

MILDRED DRESSELHAUS

June - October, 1977

Part I

Women in Science and Engineering

MC86

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Interview with Mildred Oresselhaus
 on June - Oct., 1976

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MIT ORAL HISTORY PROGRAM

Project on Women as Scientists and Engineers

Interview with Mildred Dresselhaus

by Shirlee Sherkow

Cambridge, Mass.

June 7, 1976

Session 1

transcribed by Janet Billane

Sherkow: We're interviewing Mildred Dresselhaus in her office at MIT in Cambridge. I thought we'd try to start at the beginning when you were a child. I was just wondering if you had brothers and sisters.

Dresselhaus: Yes, one brother.

Sherkow: Is he older or younger?

Dresselhaus: Older.

Sherkow: Where did you grow up?

Dresselhaus: In the Bronx, which is one of the boroughs of New York City.

Sherkow: Could you talk a little about your childhood?

Dresselhaus: I think you probably have read about most of that in the blurbs. Well, my early childhood had very little to do with what I'm doing today, and I didn't know anything about science or scientists or engineers or engineering. My father came to this country in the early 1920's, and my mother in December, 1926. And I was born in '30; my brother was born in '28. --[Interview interrupted]--

My parents were both born in Poland, both from the same country, but my father comes from a part that's Russian Poland, and my mother's from a part that was part of the Austro-Hungarian Empire. It's a different part of Poland, but it all became Poland after World War I. But they were born before World War I, so they come from kind of different regions.

How they got together was that my mother's family left Poland during the time of World War I and moved to Holland. Well, her mother died before they moved. Her mother died when she was very, very young, and her father and the children that were left after the mother died, moved as a group to Holland. The father married an older sister of my father's, so they became related by marriage. This sister died, and then my grandfather married another one of my father's older sisters whose husband had died. So the two families got together. It was in this way that my mother and father were related. My father went to visit his sister at one point before coming to the States. And it was at that time that he met my mother, and they got married several years later, not having seen each other in the interval. So the connection between my parents was very complicated.

Sherkow: What is the level of education of your parents?

Dresselhaus: My parents both had very little education. I guess my father had about the equivalent of a fourth grade education. My mother had more because she was raised in Holland. She got to the Netherlands when she was about eleven during World War I, and everybody there completed at least primary education. The schools in Holland are very good, so that she had about eight grades of formal schooling, but that would be equivalent to more in the United States. Also, she was quite well-versed in languages; they learned three languages in grade school. Her education was better.

Sherkow: As you were growing up, what was your father's occupation?

Dresselhaus: Well, he didn't have much of a job at all. At first he had a little candy store when I was born, but he lost that. After that he was a day laborer when he could find work, and the rest of the time he didn't have very much to do.

Sherkow: Did your mother work as well?

Dresselhaus: She started working when I was about ten. She worked in the candy store when I was an infant, but I don't remember that because they lost the store before I can remember anything. I must have been about one or two. That must have been about 1931 or '32, when they lost the store. After that my father was trying to make out as best he could. We were on relief--Welfare, as we call it

We were on Welfare much of the time during the depression years. It wasn't a very good situation. My mother didn't have any kind of profession, so when we were little, she worked nights. She had a job that started about six o'clock in the evening, and then she would come home seven o'clock the next morning. So we were on our own to fix dinner. I was the cook. We had to get everything ready ourselves in the evening, and then she would be home in the morning to get us to school. She would wake us up, because we had to leave for school at about a quarter of eight, and she would be home something like seven.

Sherkow: What was her job?

Dresselhaus: She was working in an orphanage taking care of young children that didn't have any parents.

Sherkow: Did she do that for several years?

Dresselhaus: Oh yes, she did that until I was about fifteen or sixteen. She changed her job, I guess, when my brother graduated college. I had a brother who was very precocious; I guess that has to be folded into this picture.

Sherkow: How much older is your brother?

Dresselhaus: Three years, but he was a lot ahead of me in school. He was about three or four years ahead of his age group in school. He was an MIT student, a graduate student; he came here when he was eighteen. He already had a bachelor's degree, so he was one of those

smart kids.

Sherkow: What was his degree in?

Dresselhaus: Chemical engineering.

Sherkow: Is he a chemist today or an engineer?

Dresselhaus: Oh yes, a very famous and well-thought of person in his field.

Sherkow: But he has a different name?

Dresselhaus: Yes, that's right.

Sherkow: Is is Spiewak?

Dresselhaus: Yes, that's right.

Sherkow: As you were growing up, what kind of encouragement did your parents give you in terms of education and schooling, not necessarily in scientific subjects?

Dresselhaus: They gave a lot of encouragement, that's to be sure. They came from an environment where education was prized even though they didn't have much themselves. They really wanted their kids to do well in school. My brother was the one that they gave somewhat more formal encouragement to, because those were years that women didn't really go to college, especially from poor families. They didn't object to my going to college but that wasn't in the game plan.

They always expected my brother to go to college, but what I did was a little bit outside of their plan. But they certainly expected me to finish high school. To them, that was some achievement already. My parents pushed us a lot in musical fields, and, in some ways, that was more important to them, at least when we were small, than schoolwork. My brother, see, was the only other child, but was older than me; [he] was a child prodigy on violin. Through him, I got to go to music school.

Sherkow: What do you mean, "through him?"

Dresselhaus: The thing was that I grew up in what would seem like a deprived environment, but it wasn't as deprived, in reality, as it might sound, partly because I had a brother who was ahead of me who was so outstanding that he attracted a lot of attention. When he was about five years old, he got a scholarship to study violin with one of the better teachers in New York City. He was only five years old! It was then that the whole family moved up to the Bronx. We used to live in Brooklyn, and we wound up in the Bronx because my brother got this scholarship, and my parents thought it would be good for him to be close to his violin teacher so they wouldn't have so far to transport him for lessons. His teacher wanted to teach him frequently, like a few times a week.

Sherkow: You mentioned that through your brother you got to go to music school?

Dresselhaus: Well, people at that point figured that I also must have talent. So when I was four and a half or five, my music lessons started.

Sherkow: In what?

Dresselhaus: Violin. Well, it didn't work out according to the game plan because the teacher, who had accepted my brother as a violin student, died very suddenly, like two or three months after we made this big move. Then he didn't have a teacher where we were living, and my parents had to transport him to the other side of the city, where another teacher was found that would take him on. See, we didn't have any money, and teaching at the level that he required was a big time investment for a teacher. So, another teacher was found that accepted him as a scholarship student, and very shortly after, I started to study the violin also. This was quite some time before I started school, because I learned to read music long before I could read words.

Sherkow: That's very interesting. So your parents encouraged you musically, and you took up the violin?

Dresselhaus: They did at first. They thought my brother was a real hotshot prodigy. Well, maybe he would have been. He's actually a very good performer today, but he's not another Heifetz. It's not at all clear how things would have worked out had the situation been different and easier.

Sherkow: But he didn't pursue a career in music?

Dresselhaus: No, that was his choice. He decided that when he was a teenager; violin wasn't really what he wanted to do, because he was equally, or if not more, gifted academically, which often happens with musical prodigies. He decided that he really didn't want to be a performing violinist. And I made that decision before he did. I sort of lost interest in doing it seriously when I was much younger than him, but I kept up music lessons at least through junior high school.

Sherkow: Violin lessons?

Dresselhaus: Yes, but it wasn't really that intensive or high-level. I didn't have that good teaching. It was after this guy died that the people that took us on for free weren't anywhere in the same league. I know now, looking back, that my teaching wasn't really first-class, but then the amount of effort I put forth wasn't first-class, either. So I think the kind of teaching I got was commensurate with my effort.

Sherkow: When you were in school, what were your friends' interests?

Dresselhaus: Oh, just ordinary things. I couldn't have identified that I did anything different than other kids did.

Sherkow: Did you have a lot of friends?

Dresselhaus: No, I didn't have a lot of friends. I didn't have a lot of time either, when I was growing up. For one thing we kids had a lot to do in the house, and I had music lessons when I was younger. Well, I had music lessons all the way through junior high school, so that I was at least traveling to them--just taking a music lesson was a half a day because it all had to be done on the subway, and it was a long day. So that took a lot of time, and even if I didn't do as diligent practicing as I might, the whole thing represented quite a big investment in time. And I used to have some jobs; I started working when I was in sixth grade.

Sherkow: Doing what?

Dresselhaus: My first job was teaching; I was helping out a mentally-retarded child every afternoon for two or three hours.

Sherkow: In what?

Dresselhaus: Just everything. He was a first or second-grade child. Everything, yes. The idea was that the teacher felt that if he had an individual tutor, he would be able to pass the first grade. I think I was with him for two grades; I stuck it out. I got fifty cents a week for fifteen hours of work per week.

Sherkow: How long did you do that for?

Dresselhaus: Oh, about two years. I thought that the amount of money was really pretty small, but the parents couldn't afford any more.

And I didn't know it was that small; I wasn't so aware of it. It was the most frustrating job I've ever had in my life because I couldn't figure out to to teach this kid. His IQ was so low that you tell him one thing, and you tell him the same thing time and time again, and it just didn't sink in.

Sherkow: But you did it for two years anyway?

Dresselhaus: The teachers claim that I did him a lot of good, but to me, it was very frustrating.

Sherkow: Well, apparently he made advances.

Dresselhaus: Yes, I guess he made some advances. That was probably the only way you could teach a child of that ilk. But it wasn't bad for me, in a way, because I learned a little bit about teaching.

Sherkow: After that particular job, you had other jobs?

Dresselhaus: Yes, we had a lot. There was a period that my mother brought home homework to supplement the family income. I was always good with my hands at making things. We used to make jewelry and piecework. You get paid by how many of the different things you made per hour. They have factories in New York that work like that. Maybe they don't anymore, but at the time I grew up, they had that. And we would do that a few hours each day. That would help out with the food budget.

Sherkow: Right. You had additional jobs as you were growing up, going into junior high?

Dresselhaus: Yes, well, I worked in a zipper factory. That was pretty hard work. I learned how to put zippers together. Every single operation that had to be made on them, I did at one time or another while I was working in that factory.

Sherkow: You did that after school?

Dresselhaus: Well, the zippers were a summer job. But mostly after school, I had this homework job, these piecework things.

Later on, I had jobs as a tutor, and that was much better paying.

You know, I was a little older. I was very good at tutoring.

Once I got into it, one parent told another and the next told another.

Sherkow: You mean when you were in junior high?

Dresselhaus: No, no, this was later. I think I started my tutoring jobs when I was in high school, and by the time I was in college, I earned enough money to completely take care of all my expenses, and even more. I was told to charge five dollars an hour, which at that time, I thought was highway robbery. But I figured that if I could get people that would be willing to pay these kinds of wages, then it would be all right. And I had more students than I could possibly teach during the week at that fee. So, I just charged that, and I was completely self-supporting, and more. By that time when I worked

my way up to doing tutoring at five dollars an hour--it was my own little business. And I would tutor kids in high school and college; I would tutor kids that were older than me, too.

Sherkow: In what?

Dresselhaus: Everything. (Laughs) Most any kind of [subject]. My most specialized things, of course, were anything in math or physics or chemistry. But I also tutored english and history and spanish.

Sherkow: How did this tutoring start?

Dresselhaus: Well, I first got one kid . I almost always used to get an A in the course for my student. I would figure out what their problems were, why they couldn't get it. It was more than just teaching them subjects. Also, I would teach them how to study and how to prepare for an exam.

Sherkow: But how did you first begin doing this?

Dresselhaus: Well, I think I got somebody who was having trouble in school. My school recommended this somebody to study with me. It came through a parent calling me on the phone--but we didn't have a telephone, so the parent contacted the school. See, when I was in high school, we didn't have a telephone at home; we didn't have a refrigerator. It was pretty primitive, [my] background. We didn't have a telephone at home until I was almost finished with college,

so the students would have to contact me through my school. And I would make an appointment with them at one lesson for the next time. Parents found it very hard to understand why I didn't have a telephone. The people I would tutor were usually very well-off, to be able to afford my fee.

Sherkow: So it initially started--

Dresselhaus: It started with one child, tutoring in one thing. I was good at it, and I was very successful. So that mother took me on to tutor everything, you know, and told her friends. So I would have a few kids in the same neighborhood.

Sherkow: Did your teacher recommend you?

Dresselhaus: Yes, something like that. I don't remember all of the details. Later on, when I got to college, the college used to have a sign-up place where you could advertise. But, by that time, I had too many students, and I didn't need the college to help me. I had more students than I could handle; I had my own work to do.

Sherkow: Did you do that in college too?

Dresselhaus: Yes, I did that all the way through college. When I graduated college, I had more money: I had saved up enough money to go to graduate school because my tutoring job took care of my college expenses, and then I had more money left.

Sherkow: It doesn't really sound like you did have a lot of time to do things with friends, but you did have some friends?

Dresselhaus: Oh yes. As a matter of fact, I had very faithful friends. I had some friends from grade school that were just exceedingly devoted to me. I guess I was more aloof than some kids. My friends used to always come looking for me when I had time, rather than the other way around. As I look back on it now, it wasn't quite a reciprocal arrangement. People knew I was pretty busy. I had, you see, different friends in different things. I had my school friends. Then later, I went to a special high school, so I had friends at the special high school. But the friends that were in the neighborhood were very devoted to me. On weekends and vacation times, they would always be knocking at the door, "Could we get together for something or another?" Then I had friends in college, a different group, and I had friends at music school which was a different group. I didn't have a large number, but very faithful friends. They would still be happy to do things with me now, but again I'm just too busy to do all the things I'm supposed to; it's all my fault, not theirs.

