. I think that this was very important.

As a matter of fact, I remember a funny -- we had -- we actually -- I don't know if I should talk about this -- well, I guess it doesn't hurt. I won't name names. But we had a professor here who nowadays would have been considered guilty of harassment towards females, towards minorities. He had a very "funny" kind of sense of humor. He thought he was being funny, but he would say things that were not very nice.

And I didn't know about this. And he was up for tenure. He had been here a number of years. And we had thought that he was doing pretty well. And I was planning to support his tenure, when one of my SWE girls told me that she was not going to take a course that -- and I said, "Why not?" And she said because she didn't want to have him as her teacher. And so finally I got her to tell me what was going on. And then I talked to some of the other women students and found out that there was this very consistent pattern of his making remarks, which were making the women students most uncomfortable.

So in those days we didn't have any of these safeguards or any of the programs for preventing this kind of thing. I mean, there was no such thing as sexual harassment, nobody had ever heard of it. This was -- I'm talking about the '70s. But in any case, I managed to prevent his getting tenure, and so he left after that year. But it's funny, I'd forgotten about that.

But now, of course, that would be unheard of. We would never

-- I mean, we now take -- I just completed a little online course in what constitutes sexual harassment. And everyone at the university is required to take this. And some of the questions are not that obvious, I mean, things that -- what is harassment, you know, and what isn't, and so on, and what kind of thing is acceptable, and what isn't. People are so much more aware of that now.

But getting back to the SWE chapter, yeah, we had a very nice active chapter for a number of years. Well, we still do this, we go to the conferences and bring the students. We used to -- we haven't done this for a few years now, but when we had a larger group, we brought in high school students, and we had programs, brought in women engineers to talk about different branches of engineering, and put on these programs for high school students, as well as, of course, having women engineers come in and talk about their work for our students, for our SWE members. So that was quite rewarding.

LK: Is it important for students to be exposed to working engineers?

GR: Oh, I think so, yes, because they -- it gives them much more motivation, much more of an idea where they're going and what they want to do, and what the opportunities will be, and what kinds of things people are doing.

LK: And how do you see the SWE section from the university point of view, how has that section evolved since you first

started in the ‘70s?

GR: Well, we’ve had -- unfortunately, it hasn’t been a smooth course. We’ve had our ups and downs. We did very well for a number of years, and then we didn’t do so well. And now I’m just starting to rebuild, actually.

LK: And do you think that today there’s more of a cooperation with the male students, or --

GR: I think that the women are accepted completely. I mean, right now I have a lot of female graduate students, most of them are international students. I have a lot of women students from India. I have a few from China, but mostly from India in the graduate program. The undergraduates, I don’t have too many. Actually, right now, I have one also from India in the undergraduate program. But a few years ago I had several, and we had a lot of fun. We went to the SWE conference and had a good time. But the last couple of years we’ve been a little inactive.

LK: Does the changing -- are the changes in just backgrounds with students -- does that change the dynamic a little bit--

GR: In terms of--

LK: In terms of you were saying there are more international students now from different backgrounds. And do you see that that has changed the dynamic of like the classroom or the SWE section even?

GR: Well, I think the international students tend to be a little more -- what shall I say -- a little less aggressive.

They're kind of shy. They're a little more hesitant about actually going out. They're not as outgoing. Well, I shouldn't generalize. I mean, this is not true of all of them.

LK: Sure, sure. But I mean, there are issues like language and--

GR: Yeah, that's somewhat of a problem, but not too much.

LK: Let's shift gears a little bit and talk about after you received your Ph.D. some of the roles you took on here in the department. Can you summarize?

GR: Well, let's see, I was the chair, the department chair for a term. What else have I done here? (Laughs) Oh, more recently, going back about six years ago, I decided -- well, I recommended that we become involved in teaching our engineering courses on the web. And you know what happens if you suggest doing something, you end up being the one who has to do it. (Laughs)

So I had a challenging job of putting my graduate courses on the web. And that's been interesting, because I've had some students from all over. I've had students from all over the United States, and I even had one from overseas, so it's become quite an interesting program. He's from Nigeria. I had the most unusual excuse for not being able to take the final exam. There was an uprising in the town that he lived in, and he couldn't get to the computer at his work because the roads were closed. So I had to give him a time extension until the uprising was over.

LK: Wow, that's very interesting. In your experience with that so far, how does this new way of bringing engineering education to students affect things like accreditation, or just curriculum building -- or has it?