Sherkow: Right. What did you do in your spare time when you weren't either working or studying?

Dresselhaus: Well, I didn't do too much with my spare time because I didn't have too much spare time.

Sherkow: I mean, did you go to movies [or other types of recreation?]

Dresselhaus: Well, I went to more movies then, than I do now. Well, okay, what did I do when I went out? The music school that I went to did a lot for me that way because they had complimentary tickets to many things, and they had very few scholarship students at the school; I was one of a very, very small number, and I think they preferentially gave tickets to the scholarship students. I don't think the scholarship students were any better than the other students; we were just poorer. So they gave us tickets, and that was a good fraction of my recreation. I got to hear the most marvelous concerts. I heard Leonard Bernstein through that, when I was a kid, when he was just a young man in his early twenties. Nobody had heard about him, and he was making a debut, or just beginning to come up; he was a total unknown. And I went to this concert of this very young conductor that nobody had heard of, and oh, what a fantastic experience that was! There were many other things like this that the school provided tickets [for.] I had an awful lot of initiative as a kid, so I took advantage of those things.

There was a period when I was very interested in the theater. I don't know if you want this on your tape, but I devised a way of how to sneak into Broadway shows. I would miss the first third of them. There was one period when I had seen all the plays from low-class to high-class, everything. I didn't have any money. I couldn't possibly afford to go to them, but I got to see them. That was a phase. I'm still kind of interested in the theater, but I don't have

a whole lot of time. I became pretty eclectic about it afterwards. Then I had a job when I got to college, of being an usher. I got to see a lot of things by being an usher. I got to see a lot of things and the deal there was I didn't get paid, but I got to see the performances.

Sherkow: Right. Were you ever active in sports?

Dresselhaus: No, I was non-athletic. Well, it's not clear whether I would have been, had the situation been different, but athletics was one thing my parents could not see. They thought that was an utter waste of time.

Sherkow: Did you agree with them on that?

Dresselhaus: Well, maybe I did. That was something that I didn't form an opinion on, until much later. And I think, in hindsight, that was one of the negative things about my childhood. I think I should have made more time for athletics and sports. I see my kids having a lot of fun doing that sort of thing.

Sherkow: Yes, I agree.

Dresselhaus: Well, in some ways I'm in pretty good shape for my age. We do a lot of hiking as a family, and I'm not the world's best hiker, but for my age, I hang in better than most. My kids say that they don't know any children whose parents or whose mothers will go on the sorts of expeditions that I go on, without complaining. I think

that had my environment been different, I would have been quite different in regard to athletics. I'm really pretty competitive, and I think that athletics would have brought this out. But the way it worked out, athletics was a part of my development that was completely ignored.

Sherkow: Did you enjoy growing up in New York?

Dresselhaus: I didn't have any option, really. Yes, sort of. There were some things that I really liked. As a kid, I really liked the museums, and the natural history museum and the art museum were free. When I was age twelve to sixteen or so, I really took a great deal of interest in museums. There was one time when I think I knew the entire collections of both museums. I went there very, very frequently. And then there was an illicit thing that I did. I got interested in science, actually, through that. I got interested in astronomy when I was in high school, and they had a planetarium in New York that I thought was quite outstanding; I don't know how it stacks up against the world planetariums. The bad thing about the planetarium, from my point of view, was that they had admission charges, and that made it impossible for me to attend. But I figured out a way of how to sneak into the planetarium. I saw every planetarium show that they had, and I knew the entire collection, but I, of course, never paid to get in. (Laughter) One time I actually was caught. Something didn't quite go right, according to the game plan of how you sneak into the planetarium, and I got caught.

But I told them that I wasn't trying to do anything wrong as far as their collection was concerned; I didn't have any money, and I was interested in astronomy. And they just sent me packing; they didn't book me for charges. And then I went right back, after a couple of weeks, you know, a cooling-off period. I went right back to my old tricks of getting in.

Sherkow: But you mentioned that this was how you got interested in science.

Dresselhaus: Well, I got interested in science when I was in high school. Going to the museums and the planetarium--you asked me about New York, and I said that it had certain things about it that I liked as a kid, that my children don't know much about. I think we have museums in Boston also, maybe as good, maybe better. But I don't have time to take them, and they're not as enterprising or something as I was, or interested, or whatever. But they don't "scamp" up and down the museums the way I did when I was a kid. See, we didn't have so much parental supervision either. My mother would not get concerned if I had said I was going to the museum; I had sort of free run of things. We used to go all over town. Traveling was five cents on the subway at that time; it would take you everywhere in the city. I started traveling by myself when I was about eight or nine. I could go anywhere, at any time. See, I didn't have anybody at home looking after me; so I was pretty much independent.

Sherkow: Did you do things with friends?

Dresselhaus: Oh yes, I went on all of these things with friends; I used to drag them along. I used to get them interested in things. They were interested, to some extent, themselves, but I was the spark behind a lot of these museum expeditions. I would get people to go with me. Some of them were less interested in the things that we saw than in the thrill of sneaking in.

Sherkow: Yes. You grew up in the Bronx, right? You moved there from Brooklyn.

Dresselhaus: Yes, I moved when I was about three years old.

Sherkow: And you lived in an apartment?

Dresselhaus: Yes, a very small apartment.

Sherkow: The Bronx has changed quite a bit these days.

Dresselhaus: Well, we lived in one of the roughest sections; it was very rough at that time too. And it's even rougher now. But it was very rough at the time. At the time we grew up, it was a mixed neighborhood. It was about forty percent refugee-types, like us. I mean, it was a mixture of immigrants and refugees that came to the country but didn't have any wherewithal, and then the others were people--blacks from the South, and Puerto Ricans. They were about sixty percent, and the immigrants were about forty percent. That was a kind of mixed neighborhood. There was a lot of racial tension;

a lot of tension of all sorts.

Sherkow: Weren't your parents Jewish?

Dresselhaus: Yes.

Sherkow: Did they raise you as Jewish children?

Dresselhaus: No, not really. Not exactly. I think that they lost a lot of their faith. They were kind of Zionist types, but not totally unreligious.

Sherkow: But they weren't Orthodox?

Dresselhaus: No, not at all.

Sherkow: So you didn't really have formal religious training?

Dresselhaus: Well, my brother had some, but girls didn't need that; I was completely left out of that. That was something that just didn't intersect with my life, but my brother went to Hebrew school and the whole bit.

Sherkow: Was he bar mitzvahed?

Dresselhaus: Oh yes, everything.

Sherkow: But you weren't [bas mitzvahed?]

Dresselhaus: No. But my parents were not that much interested in it anyway. That wasn't an important part of their existence, but it was

the sort of thing that you do. It didn't cost a great deal of money. I guess the Jewish philanthropies subsidized that sort of thing very heavily; so the people that wanted to have a Hebrew school education could, essentially on no money. My brother did it, and I didn't. I don't think they had it for girls then. I think that the free lessons were just for boys because girls didn't have to get bar mitzvahed.

Sherkow: Right. How would you characterize your home life all-around, kind of in general? I was thinking in terms of warm, intellectual, mother- or father-oriented.

Dresselhaus: Yes, well our home was [warm]. Warm is certainly the right word. My parents were very, very concerned about the kids. They gave everything for us. --[Interview interrupted]--

I was saying my parents were very devoted. I didn't have a lot of contact with my brother because even though the age separation doesn't sound that great--it was a little less than three years--he was so far ahead of me in school. The friends that he had were more geared to his school classmates than kids his own age. He was very tall for his age; so he did look somewhat older than he was. He looked about the same age as the smaller kids in his classes, even though there was a very significant age difference. The difference in age between those kids and me was very, very large; it was almost like two families growing up. I didn't have a whole lot of contact. He always thought what I was doing was very babyish.

Sherkow: So you weren't really very close to him?

Dresselhaus: I wasn't close to my brother, no. We weren't [close]. We didn't fight so much. We had sort of common interests, perhaps, but I was so far behind in everything that there wasn't much communication. And he was a very busy kid, with all of his things; he had a lot of commitments. He never wasted any time. I remember him; he was always reading. We shared a room; so you might think that we were [close]. The room that we had was about half the size of this office; it was a very small room. With two kids in the same room, you'd think that we'd have a lot in common, but he was always reading and wanted me to be quiet. So that was that. I was a big sleeper as a child. I was always sleepy, and he needed very little sleep. I can remember as a child when I got up in the morning, he had already been reading for several hours. And when I went to sleep at night, he was still reading. (Laughter) So that's my recollection of my brother.

Sherkow: Did he also work while he was going through high school?

Dresselhaus: Oh yes, he had the same kind of menial-type jobs, and it also left an impression on him that he better learn something. He also made a lot of money as a musician; that was something that, somehow, I didn't get into. Well, my teaching was so lucrative that I didn't have to go into this music angle. But he made a lot of money as a violinist playing in jazz bands. You wouldn't think a

violinist would fit into jazz bands, but he made it work out, somehow. He made a lot of money. He worked his way through college playing any kind of odd jobs.

Sherkow: Would you characterize your relationship with your parents as being close?

Dresselhaus: Yes, I would. I would. I sort of shared all my secrets with them, pretty much. I think we were on very--my mother was the one I was very close to.

Sherkow: Are your parents still alive?

Dresselhaus: Yes, they're still alive.

Sherkow: Do they still live in New York?

Dresselhaus: Yes, but not in the Bronx. There's a lot of history that goes [here]. My father was sick very much of the time when I was a child, and he spent a lot of the time in hospitals; that made it doubly hard on the family. Because of that, I didn't get to know him as well as my mother. There was a period of time when I was off at college--maybe it was after I was finished, after I got my PhD; it was sometime in there--when she was by herself, and my father was in the hospital at that time, and she got mugged. She got terribly frightened by that experience, and that made her move out of that apartment. She decided that probably her life was at stake, and she had to find something else; so that's when she moved

to Brooklyn to a somewhat safer neighborhood. That place in the Bronx was a really, really dangerous neighborhood. One of the worst in New York City. It has about the highest crime rate of all; maybe Harlem is ahead of it.

Sherkow: Both of your parents are still alive and live in Brooklyn?

Dresselhaus: Yes.

Sherkow: You mentioned that your father was very ill, so I wondered--

Dresselhaus: But he's much better now. The last twenty years or so, he's been in pretty good shape.

Sherkow: That's good. As you were growing up, did you notice or feel a lot of peer pressure at all?

Dresselhaus: No, I didn't really feel peer pressure. My environment was a matter of survival all-around, as I explained, with tremendous financial pressure, because we were at the poverty level for all the time until I was twenty or twenty-one. We were at the very lowest economic level. That was certainly a consideration. Another thing was the fact that we lived in a very dangerous neighborhood, and that would enter into my--that was a kind of pressure that we have always felt under. [I] didn't have peer pressure; what I knew was that I always had to do very, very well academically, because I didn't have any other option. I knew that to get to the next step, I would have to be a superstar. That's a little different environment than

most of the other people that you interview probably had. See, if you don't have any money, it's pretty hard to get onto the next step. I didn't even know when I was a kid about free colleges, like they have in New York. I found out about that much later. But the biggest thing that happened to me was getting into high school; that was the turning point in my career.

Sherkow: How did that come about?

Dresselhaus: Well, my brother was somewhat related to my success in getting into high school, in an indirect way. He was a prodigy, I keep saying, and just super-outstanding in school. Not only was he way ahead in years, but he was also so smart that everybody knew about him or remembered him once they had seen him. So he was ^{and} obviously a candidate to go to one of the special high schools that ^{to} they had in the city, and he went to the [Bronx] High School of Science. It was through him that I found out about special schools. Now, at the time he went to high school, the neighborhood we lived in was maybe seventy-five percent white and twenty-five percent black. And at that time, there was still quite a bit of emphasis on academic-type things in the schools. When I reached the same level in school, which was about five years later, the schools had changed: the emphasis on academics had really sloughed off, and I guess my brother could have been the only kid that ever got into the [Bronx] High School of Science from the school we went to; I'm not really sure whether that was true or not. I know I was the only kid that ever got into

Hunter High, which is the special girls' high school in New York. And how that came about was sort of a fluke. I found out, through him, because he had gotten into a special high school, that there were other schools like that in the city. Now, he didn't help me at all, finding out any detailed information. As a matter of fact, by that time he was already in college, because the age difference being what it was. But, at least I knew about the existence of things, and I had a great deal of initiative; I wrote away for information and got some old exams and looked at them, and I didn't know what anything was. I couldn't even understand the language on these exams; it was like another world. But, New York has very good libraries. I told you that we had lots of facilities. We had museums and libraries, and I got on to all of this. I tried to study by myself. I checked out books and got to work, and I figured out how to do all these problems. I took the exam, and I got into the school.

BEGIN SESSION ONE, SIDE TWO

I'd say that I got very little encouragement from the school because they thought I was ridiculous even trying out. Getting into Hunter was more difficult, in some ways, than getting into the Bronx High School of Science because they had very many fewer places. I think they admitted only eighty students at a crack, and that was for the whole city. For the boys, they had several special schools; they had three different ones that they could go to, and the number admitted to each school was much larger. So my school didn't think I

had even a chance. I got nothing but discouragement from the school. They wouldn't help me at all with things that I didn't know, which was just as well. So I prepared for the entrance exam all by myself, and kind of kept to myself that I was doing it. This was a case where I didn't get any girlfriends to go with me to take the exam; that adventure was on my own. I think I found the exam pretty hard. The math was easy. As a result of this experience, I developed a sort of callous feeling about deficiencies in math. I hear people talking about math deficiencies, and being poorly prepared in math and all that sort of stuff with incoming freshmen. I feel that math is something that anybody can teach themselves.

Sherkow: From your experience?

Dresselhaus: From my own experience, I found that it's very easy to make up deficiencies in math, but deficiencies in English are much more difficult. Anyway, I got into Hunter High School, and having studied and passed the exam, I was really up-to-date in math. I was in good shape on all subjects based on math. Studying any of the science subjects was very easy for me because the background was developed right there in the high school. My deficiencies in the English subjects came back to haunt me for about a year or two. I think by the time I was a junior, I was pretty much of a straight A student in English. But it took more doing than math; math was trivial.

So that's how I got into Hunter High. Going to Hunter High

changed everything for me, because the kids from Hunter High came from middle-income families, and from families where parents mostly had college educations and had different ideals for their kids. See, everything was so different from my neighborhood schools, so I started acting like the kids in the high school.

Sherkow: What was that like?

Dresselhaus: Well, I took on their ideals. I took things as they came. I didn't make any big plans of what I was going to do in life at that time because I didn't know what the options were at all.

Sherkow: Right. While you were in high school, you got involved in science courses?

Dresselhaus: Yes. I was active in a lot of things. The school I went to was great, because they had no cafeteria, and you had to bring your lunch; so people figured out things to do during their lunch period. During lunch we had club meetings. This way I got into all kinds of activities; I belonged to a different club every day.

Sherkow: What kind of clubs did they have?

Dresselhaus: Well, they had language and history clubs, and I played in the orchestra. I was interested in everything. I made a lot of friends that way; I got to know people. That was kind of good for me. It turned out to be a good thing that they didn't have a lunch room.

Sherkow: Okay. How do you feel now about how Hunter prepared you for science? How would you rate their courses?

Dresselhaus: Well, as far as science courses were concerned, they weren't all that good. They weren't as good as the science courses that the boys got in the boys' schools. Hunter was a liberal arts prep school, when you get right down to it. They were terrific in English and history and languages and the sorts of things that girls traditionally do. In science and math, they were adequate, but certainly not superior. But, compared to the other options I had, it was fantastic; so that's a hard question to answer. Well, through Hunter High School, I became friendly with some of the boys at Stuyvesant High, which was the brother school. That's a school that was really outstanding in mathematics, and I used to learn math from the boys. They used to teach me things that I didn't know. Some of those people are famous mathematicians today, in fact, some of my own mentors of this period.

Sherkow: I was wondering if you had any teachers at Hunter that were particularly approving or encouraging of you?

Dresselhaus: Oh yes, all the teachers were encouraging of all students. They were really good that way. The expectation of students was very high. They expected everybody to be extremely successful academically and to go on and have a productive career in something or other.

--[Interview interrupted]--

Hunter High was very encouraging, in general, of all students; however, they were pretty realistic. There was a group of students that

had a lot of means, and they were channeled to the seven sister schools: Radcliffe and Wellesley, that sort of place. And then there was another group of students who were also capable but were not channeled into those places. I think the school was quite realistic about not putting people into a situation they couldn't handle, for one reason or another. They did have a guidance system, but the guidance counselor didn't pay any attention to kids who, obviously, didn't have enough money to go anyplace other than the city colleges.

Now, being a student at Hunter High meant that you automatically had a place at Hunter College; it was part of the system. You didn't have to even apply to college; you were already in college the moment you completed the requirements for the high school diploma. Hunter College depended upon the high school for providing a certain number of talented students. That is, the best students in the college often came from the high school; it was these students who didn't have means to go elsewhere, and there were enough of them that it made a big impact on the college. So the high school felt some compulsion to direct some students toward the college, and I was one that was pointed in that direction. (Laughter) Well, I did take the state regents exam, and I placed high on that, and got a Cornell scholarship, but I couldn't accept it because I didn't have any money to pay for the rest. Of course, looking back on it, if I had gone up to Cornell, I had a scholarship plus a number of other things that came with it: I had the Regents scholarship plus the Cornell scholarship, and that took care of almost all expenses. Then if you get a job waiting on tables, you can make the rest up. But, it didn't seem too feasible to me at the time; I didn't realize that this could be done.

Also, I didn't know how much money I would need to help out the family at home. I didn't even consider going off to college as a possibility. So, to me, it seemed pretty obvious that going to college meant Hunter College.

Sherkow: Did you apply to any other colleges?

Dresselhaus: No, I didn't apply to any colleges. I just took the [exam].

Sherkow: Oh, you didn't apply to Cornell?

Dresselhaus: No. They just offered me a scholarship. That was as a result of the test. But I didn't apply to any colleges.

Sherkow: You went to Hunter College, then.

Dresselhaus: Because I was in it already. Well, if Cornell had come and said, "We'll pay all your expenses," (laughter), I might have gone up there and looked. But it was kind of nice, living at home; I liked it. That worked out pretty well.

Now why did I get into elementary school education? One thing that they didn't do very much about at Hunter High was career counseling; well, they didn't have much of it for me. Maybe they had it for other kids and I didn't get into that. I just didn't know what the different career options were. I had a lot of teaching experience by that time, so it was quite natural for me to think of teaching as a career. And I figured you could always get a job teaching school; so that's what I started doing. It makes sense, doesn't it?

Sherkow: Yes, it does.

Dresselhaus: I didn't think about it more deeply. The science and math, that was sort of for fun; I didn't consider that as a career.

Sherkow: Yes. Then, at some point, I remember reading in an article about you that a teacher came up to you and said, "You really shouldn't go into teaching, you should go into science."

Dresselhaus: Right, that's how it happened. It happened in my second year at college. I was taking the course after the introductory physics course, and the teacher that I had was a part-time teacher. She worked in medical research, generally, but came into the college to teach one course, sort of like an adjunct professor. So she didn't have a lot of students, and therefore she maybe had more time and more interest per student. The class was very small--maybe six or eight people. The class sizes at Hunter College in those years were miniscule; they were very, very small. They were about half girls and half boys.

Hunter College, you understand, was a generally girl's college, but in the post-war period they took in veterans to help out with the education of the boys returning from the war. It was right after World War II. And the boys, the veterans, frequented the science courses. In the other courses you didn't see too many of them, but if you took a course in physics, it would be sort of half and half. And for one reason or another the boys in the science classes were toward the bottom of the class. That might be somewhat significant in my story, because I never got the idea in college that science was a man's profession. I've heard that from a lot of other women in science and engineering. I went to an all-girls' high school, you see, so I certainly didn't get the idea there that women couldn't do it. I got the idea that I was a little bit of an oddball, being interested in science, because there were

very few girls who were interested in it, but there were some, and there were some that were very good. Later on, when I went to college and there were boys in the classes, the boys didn't form an overwhelming majority--it was about 50/50--and they were certainly not the best students in the class. They always used to come to me for help, so I didn't get the idea that I couldn't make it. Well, this teacher took an interest in me, and she was obviously a professional physicist. In fact, she is today a very famous and successful medical physicist. She told me, "Why don't you do the same as I'm doing? You can do it too." That was kind of the message: "You can do it too." So I decided I would try to do it too.

Sherkow: How come? What made you decide?

Dresselhaus: I don't understand your question. . . it's just another option I hadn't thought of. If I could earn a living doing science, and it was fun, why not?

Sherkow: But were you exceedingly interested in physics?

Dresselhaus: Oh yes. I was always interested in science. I was interested in math in high school. I tried to get the school to offer more math than they did, but they refused to offer a course for one person. My senior year, I wanted to take a second math course, but there was nobody else that wanted to take it in the whole school, so I didn't get to take it. Well, I wasn't very bright about this, because if I had used my head, I should have tried to convince somebody to let me go to the college to take a course; it was right in the same building. But it never occurred to me that they would allow it, nor did I know how to go about that sort of thing. But I was interested from the beginning

in math and science. As I studied it, I thought that was a real neat thing to do, but I didn't think about it for a career; I didn't know you could make a career out of it.

Sherkow: So this woman physicist made you aware of the fact that you could make a professional career out of it.

Dresselhaus: Yes, and that I could do it as an individual. You know, there were people doing this sort of thing, and I could do it. So that's how it happened. And, actually, she's kind of followed my career. I hadn't seen her for twenty-five, thirty years, and I bumped into her a few months ago. Of course, she remembered the whole thing.

Sherkow: What's her name?

Dresselhaus: Rosalyn Yalow. She'd been reading a lot of things about me in various places, and she'd been wondering if she was the person; she kind of identified herself as the person who steered me into physics.

Sherkow: She was right.

Dresselhaus: She was right, oh yes. But she figured this out herself. Of course, I should have written her a nice letter at some point, but I never managed to do that. She was a great teacher and a brilliant scientist.

Sherkow: I wanted to ask you about your expectations in terms of a career.

--[Interview interrupted]--

Dresselhaus: You wanted to know about my expectations for a career. Well, I didn't have any expectations. I never had any expectations.

Sherkow: Well, you mentioned that you were thinking of becoming a teacher; so, in a sense, that was an expectation.

Dresselhaus: Yes. But what I was thinking about was something that there are millions of in this country.

Sherkow: What I'm trying to say is that you were going to school with the aim and the objective of getting a career out of it.

Dresselhaus: Well, that's not exactly right. I was going to school pretty much with the idea of attending a trade school. Probably very few people that you're interviewing will approach it this way. My objective in going to college, or whatever I was doing, was getting some training, so I could do something better than work in a zipper factory. If I ever had to work in my life, I'd be able to do something that was a little bit easier and more rewarding than some of the menial jobs that I worked at as a child. That was sort of the level of expectation; it wasn't very high. For example, I think I would have been quite happy being a secretary, or [doing] any kind of job that was somewhat respected by society and wasn't total drudgery. I thought a secretarial job was great, as a matter of fact. When I was a child, I thought that that was really pretty fancy work.

Sherkow: That's because you didn't know.

Dresselhaus: Well, yes, I didn't know, and I thought only rich people had access to typewriters; that was really something so super..

Sherkow: When you were in college, your expectations changed. Correct?

Dresselhaus: Well, my expectations weren't really very high in college either. I was hanging loose, so to speak. I figured I could get a job doing something and, therefore, I wasn't worried anymore.

Sherkow: You mentioned deciding to be a physicist.

Dresselhaus: Yes, but I didn't know what that meant exactly. See, there are other things that you have to realize; by the time I got to college, I figured out that I could support myself. See, I was already doing it; I was studying and supporting myself at the same time. So I wasn't really too worried about a career; whatever I did, I could make out. So I didn't have expectations as such. My expectations involved being able to support myself.

Sherkow: I guess I'm thinking in terms of being future-oriented.

Dresselhaus: I wasn't. I was never future-oriented. I've never been future-oriented. Things just happened.

Sherkow: And you took advantage of things when they happened.

Dresselhaus: I took advantage of things when they happened because I always figured that I'd never get another chance. That's the way I've always operated. When I had one chance, I knew that I had to make it on that one chance; I wouldn't get another one.

Sherkow: When this woman, Dr. Yalow, directed you--

Dresselhaus: You see, she told me that I had to go to graduate school to become a physicist.

Sherkow: What was your reaction to that?

Dresselhaus: Good. Great. I liked going to school. I was good at it. Why not? That's not too hard. But going to graduate school didn't have in it any definite career goals. I'd wind up doing whatever I could do, whatever was the right thing for me. I didn't know how good I was or how bad I was. I didn't even know if I could make it in graduate school. There were a lot of questions that I didn't know the answers to.

Sherkow: What about your parents? At this point in time, did they expect that you would become some kind of a career woman?

Dresselhaus: Well, they were beginning to get worried about me, as a matter of fact. They thought I was trying to do too much. I think going to undergraduate [school] and getting a bachelor's degree was okay, but going to graduate school was a little bit beyond what they could imagine for me. I think that they have never completely adjusted to my going to graduate school; even now they're not adjusted to it. They don't understand my job exactly. You know, on the one hand, they're very proud of me, having a daughter that's a professor at MIT; they think that's pretty neat. But on the other hand, they'd be even happier if I'd be at home all the time with the kids. So they're ambivalent about what I do. Ever since the time when I completed my

undergraduate training, I'd say that I got very little support and encouragement from the home front because they didn't understand why I wanted to do any more of this stuff; I have enough, already, you know (laughter).

Sherkow: Were they more interested in your becoming married and having children, as opposed to having a career?

Dresselhaus: Oh yes, of course! Well, I was, sort of, also. I think that also contributed to my thinking; I wasn't that career-oriented, as such, not to the exclusion of other things. I don't know how it happened; well, [it was] a whole series of unusual circumstances. It wasn't planned like that, and I know there must be hundreds of thousands of people out there that could have done the same thing, if circumstances were a little different for them. If you had met me at age twenty, you couldn't imagine I would be doing what I'm doing now, because I wasn't that gung-ho about graduate school and having a career. You know, I love to go to school but going to school and having a career weren't the same thing for me. You have to understand a little bit of the time, and people's attitudes. The teachers in the college and the graduate school were not supportive of women's careers; it's different than today.

Sherkow: And that had an effect on you?

Dresselhaus: Yes, to be sure. I never expected to use my education, except to just support myself. --[Interview interrupted]--

Sherkow: While you were in college, I assume you dated boys. You had an active social life in that respect.

Dresselhaus: Yes.

Sherkow: I was wondering if you could talk about it? You've already mentioned that in terms of a career you were not thinking, "I'm going to become a topflight physicist."