GR: Well, actually, it hasn't affected our accreditation. What we've done so -- we have a variety of programs. We have fully online web courses, and then we have kind of web-enhanced courses. And so far, all of our undergraduate courses have been web enhanced rather than completely web delivered. So actually, in fact, I was just working on that now.

We've just started a new web delivery system, and I'm revising everything. But I've had -- all of my courses now are web enhanced. The university has a new program where the president decided that it's important for all students to learn how to take courses via the web. So every student at the university has to take one web course per year. And so I've been teaching those courses too.

Now, for our freshmen we have an interdisciplinary course called The Global Challenge, which draws on people from the liberal arts, from psychology, from philosophy, from engineering, from science. It deals with all kinds of global problems, global issues such as health and conflict and ethics and environment, and so on. And so I've been teaching that for the last few semesters, as well as our own web courses.

I think that for some students web courses are great, and for

some they're not so great. And one of the major -- well, there are two major issues. One of them you would think would be obvious, and that is access to a computer. But I've actually had students sign up for a web course who don't have adequate access to a computer and have a very hard time with it. You would think that that would be a given, that they would not take a course unless they had sufficiently decent access to a computer. But that's one problem.

The other problem is a certain level -- I think a certain level of maturity is needed, because you do need a certain amount of self-discipline if you're doing something on the web. Actually, I've had -- this course that I teach, this Global Challenge course is for freshmen. And that's been rather a challenge in some respects, because some of the freshmen don't seem to have the necessary maturity to -- although we set very strict deadlines as far as when things have to be done, and so on, I've had a student, actually, who came, and at some point, having not done the work, said, "I forgot I was taking the course, because we weren't coming to class." (Laughs) And this can happen. I mean, they just sort of forget about it.

But my masters degree students who take the course on the web -- I did a survey a number of times to see -- well, I asked -- I thought I was -- jokingly, but I asked them to check whether they learned less, about the same or more than in a traditional course. And much to my amazement said they felt they learned more than in

a traditional course. They felt more focused. They felt they were able to concentrate on the material, to go over it, to do it whenever they wanted to. And so I was very pleased by the reactions of some of the students. Of course, even grad students, there were some who kind of got lost.

LK: Sure. In terms of -- I mean, you talked a lot about student reactions. But from the educator's perspective, do you have a preference for teaching online courses versus in the classroom?

GR: That's an interesting question. Actually, what I've done in some cases is combined them. I have my graduate courses, which most of them, with few exceptions, they usually run both on the web and live at the same time. So what I've done is, I have the course online, but I give my live students access to the material so they can do both. And so my distance-learning students have the opportunity, if they want to, to come to class.

And actually, I had one student who was very conscientious who had been a student who was taking courses on campus, then he moved to Pennsylvania. He was about two hours away, and so he was completing the degree on the web. But every once in a while -- he asked if he could come to class, and I said, "Of course." So every once in a while, he -- and it was not just once in a while, I think he was doing it more than half the time, he would commute into class because he was afraid he would miss something.

What I found interesting too, for the distance students, I

give sort of a take-home exam, but I make sure that it's long enough and hard enough so that they're not going to be able to just, you know -- I mean, it's not the same exam, obviously, that I give to the class.

LK: Right. There's more work involved.

GR: And so he chose to come in for the exams and take them in class because he didn't want the longer harder exams. Although the exams in class, of course, are proctored and with time limits, and so on, he still preferred that.

But as I said, teaching it live, I like to have the questions. I like the response of you know, having the students ask questions. But I try to get that into the online course by -- we have a discussion board for the online course. And the students post questions, and I post the answers. So I try to keep that going so that we have a virtual classroom. So actually, I like both. (Laughs)

LK: That's fantastic.

GR: The only thing I don't like about teaching is giving grades.

LK: Really?

GR: Oh, I hate giving exams. I hate grading exams. I hate giving grades. That's a real pain. I've just finished doing it. Ugh!

(Laughter)

GR: The semester just ended. I think I don't know who

dislikes it more, the students or me.

LK: Well, my next question for you is -- you've worn the title "woman first" in several different venues. And what does it mean to you to be a woman first, or the first woman?

GR: What does it mean to me?

LK: Or does it have a meaning for you?

GR: I have to think about that. (Laughs) I never really thought about that. That's an interesting question. What does it mean to me to be the first woman to do various things? I don't think I ever consciously set out to do that. I mean, it just happened. No, it wasn't, "Well, I'm going to -- I'll show them. I'm going to be the first one. I'm going to do this." It wasn't like that. (Laughs) It was just there was something I wanted to do, and I tried to do it. And nobody had done it -- I guess it just happened. I don't know. I hadn't really thought about that. That's an interesting question. I would say it didn't bother me to be the first woman.