Dresselhaus: No, that was certainly not my intention. I had no illusions about anything like that. Well, I was a youngster; in some ways I was pretty naive at the time. Actually, I had made up a year or so in school, so I was younger than the average kids graduating with me. I had an active social life. I was pretty popular; that was an important part of a girl's life at that time. I'd say it's less so today. The boys at our college were intellectually not that sophisticated, so I didn't date boys at Hunter College; I dated outside.

Sherkow: Okay. At some point, I remember reading that you saw on a bulletin board some information about spending a year in England at the Cavendish. Could you talk about how that came about and what you did about it and what happened?

Dresselhaus: This Dr. Yalow, who you heard about, was sort of an advisor, at least a part-time advisor. And there were people also in the physics department who were advisors. The department was very small. They only had about four or five majors in this very large school. Hunter College is a very large school, and they had almost no science majors,

especially not physical science majors. So all the teachers that we had knew the students individually and in great detail. They encouraged me very much to go to graduate school, and they helped me decide on what graduate schools to apply to; they were really a very, very big personal help. The whole faculty took a personal interest in me. What more can you say? They were kind of behind me and urging me on, and giving me whatever information they knew about fellowship support and opportunities.

At that time there seemed to be plenty of fellowship support, and I had an opportunity to go to a large number of schools for graduate work. As a matter of fact, I had saved up enough money from my teaching jobs so that I didn't need so much financial support then as it might have seemed to them. But I liked to have a little "kitty" in the bank for security. I was still looking around for a fellowship, and there were just lots of opportunities for that.

Now, how this thing for England came about was that the Fulbright Program had just started at that point. It was a way to balance the payment of debts that some foreign countries had incurred to the United States during the war; they were going to pay off some of this debt by supporting U. S. students abroad. The countries would pay in their currency to support students studying in those countries; that was the idea behind the Fulbright Program. I don't know why I chose England. I thought part of the reason was that it would be less of a language problem. Also, the Continent at that time was wiped out. This was 1951. The place was pretty much devastated, and England hadn't been hit anywhere as hard as Western Europe. It just seemed

that England would be a better place to go, and it was, at that time, really topflight in science.

So I saw this announcement of a Fulbright fellowship, and an address where to write away for application forms. I sent away for application forms and I filled them out. And--like I do to a lot of things, then and now --after doing something I get rid of it and I forget about it. It sort of left my mind after I sent off the application. It was one of those things that you do, thinking that you don't have much chance of getting it. As a matter of fact, I applied for a second foreign fellowship, a Henry fellowship. I guess I never wrote about that. I got up to a certain point, I guess, in the decision. I had to take an interview, and I traveled up to Yale to take my interview. But they asked me questions that I just couldn't answer at all; I just didn't have the background to qualify. I think I just absolutely struck out on that fellowship.

But the Fulbright came through several months later, all by itself, and I decided to accept it because I'd never been very far from New York City. I was really excited about traveling; it was glamorous.

Sherkow: How did your parents feel about your spending a year in England?

Dresselhaus: Well, they were worried about me, you know. They didn't think I could take care of myself. They thought it was pretty great to study abroad; they thought it would be fun to travel. They were worried, but at the same time they thought it was a good thing to do if I wanted to do it.

Sherkow: Did the Fulbright fellowship pay for all your expenses?

Yes. Oh, everything--capitally, gloriously. I had so much money! I had more money than junior faculty members there, and I was just living by myself. Oh, I lived like a queen in England. I had a great time.

Sherkow: I'd like to get back to that, but could you first summarize your four years at Hunter? How do you feel in terms of the preparation that you had for science?

Dresselhaus: Okay. The preparation for science in factual material, in solving problems, and that sort of thing, was lousy. The level of the courses was extremely low; there was essentially no competition. I think the faculty was not, on the whole, very up with the times. It wasn't exactly what you'd call an ideal undergraduate education. However, I learned some other things. I often say, reminiscing about my undergraduate education, that it wasn't very good in science, but it was very good in other ways. It's not always clear what's good at a given time. I learned a lot of things there, in terms of the responsibility of an individual to society, that it's not enough only to take, but you have to give; that was part of the Hunter existence. There was a lot of emphasis on self-starting, initiative, the idea of serving society, all of these; all of the kinds of things about how one lives in this world, how one lives in a scientific community, and many issues of this sort. There was a great emphasis on that, and

that stayed with me and has made a big difference to my career. I think that in being a success--whatever that means--in science or in anything else, there are a lot of intangibles that are just as important as the technical preparation. Hunter didn't give me very much of the technical preparations in science, but it gave me more than what I've seen my colleagues get in these other dimensions. So if I answer your questions, I have to answer them on two sides. The Hunter education really was very good; it just wasn't very good in science, but it was good in almost any other way. Were I to go into something like English or biology or some field that they had a good background in, where they had strong departments, then the technical side would also have been good. Basically, it was a very fine school at the time. I was just in the particular part of the school that was very poor.

Sherkow: The physics and the chemistry--

Dresselhaus: And the math. It was all just not at a very high level; it wasn't much of a challenge. There were some good students there; it wasn't that they had a bunch of boobs. They had some very, very fine students in all of these departments that have gone on and done well. But when I later met these talented students, they all said that it was pretty tough at the beginning of graduate school because the preparation wasn't adequate.

Sherkow: So your overall feelings about Hunter are pretty positive?

Dresselhaus: Oh, yes.

Sherkow: You enjoyed going to school there?

Dresselhaus: Well, that's not--

Sherkow: Is that going too far?

Dresselhaus: That's going too far. You don't have the same feeling about going to Hunter College as you have about going to some other place because you get on the subway in the morning with your little sack of lunch, you go there for your classes, and when it's all over, you come home again on the subway. The feeling of college life as you get it in most other colleges is just not there. It's hard to say that you really get excited about the place; it's just not that kind of place. But I made some very good friends, both with students and faculty, and this was very rewarding. It's different from the undergraduate experience here at MIT, where the students live in the dorms, and they have all these extracurricular activities. I had some extracurricular activities, but you don't have that much when you don't live near the school.

Sherkow: While you were going to Hunter, did you tutor, or in the summers? Is that what you did in terms of jobs?

Dresselhaus: Yes. I went to school.

Sherkow: Oh, you went to summer school also?

Dresselhaus: Yes.

Sherkow: Is that how you picked up a year in school?

Dresselhaus: Yes. Summer school made it faster that way. But I was working as a tutor all the time, so it was just part of the school year. It just kept going the same way. There wasn't really a need to take a summer off, because I had a steady income. I was doing okay. There were plenty of good courses around in the summertime.

Sherkow: Other than Dr. Yalow, were there any other teachers that took a particular interest in you?

Dresselhaus: Oh, yes. I'm saying that there were many.

Sherkow: But there aren't any that you'd like to specifically note.

Dresselhaus: I don't remember all their names. It wouldn't be quite fair to those that I remember to those that I don't. Dr. Yalow was the first one, and I'd say she had maybe a special place. But then there were just many others that did similar [things], not only for me but for many other students.

Sherkow: Did you graduate at the top of your class?

Dresselhaus: Yes.

Sherkow: Were you in the top ten percent or five percent?

Dresselhaus: One percent. I also graduated pretty close to the top in my high school class. I did better in college, relatively; the competition was less. I also did very well in high school even though I got off to a slow start.

Sherkow: Were you a Phi Beta Kappa?

Dresselhaus: Yes.

Sherkow: That's what I thought, but I didn't read it anywhere; I just assumed that you were.

Dresselhaus: Oh sure, yes. I don't even think that that--(laughs)--

Sherkow: Counts?

Dresselhaus: I never put that down on my curriculum vitae, or anything like that. I had a number of honors when I was an undergraduate. I don't even remember what they all were. I got most of the prizes that were available, in my high school also, in the math-science field. You know, when you graduate there were some prizes.

Sherkow: Did they have science fairs and things like they have today?

Dresselhaus: Well, maybe they did, but I didn't get into that.

Sherkow: I know that a lot of people who are at MIT, or are planning to come to MIT, really are involved in that kind of activity.

Dresselhaus: Yes. You see, I didn't have the kind of time to do that, and I didn't have the wherewithal either. I didn't circulate in the kind of environment where that would have happened to me.

Sherkow: By the time you were in college, was your brother already finished with school?

Dresselhaus: Oh yes, for a long time, yes.

Sherkow: He was already an engineer?

Dresselhaus: Well, yes. See, he came to MIT in '47. I think he finished MIT [graduate school] before I started high school.

Sherkow: You graduated from Hunter [College] in 1951. By that time, he was already done with graduate school?

Dresselhaus: Oh, a long time. I think he left MIT in '48 and I suppose that in January '48 I finished high school. I suppose he finished graduate school when I finished high school; that's about right.

Sherkow: Did he encourage you?

Dresselhaus: I didn't say that.

Sherkow: What did he do after he finished all of his graduate work?

Dresselhaus: When he was about fifteen or so and started going to college, after that I didn't see much of him; he sort of disappeared from the house, and that was it. So, my contact with him was sort of zero; I can't say I had much encouragement from him.

Sherkow: But even later?

Dresselhaus: When he came to MIT, we were all working pretty hard to help him out here. He had good financial support from the Institute when he came here, but it wasn't exactly complete. My mother was worried that he wouldn't have enough money for his studies, so we were all working hard back home trying to send him some extra money. So that was that. Then, when he finished MIT, he went down to Oak Ridge

National Laboratory, starting work in a new nuclear engineering division there. He was among the first arrivals in that division, and he's been there ever since. He's still there. He moved down there about 1947 or '48, thirty years ago.

Sherkow: Where's that located, exactly?

Dresselhaus: In Tennessee.

Sherkow: That's where he lives?

Dresselhaus: Yes. So I saw very, very little of him during those years.

Sherkow: Since he was in science and math, I thought he might have encouraged you, while you were in college.

Dresselhaus: No, no. There was very little interaction (laughs)--as a matter of fact, I would never go into any area that he was in because he was just so outstanding in everything he did. I didn't want to be compared with him and so I always went into a different field.

END OF SESSION

MIT ORAL HISTORY PROGRAM

Project on Women as Scientists and Engineers

Interview with Mildred Dresselhaus

by Shirlee Sherkow

Cambridge, Massachusetts

June 15, 1976

Session 2

transcribed by Janet Billane

Sherkow: This is Shirlee Sherkow in the second session of an interview with Mildred Dresselhaus in her office at MIT in Cambridge. One of the things that I just wanted to make clear was your degree at Hunter. What subject matter was it in?

Dresselhaus: It was a bachelor's degree, and it's hard to say exactly what the subject matter was. It was a liberal arts degree; [that] is really the best explanation. The number of required courses at the college was quite large, and there was a lot of stuff in languages and English and social sciences and just general background-type things. The subjects that I concentrated on most were math, chemistry, and physics. However, in describing a major by today's standards at schools that I've taught at, it's hard to say that what I accomplished as an undergraduate corresponds to a major, as we understand it today.

Sherkow: All right. You mentioned in an earlier interview that in your relations with Dr. Yalow, she made you interested in going on for a graduate degree. She said that if you wanted to be a physicist, you had to go on and get a graduate degree. You mentioned that that was one of the reasons why you considered going on. Were you thinking along the lines of getting a PhD?

Dresselhaus: Well, I'm not really sure that I had a very good or clear idea of how far to go with an education at that time. I just was sort of doing things year by year; I didn't have a master plan.

Sherkow: So your idea was simply that you would be going to graduate school?

Dresselhaus: Well, I would see what opportunities I had. I didn't know a lot about the outside world at the time. As for technical jobs, the only thing that I really had experienced was doing a lot of tutoring, that is these teaching-type jobs with which I worked my way through college. The only paid job that I had that was more technical than the tutoring, occurred the summer after I graduated college [when] I was working at Sylvania Bayside. I realized that summer how very little I knew.

Sherkow: What were you doing there?

Dresselhaus: Well, it wasn't exactly clear what I was doing there. I think I was pretty much reading a lot of stuff. I don't have a whole lot of recollection. I applied for work at this laboratory, and I think that when they hired me, they didn't have a very good plan of how to use me--

or maybe I was incompetent for what they had planned to use me for; it wasn't totally clear. I think I did a lot of reading that summer on various subjects of interest to them, like phosphor for photo-detector applications, and things that I really knew very little about. I think I did some reading; I learned some technical material. I learned a little about an industrial laboratory. But I'm sure I didn't earn my keep for them; I don't think I did useful work for them. I think the experience gave me a real idea that if you wanted to do something in physics, you had to know a lot more than I knew, but I think I already knew that.

Sherkow: But this was further indication.

Dresselhaus: It was further confirmation.

Sherkow: How did you find out about that job? How did you get involved in it?

Dresselhaus: Oh, I just applied to several local companies around New York City for a summer job. I maybe saw an ad in the newspaper; I don't remember anything, specially. I had a very good academic record, which I'm sure helped me get this job. It was close enough to home so that I lived at home and I just commuted to this job by subway. It was a convenient sort of job and very good experience. I hope there were not too many times in my life that I was hired and didn't earn my keep; I think this was one case where it worked out like

that. But then there were many other times when I did earn my keep, so I guess these things even out in the end.

Sherkow: I was just curious as to why this one particular summer you got involved in a scientific job and the other summers you didn't.

Dresselhaus: Well, I was going to school the other summers.

Sherkow: Oh, so this was the first summer that you weren't going to school.

Dresselhaus: Well, I was all finished; I had already graduated from college. The other summers I was going to school, and I was teaching my little teaching jobs. Somehow, with World War II, people got into the idea of a twelve-month school year, for some reason. During the war there was a big emphasis on doing everything fast. Even our high school was organized that way; we started school at seven in the morning because they had to use the building for something else in the afternoon. Everything was rush, rush, rush. The veterans were coming back; they were in an awful hurry to get through college. Going to school in the summer was something that everybody did in New York; it never occurred to me that that was anything unusual. So there wasn't a real opportunity, there wasn't a logical point to start working until I had graduated.

Things are very different today, it seems. The students, when they get finished with the academic year, are tired, and they think they need the summer off to gain experience. And I agree with this; I encourage all my students to do that, to go and get some professional experience in the summer. It never occurred to me to do that at that

time, and I'm not sure it would have even been possible. There weren't that many jobs available for people in technical fields.

Sherkow: In terms of summer jobs then, you were adjusting yourself to the situation at the time.

Dresselhaus: Yes.

Sherkow: In your paper, "Frontiers of Knowledge," [Ch. 6, Distinguished Scholar Lecture Series, University of Southern California], I read that you really weren't sure, as a senior at Hunter, if you were going to go into math or physics. I was just wondering how you made up your mind and on what basis, of which avenue you were going to take.

Dresselhaus: Well, my mind was made up for me, through quite non-technical considerations. I'm not sure what fraction of people build their careers on life plans and what fraction stumble into things; but mine was a case of stumbling into physics. I think my training in undergraduate school was stronger in math than in physics, so that going to graduate school in math would probably have been technically easier for me. I wasn't sure at the time I graduated what I was going to do, so I applied to different graduate schools in different things to see what my options might be. How I got into physics was that I got this fellowship, the Fulbright Fellowship, and that was in physics. The fellowship was attractive to me because it had a component about traveling abroad. You see, it was in Europe; all the other fellowships were here in the United States in some college or another. I was attracted to the idea of going abroad and traveling and seeing the world; it was more that than my preference for physics over math that made that choice.

Sherkow: Was your interest in physics and math about approximate, then?

Dresselhaus: Well, I think it was about the same. Primarily because I knew so little of both, it was very difficult to make a choice, to say which one I was more interested in. It was a question of lack of knowledge.

Sherkow: You just mentioned that you applied to a number of different places in a number of different fields. What were the other fields?

Dresselhaus: No, it was just in math and in physics.

Sherkow: How many fellowships did you get?

Dresselhaus: I got fellowships everywhere I applied. Well, it was easy in those days. I had a good academic record, and I suppose I filled out the fellowship forms well. And that was an age when science was expanding. There weren't so many applications, and I think that the schools were interested in finding all the qualified applicants they could. I don't know what the statistics and details are of what it was like in 1951, but it seems to me that it was very easy to get a fellowship. Every place I applied [to] gave me some kind of an offer to make it possible to go to school.

Sherkow: At Hunter, were there other women who were applying to similar graduate schools for fellowships?

Dresselhaus: Yes.

BEGIN TAPE TWO, SIDE ONE

Sherkow: We were discussing fellowships, and if there was any kind of a

difference between men and women at that time.

Dresselhaus: Well, that's not an easy question to answer exactly because at Hunter College there were more women students than men students, and the women students tended to be at top of the class, rather than the men; so the women students normally had better fellowship opportunities than the men. It's very hard for me to go back and say whether it was easier or more difficult for women than men to get one. I cannot make that comparison. I think what was important in my case is that I wasn't aware that there was any special difficulty for women to get fellowships or to advance themselves. Even that summer job that I had at Sylvania Bayside, there were quite a number of women scientists and engineers employed there and they were doing very well in the company.

Sherkow: You mentioned that you had several male friends who were in an adjacent school in the area.

Dresselhaus: Well, to begin with, when I was in high school, I sort of picked up kids from neighboring schools, and also in college; yes.

Sherkow: I just was wondering if there was any kind of comparison that you can make at the college level with men that you knew?

Dresselhaus: Well, I'm not sure that I made a comparison of who got better fellowships; I guess I didn't make that comparison, so I don't know. I made out well in terms of having opportunities, especially at that particular point.

As I was saying, I decided to go into physics mostly for social reasons. I wanted to see Europe. It was also a very good opportunity

in terms of financial rewards; the Fulbright Fellowship not only took care of all my academic needs, but there were travel subsidies and books allowances and all kinds of things. It was just a very, very lucrative-type fellowship compared to any of the other offers. So that's how I got into physics. It was a great opportunity, and I'm sure I did the right thing.

Well, it's hard to know whether I did the right thing or not, in terms of a technical career. The other option, the thing that I probably would have done had I not gone to the Cavendish in Cambridge, England, would have been to come to MIT and go into computer-type things. I had a fellowship from MIT to work on this Whirlwind machine, which was the forerunner of modern computers; it was among the first computers that were operationally useful. I had an opportunity to work on this machine; that was what my fellowship, R.A. or whatever it was, was for. I think that this is a field I would have been very good at, and it is a field that I would have entered in the very, very beginning. And it's always good to get into a field when you're right there at the beginning. At the time, I didn't know and also other people didn't know that computers would be such important things as they turned out to be, but computers were things intrinsically interesting to me; that's probably what I would have done. And looking back, I may have turned out to be more successful at that, than what I'm doing now, because I think I would have been kind of good in that particular area. However, that isn't what I did, so it's hard to know how it would have turned out if it had been that way.

Sherkow: But it's nice to know what your possible alternative courses of action were.

Dresselhaus: Well, there were a lot of different alternatives because I had fellowships at a number of other schools; so it isn't really completely clear where I would have gone or wound up.

Sherkow: But this one at MIT you were very interested in.

Dresselhaus: I was very interested in that one, yes.

Sherkow: So you decided to go to Cavendish, and you've mentioned in a number of places that it was great, professionally and socially. I'd like you to elaborate on that. Maybe we should just start with the classes, and how you felt about them.

Dresselhaus: The classes were very informal. The classes were quite different from courses that you take at an American university, and, therefore, were totally different and new to me. My background was very poor, so everything I was doing there was quite new to me, technically. The organization at the Cavendish Laboratory was that there were a lot of available lectures, and they were all posted. You could attend as many lectures as you wanted to. They didn't have problem sets or examinations, or anything associated with the lectures; you could just attend as many and do whatever you wanted with them. So I attended what I thought were the best ones. I also attended other things that had nothing to do with science because there were so many cultural things available. For example, they had some terrific art lectures. I wasn't all that knowledgeable or familiar or maybe even so interested in art, but I attended lots of lectures on that subject when I was there, art history and that sort of thing; that was a big item at Cambridge. And

I was singing in the chorus, King's Chapel Choir; all kinds of things that I would never, never have gotten into at an American university.

It was sort of a year that was mine; I could do what I wanted. So I got into sort of broad things. But I worked very hard in my technical studies. As a matter of fact, I think I worked as hard as anybody around.

Sherkow: Did you have to produce a doctorate or anything like that?

Dresselhaus: I was just getting into what the system was. There were these open lectures, and I attended a lot of them. In addition, we were assigned tutors, and I had usually about two tutors working with me each term. Most students only seemed to have one tutor, but I think I had more tutors because I didn't fit into the system exactly. I didn't have the right preparation, and I wasn't really on the exact track; so they looked after me by giving me an extra supervisor. What the tutors did was they gave you work to do, individual work that was kind of geared to your own level and your own needs and interests. So I had individually-directed study, and the tutors were the ones who gave me my weekly assignments. It was sort of like going to a music lesson or something; they give you a lot of work to do and you come back with the work done the next week and you talk about it. They critique what you've done, and then give you some more to do.

Sherkow: Well, how did you feel about the fact that you had more tutors than everyone else?

Dresselhaus: I thought that was a pretty good opportunity. I welcomed having more tutors. --[Interview interrupted]--

I wasn't too clear what sort of physics I was going into, so I had one tutor in high-energy physics, and I had another tutor in solid-state physics. The people I had were terrific; I had excellent tutors, just great scientists and great people. That was a fantastic opportunity. I thought it was a big advantage having more tutors than the other people. I think that the other people didn't need as much tutorial help as I did because they had been there before. See, I didn't start there; I came there with some undergraduate training, but I was doing an undergraduate program because, after my Hunter education, I was still at the undergraduate level. And the other undergraduate students had been in the system before. They were pretty well-organized, B-follows A-type thing. So one tutor was pretty adequate to take care of their needs; they knew exactly where they were heading. But nobody seemed to understand where I was heading, including myself; so I had more tutors, and that worked out very well.

Sherkow: Who were they? Who were your tutors?

Dresselhaus: Well, I had Bob Dingle, who was a really brilliant fellow. And I had Bob Chambers, and Tony Lane, a high-energy fellow. Those were the three tutors I had. But I didn't have all three of them together; I had them two at a time.

Sherkow: Were there a lot of other women in the classes that you took?

Dresselhaus: Yes, there were a lot more women there than there were in the U. S., and they did quite well. The women students were right up there with the men students; it wasn't a big difference. Where the big

difference came, I think, was that they didn't aim very high; I think most of them were anxious to teach in high schools.

Sherkow: In England?

Dresselhaus: Yes, that was the expectation. But I didn't have any high expectations myself, so I wasn't too aware that they weren't aiming very high. But looking back at it now, I'd say that there were maybe two or three times more women, as compared to men, in comparison to what there would be here, in the U. S.

Sherkow: In the graduate schools here in the United States?

Dresselhaus: Yes. Right. There were many more women doing math and physics-type things, and they were doing them at a high level, too.

That's another thing that you have to consider. --[Interview interrupted]--

Sherkow: You were comparing the women in Cambridge with the women in the graduate schools in the United States.

Dresselhaus: Yes. Pretty much the way you would see it is that, in the U. S., usually there was one, or at most two, women students in a class. And in Cambridge, England, there were always a number of them, like four or five or six. There was never a class that I took that I was the only woman; there were always a few, and there were always some who really knew what was going on.

Sherkow: You're talking about science or other classes?

Dresselhaus: I'm talking about science classes. Of course, in the other

subjects there were more [women]. They had two women's colleges, and about twenty men's colleges at Cambridge, so I think from that you get the idea that the ratio was something like ten to one. I'm not sure what the numbers were, but I'd say that might have been about what the ratio was. And the distribution among subjects wasn't terribly different from the percentages that were at the school. So there were quite a number of women in math and physics, at all levels; at least it seemed that way to me. There were quite a few women on the faculty, too. Maybe there weren't many, but it seemed to me that they were there.

Sherkow: But less than in the nonscientific subject areas?

Dresselhaus: That's hard to say. Well, you see, what there was at the two women's colleges, was a whole bunch of tutors and dons, as they were called. And they had some university status and rank. All the colleges had a similar percentage--the ratio of tutors and dons to students was about the same for all the colleges. In that way the fraction of women who were teaching and the fraction that were students was geared to each other; so there wasn't the big disparity that you see in American schools, even today. The impact was that I didn't get the idea from that, that there was no opportunity for women; I thought that everybody had about the same opportunity. My problem was trying to figure out if I could make it myself, and sex didn't have anything to do with that.

Sherkow: You had deficiencies in physics?

Dresselhaus: Oh, yes; I didn't hardly know anything.

Sherkow: At the end of this year, did you feel that you'd caught up?

Dresselhaus: Well, I caught up with some things. One of the things that I didn't catch up on was lab work; that was because they didn't have room for me in any of the labs. When they accepted me as a student, they told me that there wasn't any room for me to take any of the lab courses, and I could only take the theory courses; that's what I did. It wasn't until later that I got some lab experience; I was probably even more behind in that than I was in the theory, and I didn't catch up with that at all while I was at Cambridge. But I'd say that by the time I returned to the U. S., I had a pretty good background in undergraduate physics; it was spotty. It wasn't very well-organized; it wasn't as well-organized as it would have been had I gone to a high-quality school all the way through here in the States.

But I had another opportunity a little later on, when I filled in more of the cracks. We'll get into the story later. This happened when I went to the University of Chicago to get my PhD; that will come into the discussion eventually. At the University of Chicago, there were no course requirements; it was all through examinations. The department made available old examinations for study in preparation for the examinations that you were going to take yourself, and in preparing for these exams, I worked many, many problems; it was in this way that I formed a pretty good idea of what I was supposed to know as an undergraduate. I got lots of practice at that time. I filled in many cracks. It was a very good experience for me, and it came at the right time.

Sherkow: Did this year at Cambridge strengthen your interest in physics?

Dresselhaus: Yes. It did, in a lot of ways. It was strengthened because

the physics at Cambridge was very, very good. The lectures were good, and the students were terrific. They had very, very smart students there. The faculty was very bright, and it was a place that was popping. It was very, very alive and exciting, and I think it would have been interesting to study anything: mythology, Greek literature--

Sherkow: Did you study with other people?

Dresselhaus: Not so much. I interacted a lot with people because the system was such that the graduation requirement at Cambridge is living in college. It's not so much by taking any examination or doing any specific academic thing; it's just sort of living at the college for three years that gives you your undergraduate degree. And part of living at the college is to eat in the hall with the other students. The meals were served around these big tables, and then once a month or so, you ate at the high table with the dons. The high table was really elevated from the other table, on a little step, a little pedestal. But to make a long story short, the conversation around the table was very educational and stimulating; it was something that was very good for me at the time.

Sherkow: You mentioned that you felt socially it was a great experience. I was wondering if you could elaborate on the social aspect.

Dresselhaus: Well, yes. I went to an undergraduate college in New York which was a subway college; I lived at home, and I worked very hard by myself. But it wasn't what you would call a college experience; it was mostly studying out of books and figuring out what you could by yourself. There was not too much interaction with people. My experience at Cambridge

was very, very different. I was living by myself, on my own for the first time in my life. I was thousands of miles away from home. I really had to make it on my own in all kinds of ways. And the environment was just a very stimulating place for a young person to be.