LK: Has being a woman affected your career? I mean, it seems like an obvious question, but--

GR: Well, yes, certainly. I think that the fact that I took so many years off definitely hurt my career.

LK: You think it hurt your career?

GR: Oh, certainly, because it delayed my -- well, you know, I would have got -- at this point, it doesn't really matter. But I mean, I would have achieved -- well, I'm a tenured full

professor, I've been one for a long, long time, so at this point it doesn't matter. But I certainly would have achieved those levels at a younger age if I had not had the time out.

There was certainly discrimination when I started in the early days. I remember at one time seeing -- I don't remember why I was thinking of changing jobs, I guess just to see what was out there, you know. And I think I answered an ad, and decided since there was prejudice against hiring women engineers, to answer the ad "G. Brooks Reinish" instead of "Gloria Brooks Reinish" and discovered that that was a rather stupid thing to do, because when I came for the interview, I was given a very perfunctory one. I never got to even talk to any of the engineers. The personnel people who didn't understand anything about engineering, when I was asked what kind of work I was doing, and I could see that they hadn't a clue what I was talking about. And I never got to -- so I thought, well, there was really no point in having wasted a trip out to this place. I should have told them, let them know I was a woman before I came.

LK: Right, a wasted trip. My next question is: You being in a family of engineers, can you talk a little bit about that experience?

GR: Oh, yeah, yes. I didn't mention that. My children are all engineers. My oldest daughter is a chemical engineer like my husband. Well, her bachelor's degree is chemical engineering, her masters is in environmental engineering. My middle child is an

electrical engineer with a masters in business administration. And my son, the youngest, is an industrial engineer, operations research actually was his bachelor's degree, and a masters in management science. Oh, and one of my daughters is married to a civil engineer, the other one is married to a science teacher. So yes, we do have a lot of engineers (Laughs) and scientists in the family. And no, we don't talk shop when we get together. (Laughter)

LK: Do you think that just being surrounded by engineers has influenced your grandchildren, how they -- I mean their image or perception--

GR: Well, so far (Laughs) unfortunately, my oldest two grandchildren have not gotten into engineering. I have six grandchildren. The third one also is -- he was considering engineering, but now he decided he doesn't think he wants to be an engineer. I have three left to go, so (Laughs) my -- I have two more girls and one boy. I think the youngest boy is going to be an engineer. He's showing very definite -- well, his parents are both engineers, and he's extraordinarily gifted in math and music. I think he will probably be an engineer. But no I'm -- shall I say surprised that none of -- that so far the three oldest ones have not opted for engineering.

LK: In a more general sense, do you think that the public has a good understanding of what engineers do or what engineering is?

GR: Oh, absolutely not.

LK: Can you expand on that a little bit?

GR: Well, I think that -- well, actually, one of the things is that engineers do so many different things. I mean, not only are there many different branches of engineering, but even in my field, either in -- well, bioengineering is separate, but in electrical engineering there are so many different sub-branches of electrical engineering, and then within any branch there are so many different kinds of things that an engineer can do, I mean, the research, development, the production, sales, there are just so many variations, so many different kinds of jobs that people can do. And unfortunately, I think that none of this is sufficiently well -- what shall I say -- promoted, glamorized? I think that people don't seem to -- don't consider engineering to be a very glamorous or exciting thing to do.

I know when I was working on the bioengineering at the College of Physicians and Surgeons, there were very few -- relatively few women med students in those days. I'm talking about the late '60s. And there was a lot of prejudice, actually, as far as taking women med students in for the same nonsensical reason that was used about engineering. In fact, I remember the head of the physiology department stating this publicly: "We have limited resources. We can't waste them on women, because they're not going to remain in the field." They were saying this about medicine.

And now I think there are as many women med students as men, probably maybe even more. And law, the same thing, there used to be relatively few women lawyers. Now I think there are more women law students than men.

So we've made remarkable progress in some professions in terms of women. Why has engineering not kept pace with these other professions? And I think one of the reasons may be you see glamorized versions -- on the screen or TV or whatever, you see women lawyers, women doctors. You don't see women engineers. And engineers -- well, engineers get bad -- I don't know why engineers always seem to get bad publicity (Laughs) whereas -- I think that it's a profession that maybe we just don't know how to advertise ourselves, maybe we don't like to show off or talk about how great we are. But really, I think engineers are -- I think it's the best profession. I mean, I don't know why we aren't drawing more women into it.

LK: I've heard people express that it's almost like a black box profession, that you know, there's such a mystery about what goes on--

GR: What goes on.

LK: -- behind the scenes in engineering.

GR: That's interesting. I hadn't thought of it that way. But--

LK: Because I mean, with so many different disciplines, there are a lot of subdisciplines or specialties within medical,

and within law. And yet, you know, people seem maybe not to understand every possible subspecialty. But I don't know, I think -- I mean, I agree with you. I think--

GR: Yeah, that's interesting. Well, I wonder who's at fault there. I mean, do you think -- should engineers -- what should we be doing to--

LK: Yeah. That's exactly my question.

GR: Maybe we need to hire a good PR man (Laughs) -- PR woman, pardon me!

(Laughter)

GR: What am I saying? I was using the term generically.

(Laughter)

GR: But we do need more -- we do need better publicity. I think that it's just -- and it's really -- there's another aspect of an engineering education that I think is not fully realized by people, and that is that it's such a good preparation for any kind of lifetime work. I mean, you don't have to work in engineering with an engineering degree. You can go on to law school, medical school, technical writing. There are so many doors that are open, that to get an engineering degree is -- well, of course, it's hard work. (Laughs) That may be one disadvantage. But once someone has an engineering degree, the choices are so limitless, really. One can work as an engineer, go to grad school, an engineering school, go to any one of a whole variety of other types of professional programs. It's a wonderful preparation for many,

many different kinds of work.

LK: Looking back on your engineering career, what would you say would be your most significant contribution to the field? I know that's a loaded question.

GR: Hmm, that's interesting, because I almost feel as though I have several careers and several different (Laughs) -- I mean, in which life? In my life, the early ones, back pre-babies, I would say the work I did that led to the patent was the most fun and the most significant.

In the post -- let's see, in my teaching time, what was the most significant? Well, during -- in the days when I was doing research, I would say my research work. After I got the Ph.D. I was doing research work on electrical properties of bone, electrical stimulation of bone. I think that was quite interesting and quite satisfying, so that was one.

More recently, probably my work with web courses. I think this has been quite challenging and quite exciting.

LK: Was there anyone here that's really working with you on that, or is--

GR: Oh, yes. We've got a number of people working on it. It's funny, when I first started working with computers -- I mean, this goes back some years -- I was not terribly thrilled with computers when we first started using them, because I think my problem with it was, I'm accustomed to knowing what I'm doing before I start doing something, you know. I like to read the

book, or read the instructions, or read the chapter, or study it, and then try it.

And I discovered that with computers, I just can't do that, because the book consists of ten volumes, and you can't learn all about it. You have to just do it. (Laughs) And when you find you can't do something, you try doing something until you do it. At first, I mean, I would ask someone, and then when I found there wasn't anybody around to ask, I would have to just try something and figure it out. So initially, this was totally contrary to everything that I was accustomed to, and to the way I liked to work. So I was not one of these avid computer people, you know, that just jumped into it happily. I was kind of dragged into it. And now all of a sudden, I'm the expert.

(Laughter)

GR: And everyone is coming to me and asking for help with--so I guess I did sort of pioneer this online program. But now it's become -- well, now it's relatively easy, although there's still a lot of frustration. I mean, computers supposedly do the same thing every time, but they don't. They get bugs in them for reasons that are totally incomprehensible.

(Laughter)

GR: And at least now I know not to be fazed by it. If all else fails, I just reboot, what the heck. But it's been fun. I mean, it's been challenging, as I said. I suppose that that's been one of my things that I'm kind of pleased with. Actually,

when I started it -- I mean, now, of course, everybody's doing it, but back six years ago, there were online courses, and there were plenty of schools that were offering online courses, but there weren't online engineering courses. And trying to put these -- my lectures were highly mathematical, so that in a one-week lecture I might have somewhere around a hundred equations, you know, in a lecture.

And in order to -- the software that I was using, the systems that I was using were quite primitive. I didn't have everything available that I have now. In order to put this online, I had -- first of all, I discovered that I had to chop the lecture up into pieces, because I couldn't handle all of the equations, the conversion of the complete lecture with all of the equations into the format that was needed in order to post it on the web. But the size that I did need was something that I had no way of determining, so it was strictly a trial and error thing. So it ended up that I would have to chop it into maybe four or five parts. But then each part would have about twenty-five files, one for each equation. And then when I had to upload those into the system that we were using to deliver the course, that meant each one of these equations, each one of these files had to be individually uploaded. So I ended up with this -- about a hundred files that I would upload into this thing. Then when I was all finished, if I discovered that I made a mistake, maybe had "X-one plus X-two," and it should have been "X-one minus X-two," or

something like that, I would have to basically do that whole thing over again.