Sherkow: Did you make a lot of friends?

Dresselhaus: Yes. I made a lot of friends, and I think being an American was a big help. At Cambridge University the majority of students, maybe three-quarters, were British; they were local people. But they also had many, many foreign students. I don't remember how many Americans they had, but they must have had about thirty there at the same time; maybe they had more. We would intersect with each other now and then, here and there. There were a lot of Americans in Cambridge itself, because there was an American military base that was close by, and there were a lot of G.I.'s floating in and out all the time. Americans were not very well-liked because of the presence of the G.I.'s. Americans were not very popular in Cambridge when I was there. But I think the American students were accepted very well.

I lived in a house that had several foreign students; they were all girls. Well, that's another part of this. Part of the college life in British universities is living in college, but they were overcrowded when I was there. I was, I guess, a little older than most of the undergraduates or in the older group of the undergraduates; so when there was a shortage of room, they put a small group of us in a house right across from the college. Normally, I would have lived in a house that was all for foreign students. There were about twenty foreign students living

in this one house. Right across the street from that house was another house that took the spill-over of students; the rest of the foreign students lived in there, and I was in that spill-over house.

In this house, besides myself, there was a student from Australia and one from India. We had a lot of interaction with the other house that had the other foreign students, and they were from all over the world. That's part of going to college in Cambridge--having tea; always having tea. Tea is a study break, translated in modern parlance, and eating your meals is conversation time. Not all the foreign students were all so serious. I remember the girl that was from Australia was really just out to have a great old time; I can't remember her studying at all. The girl from India was about ten years older than me, and she had left her husband and baby behind in India and had come to Cambridge to take a PhD. She stayed after I left; I never did find out if she finished her PhD or not, but that's what she was there for.

Sherkow: Did some of your social relationships extend beyond the time that you were in Cambridge?

Dresselhaus: Oh, yes. I used to write to a number of people afterwards. Yes. I wasn't very good about [corresponding]; I'm not a terrifically good correspondent. Then, as now, I got busy and I got to the point where I don't answer all my letters. People don't write back, when one doesn't answer letters and then these things peter out in time. But I did write to a number of people. While I was there, a number of students, maybe five or six, invited me to their homes in distant parts of England

all over the place, and that was one way I got to see the country. They would invite me for weekends, or something, and then we'd go way, way over the countryside. That was very nice. I spent most of my time not with foreign students, but with the natives. But I guess I did spend more time studying than socializing.

Sherkow: I was just going to ask you what you did outside of studying, but I had the feeling you were going to say you spent most of your time studying. How would you characterize the particular personal outcomes of that year in Cambridge, positive or negative?

Dresselhaus: It was almost all positive. I learned a lot of science while I was there, and I also learned that I could do better in science than I had expected. Cambridge was a very competitive environment. I wasn't competing with the English people because I wasn't part of their system--I was just there for a year, and therefore not eligible to take a degree in anything--but I think that had I had to compete with them, I could probably have survived. --[Interview interrupted]--

At that time I learned that I could manage to do science at a satisfactory level for me, and that was a good feeling.

Sherkow: Did you expect at the end of this year that you would then go on for a PhD?

Dresselhaus: Yes. You see, at the Cavendish there were two kinds of students: undergraduates and graduate students. The graduate students were kind of the top ten percent of the undergraduates or maybe the ratio was a little

different; being a graduate student was, in a way, a sign of success. Now I'm not sure that my abilities were commensurate with the students that were asked to stay on there, and I never asked myself that question, exactly. But it was clear that if you wanted to do anything significant in science that you'd have to go to graduate school; I learned that while I was there. That became clear, and so that was part of my experience. I also learned a lot of professionalism; I got to know a number of people that were doing research and what doing research meant. I got much better exposure to the profession than I had as an undergraduate at Hunter College.

Sherkow: So, all in all, it sounds like it was a very positive experience.

Dresselhaus: Well, I also did a lot of traveling while I was there, not only in Great Britain, but I had a lot of vacations; between terms we had six weeks off, and I used to spend quite a bit of that time traveling around the world because my fellowship gave me travel funds which made it possible to travel around.

Sherkow: Where else did you go?

Dresselhaus: I went on the Continent to a lot of places, and that part of it was pretty much of a shock because Western Europe was so bombed out and in such a mess after World War II, and [I] got a chance to see that. But there's another part that you would see, and that's the old history. Europe was so different, and had so much tradition. There were so many things that were very new to me and were so different from things in the U. S. And then one could see how other people lived; that was important.

Sherkow: Did you go by yourself on these excursions?

Dresselhaus: Yes.

Sherkow: Did you have any language problems?

Dresselhaus: Well, I had some relatives on the Continent and some friends of my parents, and that made traveling a lot easier; I visited them some.

Sherkow: The next thing that happened in your career was that you went to Radcliffe; that's where you started out. I was wondering how you decided on going to Radcliffe for your graduate work.

Dresselhaus: Yes, okay. Like everything else that happened to me, that wasn't planned, either; (laughs) that wasn't dictated exactly by science. Actually, before I left for Cambridge, I had a boyfriend that I left behind in the States. Then I went off on this year to Cambridge, and he was a graduate student at Harvard; that's how I wound up at Harvard [Radcliffe].

Sherkow: That was the main reason?

Dresselhaus: That was the main reason, rather than a scientific reason. Radcliffe was a good school; it was one of a number of schools that I would have wanted to go to anyway.

Sherkow: Did you apply to other schools?

Dresselhaus: Yes. I applied to other schools, you know, just to see what

I would do, but I think I'd pretty much made up my mind beforehand that I was going to go to Radcliffe, and that's what I did.

Sherkow: Did you receive a scholarship or fellowship to go to school there?

Dresselhaus: Yes, I did, but at that time you received fellowships to go anyplace; that wasn't so difficult or unusual.

* Portion removed; see Appendix.

Well, I wouldn't say--I don't thing^y it happened that way. I think I changed a lot as a person from all this experience. However, I don't think that my ideas about my career developed significantly until much, much later. I still wasn't a real career person at that time. I certainly put a lot of effort into it; it wasn't that, but I got a lot of negative career input from people who believed that a woman's place is in the home. That was the time right after World War II when the men had come back, and this was the time for women to return to their families and keep the home fires burning.

Sherkow: What kind of effect did that have on you, that thinking of the time?

Dresselhaus: Well, I was very much--I think I was influenced by the thinking of the time, and I saw that it applied to me. Also, my supervisor at the University of Chicago was a person who felt that educating women was a waste of time and money, and everytime he saw me, he told me that. I heard so much of this that I believed it.

Sherkow: But you didn't drop out?

Dresselhaus: No. I didn't drop out for a number of reasons. For one thing, I had already invested a lot of time in getting a PhD; I had passed all the examinations, I was well along on my thesis, [and] I didn't see that there was any percentage in quitting. I'm not a quitter. So I just thought I'd stick it out another year, and I'd be all done, and I did it too.

Sherkow: You mentioned that you felt that you learned a lot of things [which] you said didn't necessarily affect your career plans. Could you elaborate on that?

Dresselhaus: I learned a lot about myself during those years. I learned about what was important in my life and what I wanted to do. I think the decision to go into solid state physics where I would have more control over my own personal affairs was a right decision that has made an important difference to my life. And I set priorities. I decided that a family was important to me; these things that had a lot of impact in the next ten years of my life.

Sherkow: All right. How did you decide on the topic for your thesis?

Dresselhaus: The system at the University of Chicago was quite different from what we know today in terms of thesis work. There the students did it more by themselves. At that time they figured out their own thesis topics, and they did the work by themselves pretty much; [one] didn't get a lot of help from one's thesis advisor. The local folklore

about this was that the thesis advisor was not allowed to put his name on any paper that was written in connection with thesis work; so since thesis advisors got no visible credit for thesis supervision, they put very little effort into it--or at least that was the student folklore. But, there's another way of looking at the Chicago system. This is what I personally think was behind it--this system was the [Enrico] Fermi system, who was the top professor at the University of Chicago at the time. He felt that a PhD was an advanced degree, and having the degree meant that you were a self-sufficient, professional scientist. Selecting your thesis topic or selecting a research problem and figuring out the mode of attack is part of what research is about; it isn't only solving a problem after it's been assigned, and the course has been charted out. The hard part is finding out what to do and how to approach it. And according to the Chicago system, the PhD degree meant that you started at square one and really finished something all by yourself. In retrospect, that was a very good system, and when I graduated [and] I got my degree, I was quite independent. I did have a lot of experience on how to find and solve a problem, and I was an independent researcher. And I was, in a way, ahead of other people who had been spoon-fed as graduate students.

BEGIN TAPE TWO, SIDE TWO

Sherkow: We just came to the end of the tape, and there was an interruption in the discussion of the selection of the thesis topics at the University of Chicago.

Dresselhaus: There was one major professor there, Andy Lawson, who took on all students who were working in the solid state area. Somehow you found a thesis topic. In fact, the thesis topics that were found were almost all very, very significant pieces of work. Part of the thing that helped at the time was that solid state physics was a very, very new field, and it was easy to find a significant problem. Even though we didn't have a thesis supervisor who helped a lot, we had a lot of colleagues; we had all the other students in Lawson's research group. There was a lot of student-student interaction, and I learned more from those students than I think I could have from any professor. We really learned a lot from each other, and almost all of those students have become famous and important people in one thing or another.

Sherkow: Who were they? Who were some of those people?

Dresselhaus: Oh, George Smith, who runs a big division at Bell Labs, was my next-door neighbor. And Darrell Reneker, who's a very important person in high polymer physics. And, oh, there was Jim Phillips, who has won several prizes in physics--he has been oscillating between Bell Labs and the University of Chicago over the years. And Richard Prange, a very successful theorist at the University of Maryland. Oh, and there's just various other people. It was really a high-level group of

students, and since we didn't have many professionals to talk to, we talked to each other. That was very good. At Chicago there was a lot of emphasis on doing things for yourself which I think is a good way to train students, and the education that we got was terrific.

Sherkow: Who was your thesis advisor? I don't think you mentioned that.

Dresselhaus: My thesis advisor was Andy Lawson, but I didn't have much contact with Andy. He was very busy, and didn't even know what topic I was working on for a couple of years. I did get some help from Brian Pippard, a visiting professor from Cambridge whom I had known when I was at Cambridge. He spent a sabbatical year at the University of Chicago. While he was there, he was doing some experiments on the Fermi surface of copper, doing some really radically new experiments that had a big impact on solid state physics. He spent one year at Chicago, and while he was there, we talked together quite a bit. I was talking to him mostly about superconductivity because he was also working in that field; that was one of the major fields that he'd been contributing to. At this time I started moving into a project in superconductivity, and he was the only person around who could give me any help; so I talked to him quite a bit. But by the time he left, I hadn't gotten very far on the problem; I was still at an extremely preliminary stage. I completed my thesis two years after he left, or maybe even a little more than two years after he left; so when he left I was clearly not very far along. But he answered a couple of letters of mine; I corresponded with him some, and he was very helpful.

Sherkow: Could you elaborate on the courses there? You mentioned that the teachers were really great, and the courses were really great.

Dresselhaus: At Chicago?

Sherkow: Right.

Dresselhaus: I didn't take so many courses there, as a matter of fact, because I had pretty much completed a lot of the formal course work before coming to Chicago, and Chicago didn't require courses; so I didn't take many courses at Chicago; there was not much need to take any. But I did listen to some courses because they were especially interesting and well-taught. Fermi was a fantastic teacher; because of his influence, other people tried very hard to emulate him. When Fermi gave a course, hordes of people would go to listen to his lectures. He had, I'd say, a very profound influence on me in many, many dimensions. He was very friendly with the students; he got to know everybody personally, and invited everybody to his house. It was a part-of-the-family type thing with him.

Sherkow: That's really nice.

Dresselhaus: Yes. I've just never encountered another person that was quite like that, who took so much interest in people and in students. Looking back upon it, I don't see how he possibly found the time to do all the things that he did. But he did. And his courses were great. He was unusual in handing out lecture notes as aids to students. Fermi was very devoted to students; he really wanted to serve them, and

he wanted to teach physics. He had these handwritten notes that he distributed, so students wouldn't have to copy down things from the board. When you copy down equations from the board, you often get them wrong; sometimes they're even written wrong on the board. But if you prepare notes ahead of time, then you make sure that equations are right, so the transmission of information becomes more efficient. So I got the idea of distributing lecture notes from him, and I've been doing that ever since. I also got from Fermi a sense of commitment that teachers are there to teach students, and it was important to try awfully hard to do the best you can for them.

Sherkow: Were you invited to his house?

Dresselhaus: Yes.

Sherkow: Did you become friends with him?

Dresselhaus: Yes. Part of the thing that helped there, was that he had a daughter who was exactly my age; I was six weeks older than she--we couldn't have been closer in age. Well, we sort of became friends. And his wife was the most charming person you could imagine; she was like a mother to all the graduate students. She used to cook these fabulous Italian meals for us; oh, was the food ever fantastic! They were more fantastic than ever because as a graduate student, you don't have that much money, or time to prepare food, or, maybe, don't have the knowledge, either; all of those things.

Sherkow: Were you living in an apartment?

Dresselhaus: Yes.

Sherkow: The kind of relationship that you talk about Fermi having with his students, I don't really notice that today.

Dresselhaus: He wasn't my thesis advisor, or anything. I mean, he had this kind of relation with a lot of the graduate students. There weren't so many graduate students at that time. How many students did we have in our class? I think we had something like seventeen or eighteen in a year. I'm talking about small numbers; it's a different ballpark here at MIT today. In my department at MIT, in a graduate class, they net a hundred and fifty new students each year, or something like that; I'm talking about a size of class that's maybe ten or twenty percent of that. So everybody knew everybody else; it was a very individualized interaction.

[The] University of Chicago had many people who had worked on the Manhattan Project--the atomic bomb--and all that, during the war; many of the graduate students who were studying there were professionals before they arrived. They had already done important pieces of research and were very far along in their careers but didn't have any formal degrees; there were a lot of those types at Chicago. Many of these types had finished by the time I came, but there still was some of that heritage left over, and much of the flavor of the Manhattan Project was still there. So there wasn't such a big difference between faculty and students, as you would normally expect in an academic environment.

Sherkow: Were a lot of these other graduate students women?

Dresselhaus: Yes. Well, there were some women graduate students; there were very few. As I said, in the U. S., the percentage of women to men was much lower than it was at Cambridge, England. There was Nina Byers, who was two years ahead of me, whom I got to know. Then there was Carolyn Littlejohn, who I think was one year behind me; she might have been in my year, but it seems to me I was a little ahead of her in some way or another. And there was Shulamith Eckstein; she must have been two years behind me. That was, more or less, the women students that they had; it wasn't a very large number. Maybe it was five percent, which isn't really so bad, either, when you come to think about it.

And they had some women faculty members who were doing very well. Maria Mayer, who later won a Nobel prize, was there. And Leona Marshall was very active in high-energy physics; and Margaret Burbidge was a big person in astrophysics. They had some women professionals there who were just terrific.

Sherkow: Did they serve as role models for you?

Dresselhaus: Well, sort of. I actually got to know Maria Mayer quite a bit because we lived in her house as a boarder for about a year. But the important thing about Chicago was that I didn't think that sex was an obstacle toward doing physics; I certainly didn't get that idea. I saw around me many women who were doing very well. Now, it turned out later--and I wasn't so much aware of it at the time--that these women at Chicago did have a number of obstacles, in fact. But I

wasn't too aware at that time of the fact that there were double standards; that these women didn't have the opportunities that they would have had, had they been men. But as a student, I wasn't keen on the differences and the discrimination.

Sherkow: You're discussing the faculty members now, right?

Dresselhaus: Yes. As for the students, I don't think anybody gave us a bad time at all about our studies. Women students at the university, I think, did quite well. I think we held our own; it wasn't any problem.

Sherkow: Were there any special advantages to being a woman?

Dresselhaus: You were more visible. I think I got invited to more parties at the Fermis because I was a woman. Somehow, everybody knew me. I think that was part of it. I was so visible; I just was known by every single person in the department; either for better or for worse, women students were far more visible. (Laughs)

Sherkow: Did that put pressure on you? Did you have, maybe, more pressure than others?

Dresselhaus: Well, not so much. At that point, I wouldn't say there's too much. I think later on, as you move up into the profession, there's more pressure because of the difference in sex, but I think, as a student, there isn't much pressure that way. The criteria for getting a degree or passing an examination are pretty well-set. I think I had a lot of advantages in getting fellowships because there

weren't very many women who applied, and I always felt that they chose me because they wanted to have a woman candidate or a woman [as] a winner, just to be different, to make it a little bit more interesting for the public. They could put my picture in the newspaper, or something.

Sherkow: Did they put your picture in the newspaper?

Dresselhaus: Oh, I don't know--I don't know that they ever did. But I was especially lucky at getting fellowships and related things. I probably didn't deserve these awards as much as some other people who didn't get them; so, I think, in that sense, probably being a woman was an advantage.

Sherkow: That's interesting. You mentioned earlier that Fermi had a large influence on you. Did he influence your career goals at all?

Dresselhaus: I was saying that he influenced my feelings about professional excellence, about service and the role of the teacher to a student; I was mentioning that. You see, Fermi died in 1954--the first year I was at Chicago, he was there, and I had a lot of interaction with him because he was such a friendly, affable person. The following summer he got very sick with cancer, and he died the next fall, so by the end of that first academic year he was out of the picture and I didn't see much of him. So, during the years that I did my own research and my thesis work, he wasn't around. Our interaction was thus limited to that early period.

Sherkow: Did you have other mentors then later in your career at the University of Chicago?

Dresselhaus: Not really. It's hard to say who my mentors were at the time. I was just sort of getting through the system, like everybody else. You know, nobody had mentors. As I was saying, we did our theses; a PhD degree is mostly doing your thesis, and for all the students, the thesis was done by oneself. The male students didn't have any mentors, and I didn't have any; nobody had any mentors. Mostly, we just had each other, and we had to get through the system and write our papers. And that was the PhD degree.

Sherkow: Okay. I think we'll stop here. This is the end of Session Two.

END OF SESSION

MIT ORAL HISTORY PROGRAM

Project on Women as Scientists and Engineers

Interview with Mildred Dresselhaus

by Shirlee Sherkow

Cambridge, Mass.

August 11, 1976

Session 3

transcribed by Beth Gould

Last time we concluded with a discussion of the time that you were at the University of Chicago working on your thesis. I'd like to back-track because there are certain unanswered questions. It's going to be a little random, but I'll try to be somewhat chronological. You mentioned that until you were fifteen or sixteen, your mother worked nights in an orphanage; then you also said that you felt closest to your mother when you were growing up. When did you and your mother find time to be together?

Dresselhaus: My mother quit that job at the orphanage when I was starting high school; I guess I was about thirteen or fourteen at the time (I must have been if I graduated at sixteen). During the next period after the orphanage, she had a job working in a leather factory, making wallets; that job had regular hours, like eight to four-thirty or five. So, all

my high school years, we went to school together. I went to school on the subway, and she went to work on the subway; we had the same route because her job and my school were pretty close together. It was almost an hour's train ride, and we went together most of the way. We saw each other in the morning, obviously. I got home before she did, and it was my job to [cook]. I was the cook--I used to start all the meals during my high school period because I used to get home first.

Let me explain how things were, because that's all very unclear. My brother was already long since gone when I was in high school. He was very far ahead in school relative to his age. So, when I was quite young he already had left home; he was off in his own things. Now maybe I should clarify that; there's a three-year age difference between us, but he was four years ahead of his age group in school. And although he went to college in New York City and nominally lived at home, we saw very little of him after about age sixteen; that means after I was about thirteen, we saw very little of him. The other person in the family is my father. During those years, my father was sick most of the time, and he was in the hospital a lot of the time, so he wasn't at home. So, for most of the time I was in high school--at least half of the time--it was just the two of us, mother and I, at home. And when my father was around, he was often "out of it." So that explains some of the family background of those years. That was also the period of World War II, when I went to high school. I think I finished high school about '47, or thereabouts; so I started high school during World War II, and I finished in the immediate postwar

period. That gives you some other idea of what was going on in the world. Now your question was, "How come I was close to my mother?" It was because we were the only two people that were really at home all the time together, and we kind of managed the home and all the responsibilities between us. And we always had a good relationship, all the time; we still do. The only problem we have is that my mother still looks upon me as the baby of the family, despite my advanced age.

Sherkow: Aren't mothers usually that way?

Dresselhaus: Yes--well, I think so. I mean, she hasn't ever accepted the fact that I have grown up.

Sherkow: Yes. That must be kind of hard, in a way.

Dresselhaus: No, it's not, really. I think it's awfully cute, though. She's still as concerned about me now as she was when I was a little girl.

Sherkow: Right. At another point you mentioned that until you were about twenty or twenty-one, your family was at the lowest poverty levels. I was wondering what changed that situation.

Dresselhaus: I think it was the general improvement of the economic situation during the war years and postwar years. It was very, very hard to find a job during the Depression, and my father had no training, so his jobs were all of the laborer-type. That kept us at the poverty level.

It was always hard for him to find a job. And my mother, in the beginning, wasn't completely socially-attuned to working; she only started working out of need. Working in this orphanage was very small pay for very hard work. When I was in high school, she had this job in a leather factory, and the pay was somewhat better because the minimum wage had increased. Some of the other considerations were that my brother was financially independent by that time, and I was financially independent. I always had quite a good income, starting with high school because I used to have after-school jobs, and whatever. So by dint of lots of effort on everybody's part, our financial situation improved somewhat.

Sherkow: Did your father find jobs, then, at this particular time?

Dresselhaus: During this particular period, when I was in high school, his situation wasn't very good because of his illness, so he was not working a lot of the time. And when he was working, he wasn't earning too much money. But the rest of us were doing better. He was no longer the major breadwinner.

Sherkow: Do you and your brother contribute now to your parents?

Dresselhaus: We used to do it actively, years ago, but my parents never liked it; they felt that they wanted to be independent, and they made out quite well by themselves. They live modestly, but they live respectably. What happened later on was [that] my mother went on to nurse's training. When I was a graduate student, my mother went back to

school and completed high school and nurse's training, so she became a nurse and then could earn reasonable wages. So, toward the end of her working years, she had a relatively good salary. Her savings plus social security have put her in a position that she is fairly independent, financially, and has a tremendous amount of pride; so she doesn't want to accept money from anybody else. Also, in later years my father found a better job with a better income.

Sherkow: Right. One of the things that I didn't get into in any of the past interviews was the subject of role models. But in reading certain materials about you I found certain information about the subject of role models. At one point you indicated that women school teachers in elementary [school] and high school were role models, as well as a Jewish family doctor. I was wondering if you could just talk a little bit about these role models and what possible effect they might have had on you.

Dresselhaus: Yes. It turned out that the role models were women; I don't know that the sex had so much to do with it. In the background that I grew up in, there didn't seem to be as much differentiation between what men and women did, as in the society that a lot of my colleagues and people whom I met later on came from. You must remember, of course, that my mother worked, just like my father, so at home I didn't get the differentiation between the sexes, particularly. Now, most of the teachers in the school system were women, at that time, so the school teachers I met were women; a number of them were very

encouraging to me and took a lot of interest in me, personally. Now, I don't know that it was important that they happened to be women; they just happened to be women. It's hard now, looking back on it, to try to assess the importance of the sex role. Later on, when I was in high school, since I went to an all-girls high school and all teachers were women, the teachers I encountered in high school, again, were women; certain of them took a personal interest in me, and the fact that they took a personal interest in me made them role models; I don't know how important the sex aspect was, because that aspect wasn't known to me. I wasn't aware of the differentiation between what men and women do until I was really very grown-up. Very grown-up meaning twenty or thirty years of age . . . Our family doctor was a woman doctor who was a war refugee. She had had a really very, very hard time of it. Her escape from the Germans in the thirties was a pretty hair-raising experience and then she had much difficulty in settling in the states: not knowing the language, not having a license to practice. To make matters worse, she had a husband who was also a doctor, but he could never get a license; he kept failing the examination. In Europe, he was the big guy in the family, and here he couldn't even become a qualified doctor; this got to him, and he cracked up from that experience. And she had to cope with him and raise the children and adjust to a new country--the whole bit. She was very interesting, and remarkable.

She was a remarkable person in all ways. She was kind of a role model to me, in the sense that she ran this doctor's office and would accept patients whether they could pay for her services or not; she was

just interested in treating people. And somehow with the people that could afford to pay for their services, she had enough income to survive. But she was only interested in earning enough money to keep herself and her family going; she wasn't in it for the money. She was a real humanitarian. She was a very, very little woman. I think she must have been considerably less than five feet tall and maybe weighed about seventy-five pounds; that's my recollection, a little wisp of a person. [She] took care of just a phenomenal number of people; her office was always open.

Sherkow: How long was she your family doctor?

Dresselhaus: From the time she came to the States, essentially-- we kind of came across her very shortly after her arrival--until I completed college. She wrote all my recommendations for scholarships, and everything else. You know, you have to have somebody that has known you for a long time to apply for this, that and the other thing; she was always the person who did that for me.

Sherkow: But you don't feel that the fact that she was a woman had much [of] anything to do with your relationship with her?

Dresselhaus: I think I admired her, and I recognized that there were women doctors and that women and men did similar work. I think that was the most part of it; in the neighborhood where I grew up, everybody was doing their thing because there was no leisure in the sense [that] there wasn't that much money to go around. I wasn't that aware of the

difference between the sexes. In that sense, I think that she did provide a lot of stimulation. But she provided stimulation because of the very remarkable person that she was, rather than because she was a woman.

Sherkow: Did she become a family friend, as well as a doctor?

Dresselhaus: Not exactly. No, I wouldn't [say that]. The professional relationship always remained. She was the family doctor and not a family friend. That wouldn't be the right term for it. Although [from] the family doctor, we did ask for things besides healing. A family doctor in a ghetto community does a lot of things. It's sort of like the rabbi in Europe; that's the function. If you have a problem that you want to discuss with somebody, the doctor is the one educated person in the neighborhood and you go to that person for a variety of things; it isn't only medicine.

Sherkow: Right. That's not the situation today, at least not the situation that I have with my doctors and any of my friends have with their doctors.

Dresselhaus: I still maintain something of the same relationship with all doctors. I still go to the doctor that I have here at MIT, who has looked after me for a long time, when I have a question about things. I think we have very good personal relations, and I feel he really cares about my state of health and well-being beyond the health

itself. We have a pediatrician with whom I have exactly the same relationship with respect to the children; he doesn't treat adults, but he does the kids. So I wouldn't say that this kind of doctor has disappeared. I think you have to look for such people, but you can find them. I've just been lucky; maybe it's because I assume that a doctor's supposed to do more than just look after your colds and flu, and whatever.