I was really putting in a horrible amount of work. Then things got easier when I discovered easier ways of doing it using other formats. And so now it's relatively easy. Relatively, because you never know, there's always some new bug that comes up.

But I guess that's what makes it interesting, the fact that there's always something new, some new problem to solve. Well, I'm the sort of person that likes to do crossword puzzles, and cryptic crossword puzzles, and things like that. So I guess I kind of get a certain satisfaction out of solving problems like that.

LK: Sure. We have a few minutes left. Can you talk about your earrings?

GR: Oh, yes!

(Laughter)

GR: Well, when I got this separate but not equal women's badge for Tau Beta Pi, then married Martin, my husband, was a member of Tau Beta Pi. So he thought it was not fair that I had not been able to have the Tau Beta Pi key because I really deserved one, so he gave me his. I mean, this is -- you know, it's not like a fraternity pin. The Tau Beta Pi key is not supposed to be given to anyone. But he felt that since I had really earned one that I should have it. So he gave me his key, and I wore it on a chain.

And then some years -- oh, quite some years later, in the '60s, finally, Tau Beta Pi came into the present century and voted to admit women. There had always -- most of the chapters were in favor of it, but there were always a few down south that would veto it. But eventually they came around. And so I was then awarded full membership in Tau Beta Pi as a distinguished alumna at Columbia, and so I finally got my own Tau Beta Pi key. And my husband didn't want his back, so I made them into earrings. (Laughter)

GR: So I think I'm probably the only one who owns a set of Tau Beta Pi key earrings.

LK: Right. I thought that was neat.

GR: Thanks. (Laughs)

LK: In our final few minutes, I guess my last question is about SWE, and your thoughts on whether you feel that there's a need for a Society of Women Engineers today.

GR: Well, I think there is a need today. I hope that the time will come when there won't be a need. I used to say that SWE -- I thought our main goal was to make ourselves unnecessary. (Laughs) I mean, I think this has not yet happened by a long shot. In fact, I think it's going much more slowly than I had hoped it would. But I would love to see the day when we are not necessary anymore.

And I think, yes, we certainly are needed. Women need to have networking, we need to have support of other women engineers.

We need to encourage young women to enter the field of engineering. I think these are extremely important goals if we're ever going to make -- to match medicine and law and these other professions. I mean, I don't see any reason for engineering to not have as many women as men.

LK: Do you have any final thoughts?

GR: (Laughs) Let's see. What would final thoughts... Well, I've enjoyed talking to you. I've enjoyed the interview. Let's see what -- oh, do I have any regrets, perhaps? I think one thing might be that I should not have taken so much time off. I think that I would have done better to have been more involved, either full time or part time, in engineering work, all the way through, rather than taking time out.

Incidentally, both of my daughters went back to work when their children were infants, and I think that this is the trend now. Most women engineers do manage to have the career -- it's not easy, of course, having -- I know Nancy cried when she first went back to work and had to leave her baby with a sitter. But I think that this is probably better.

Although, it's funny, I remember when I started teaching, Nancy resented it somewhat, the fact that I was no longer on call constantly. She wanted me to be there the way I always was. And I mean, this was when I was preparing a lecture, and she wanted me to -- she needed something for school for the next day, and I said, "Well, when did you know?" And she had known the week

before but didn't tell me until that night. And I said, "Sorry, but I really can't do it. I have to prepare my lecture." And she was quite upset by that, but that was when she was quite young, of course.

LK: But you do feel that today's environment is more -- or is supportive of women--

GR: I think so.

LK: -- returning?

GR: Yeah. Well, I think not only women engineers are working now, but I think that women tend -- women in many different professions, and even in less well paying jobs, I mean, there are women -- most women, or a large number of women do work after having children. And so it's a much more accepted thing. There are more daycare programs. Society in general is much more supportive of women who are managing careers and families, so that it's not as much of a problem. I mean, I felt I had to stay home with my baby. My husband expected me to do that, and I guess I expected it of myself. I mean, this was -- you didn't just go back to work after having a baby in the '40s and '50s.

LK: Do you know anybody who did that?

GR: No. (Laughs) Now, I wouldn't have minded being the first. Actually, my mother would have been delighted to babysit. But I think, possibly if my husband had not felt so strongly about it I might have.

LK: Well, I want to thank you for participating. And I

think if you don’t have any other thoughts, we’re done.

GR: Well, thank you for all of your time and help with this.

LK: Okay, great.

END OF INTERVIEW