Sherkow: You mentioned that you weren't aware of the sex differentiation until you were twenty or thirty. What--

Dresselhaus: What made me aware of it?

Sherkow: Right. (laughs)

Dresselhaus: I think what made me aware of it is [that] after I left Hunter College, I got into the science business and discovered that there weren't any women in it, or very few. Initially, it doesn't hit you because you're too busy doing your own thing and trying to keep up with your profession. But, eventually, this does ring a bell. So, I'm saying that sometime after I finished college and I got into the real world, I became aware, in time, that there weren't many women around and maybe it was harder for women to get ahead.

Sherkow: You mentioned earlier that getting into Hunter High was a turning point in your career. And you highlighted the fact that the parents of the children who went into Hunter High had different ideals for their kids, and that as a result you changed your ideals.

Dresselhaus: Well, it wasn't that I changed my ideals but I had not been aware of all the possibilities; going to Hunter High broadened my horizons, rather than changed my ideals. I think there's a difference. I think my parents also had very high ideals and ambitions for their children, but they weren't very well-delineated because they didn't know what all the options were. They just wanted the "best" for their kids, but the best wasn't well-defined. Whereas the parents of the children whom I met in my high school came from a different kind of society where they had been exposed to many possibilities. Thus the kids knew a lot of these things from their parents, and I found out about these options through them.

Sherkow: So you wouldn't characterize your parents' influence, in terms of their ideals, as really that different?

Dresselhaus: Well, they weren't different in principle. They were different in detail in many dimensions. For one thing, very soon after I got into my own things, my parents were completely unaware of what I was doing and they didn't understand my life. They had no understanding of what I was doing in school; that is, when I was going through high school, my parents weren't knowledgeable about the sorts of things that I was studying. They kind of lost detailed contact with my activities, so they could only approve in a general way that going to Hunter High School was a pretty good thing to do. But what I was doing there, they had no idea or appreciation for, whereas the parents of the other kids had some substantive ideas of what their children

were doing. Now I had another intersection point with parents that were different from the parents I met in my neighborhood and that came from music school. Did that ever come through on any tapes that we talked about music school?

Sherkow: No, that came through in things that I read.

Dresselhaus: Well, music school had a big influence on me--even on getting into Hunter High School. As a matter of fact, without music school, I never would be where I am today--not in any way. Music school was the first way that I left the environs of my neighborhood. If we didn't discuss music school, and you're interested in it, we could talk about that now.

Sherkow: We didn't discuss that aspect.

Dresselhaus: Well, how I got into the music school business was the following: I had a brother who was a child prodigy, and he was so enormously talented that everybody wanted to teach him, so he got rather good teaching. Looking back at it now, the teachers weren't all that good, and they would've been better, had my parents known more about it. But they didn't know about it, and we children didn't know about it, either. But my brother did have a tremendous amount of talent. We moved to the Bronx because he had been given a scholarship by a really very fine violin teacher. But the year we moved to the Bronx to be right close to where his studio was, he died. We remained

living in the Bronx at the same location for many years, but the teacher wasn't there. After that, we traveled to the other end of the city for violin lessons because another teacher took my brother over.

Now, how I came into the business was that I had a very good musical memory and all the pieces that I ever heard, I could sing; I could sing them at a very, very early age. The teachers who taught my brother thought I was going to be another musical prodigy, so they wanted to teach me. As a side benefit, I got lots of music lessons, but I didn't get music lessons from the same teachers as he had; I had lower-level teachers at the same music school. My teaching, as it turned out, really wasn't all that fantastic. But I didn't put very much effort into the violin, either. It was a case where I had a lot of talent but not very high motivation; that's kind of irrelevant to the argument.

I did, however, have enough talent and enough motivation that I remained in music school through most of high school, and the influence of that on my scientific career was that I met all kinds of people. People that went to music school were not like people in my neighborhood; they were different kinds of people. A music school would have maybe five percent scholarship students, a very small number of scholarship students; I was one of these. The rest of the people were paying people. The people that paid for music lessons have to be pretty well-off; they were middle-class people, professionals, and so forth. So in music school I met this kind of parent and child--the same kind that I later on met

in high school. I met such people at a rather early age through my music school career. I started music school when I was about six or seven years old, so I was in music school all my early life. I quit music school when I got very sick during the middle of my high school career, and I had to stop something. I got the whooping cough, and I missed almost a full school year.

Sherkow: What year was this?

Dresselhaus: This happened during my junior year of high school; I almost missed the whole year.

Sherkow: That's a long time.

Dresselhaus: Yes. I was sick for a long, long time, and unable to attend school; I mean, I had to stay home. I missed about two-thirds of the school year, I guess, a lot of time.

* Portion removed; see Appendix.

Sherkow: So you indicated earlier today that going to music school had a great influence on your scientific career.

Dresselhaus: Yes, well I sort of explained how that happened, I think.

Sherkow: Maybe I didn't get it . . . (laughs).

Dresselhaus: Oh, well--

Sherkow: The people that you met?

Dresselhaus: Yes. At music school, I met a new kind of people, both children and adults, that took an interest in excellence, in perfection, and in learning things; say, an intellectual approach to life, which was something I didn't see in my own neighborhood. And science is really an intellectual approach to learning; it's in a different realm from music, but it has much of the essence of what it takes to be a successful musician.

Sherkow: Okay. Is that why you kept on in music even though--as you say--you disliked it?

Dresselhaus: Well, I disliked it, but I liked it at the same time. I had made up my mind that I wasn't serious about music, and I didn't put a lot of effort into it. But, nevertheless, I enjoyed music school; I didn't enjoy practicing, but I enjoyed music school, and I enjoyed playing, but I didn't enjoy playing for other people and performing. I've enjoyed music very much all my life; I've kept up my playing; I still do.

Sherkow: Violin?

Dresselhaus: Yes. It was a situation where I didn't enjoy it for a profession, but I enjoyed it as an avocation. It was too much hard work for--

Sherkow: Well, you were also doing a lot of other things.

Dresselhaus: I was doing too many other things. I wish today that I had spent more time at music during that period and had been more serious

about it. But, it didn't work out that way, and I now have to accept what I didn't accomplish as a child.

Sherkow: Why do you feel that you wish you had done more?

Dresselhaus: Oh, later on, when I became a little bit more of an adult, when I was a graduate student, I went back to music. I started doing a lot of playing again, and I have played the violin ever since. I just have always felt that if I had spent more time at it as a child, I would be more professional at it now. I mean, the level of my playing would be higher than what it is. That is, I have a lot of unexploited talent (laughs), put it that way; I've always felt that about my playing, ever since I've taken it up again.

Sherkow: Yes. In what respects are you involved in music today?

Dresselhaus: I should go back because music has had a very important influence in my scientific career. Music sort of runs through it, in and out, many times. I met a lot of people through music that later have helped me in science because there are a lot of science people who are musicians.

Sherkow: Like who? Are there any people that you can mention?

Dresselhaus: Well, no, it isn't important-type people that did important things for me in terms of career things, but it was people who helped me with an experiment, who had some facility or some piece of equipment. Or we'd get into a discussion after a chamber music session that gave me

an idea which later I applied to a scientific problem. Put it this way: what the music did for me was to introduce me to a wide spectrum of other people whom I wouldn't have met through my daily professional life. I think it also had a big influence on my contribution to the women's movement because, again, I met many other people and took a broader view of life and various professions that I would [have] if I had just been doing my own professional thing.

Sherkow: In terms of the women's movement, you mean you met other individuals?

Dresselhaus: Well, yes; I met people whom I wouldn't meet through the lab. And then there were other things, like when I first came to MIT, and I wasn't as busy as I was later on, we used to put on chamber music concerts here; I used to play in the department string quartet, and I used to get together with students. We'd work up a program, and we'd put it on for the whole department. People liked that a lot. I don't think the playing was all that great, but we used to get a big audience and a lot of favorable comments. I think it was awfully good for the spirit of people in the department. There are various things of that sort that I did just because they were fun. I also put on a number of concerts while I was at Lincoln Lab. I'm just saying that music has threaded my professional career in many ways. Today, I don't really do much playing other than with my children. My children are all very good musicians and we have "house music," as I call it, now.

Sherkow: "House music?"

Dresselhaus: Well, we play at home. We have family chamber music once a week; we get together as a family, and we play with each other every Friday night--for the whole evening.

Sherkow: Do you all play different instruments?

Dresselhaus: Yes. We have many combinations of things. My children are getting to be too good for me now (laughter). So it won't be too many years from now when they won't want to play with me; however, I'm enjoying it right now.

Sherkow: Who organized this family chamber music?

Dresselhaus: Well, that just developed with time. In the beginning, of course, the kids couldn't hardly play at all because they were just learning; it started with just a few of them. We had maybe just duets, or trios, but it wasn't too long before the others wanted to join in, and I'd say, for the past three years we've had regular Friday night quartets.

Sherkow: Who plays what? Maybe that would be a better indication of what instruments are involved.

Dresselhaus: I have two children that play violin, two that play the cello, and three that play the piano; I play the violin and viola myself.

Sherkow: What about your husband?

Dresselhaus: He's the conductor (laughs). In the beginning, he used to keep peace between the children, and now he's the impresario.

Sherkow: Do you compose your own music?

Dresselhaus: Well, no, not really. I've composed a few things, but I'm not too good. I was a super student when I went to music school in theory; it was my really best subject in music school. Maybe that's because it's like mathematics; it's a combination of mathematics and art which I was very good at. Not only was I good at it, but I really loved it.

Sherkow: Did you get your children involved in music?

Dresselhaus: That evolved in a very natural way. It wasn't my idea; it was kind of their idea in all cases, pretty much. When they were little, I used to play [in] a lot of quartets. I used to get roped in for playing for churches, for church services, and, oh, concerts in the suburbs, and in different towns. Many towns around here want to put on musical programs for one reason or another, and they don't want to pay much money. So they get amateur players who will play for nothing; the players aren't so bad that you can't listen to them, but we were really pretty bad. So that's how they get people like me to perform. Especially for church services, they go in for amateur playing quite a lot.

So I used to take the kids to those performances. Of course, to put on a performance you have to practice for the program. Since I had

a job and little kids, it was harder for me to travel than the other members of the quartet or quintet or whatever group that was involved; so the practice for the programs almost always happened at my house. In this way, the kids heard a lot of chamber music and met a lot of people playing chamber music, and they got the idea when they were little that almost everybody played some instrument at a competent level. They sort of grew up with that idea; I don't know where they got the idea, but they've had that idea from a very tender age. So when they got to the point of starting school, they figured that it was time for them to take up some instrument and become proficient. That's how it worked; it was really very easy. I speak to a lot of parents who have kids and try to give them music lessons. And for them it's a big hassle, but it was not that much of a hassle in our house; the kids really have taken to music and have enjoyed it.

Sherkow: In another article that I read concerning you, you mentioned that music helped you in socially adjusting to the class-conscious England of the fifties.

Dresselhaus: Oh, yes!

Sherkow: I was wondering if you could just talk about that?

Dresselhaus: You see, the people at Cambridge were kind of elitist people, and my background wasn't exactly elitist, if you can see that picture. However, I had all sorts of attributes that were confusing to my British colleagues. That is, I had a good undergraduate liberal arts

education, so I was what we would call well-read, compared to the Cambridge students with whom I was associated. This might surprise you, but it, in fact, was true. See, I had gone to Hunter High, which was a very good academic school, and then I had some years at Hunter College, which was very much liberal arts-oriented; so I was really well-read. I could play the violin at a respectable level, and to the English, if you can play the violin that well, you had to come from a pretty well-educated home. Right? And then I was singing in the Cambridge Choir; I was pretty good at that. So my music, together with the liberal arts background, made me seem like a kind of person that I really wasn't. But this fact was never discussed; I'm saying that music helped me fit into the class of people that I met in England without any compromise. By that time, I had social graces like other educated people; it wasn't like when I started high school.

Sherkow: Yes, I read that somewhere.

Dresselhaus: The biggest thing that I still remember in this connection is a very amusing incident. In the junior high I went to, the community school, the kids were very rough and the teachers never could keep order. If you ever had a class where anything was taught, that was amazing. So, when I first arrived in high school, it was hard for me to imagine that the teacher would keep order in class and teach anything. There were a couple of kids in this class who had come from similar schools to [mine], and we got tired of sitting still all day. We had recess one day--this was very shortly after I arrived in high school--and the

couple of us who had come from ghetto schools got involved in this board-eraser fight, and we had board erasers flying all over the room; it was really something. These other kids who came from a different environment, they were pretty amazed by all this. They thought the board-eraser fight was so funny, that they egged us on (laughs). Well, things really got out of control. Then suddenly the teacher walked in, with the ending of recess, and she got hit in the face with a board eraser that I threw (laughs).

Well, I don't remember being punished. The teacher was so amazed about all of this, she didn't really say anything. (Laughs) And that ended that; never more were there board eraser fights at Hunter High. That was the end of it for me. But there was a lot of social adjustment that had to occur from my past to face the present. But all of that social adjustment was out of my system by the time I got to England.

Sherkow: Why was it possible at Hunter High to control students, and it wasn't possible at the neighborhood school.

Dresselhaus: The kids were interested in learning at Hunter High; I mean, at Hunter we had a very select group of kids, and [in] the neighborhood school that I came from, nobody was interested in learning anything. The students weren't interested, and the parents weren't interested that the students learn anything; the level of education was just extremely low. We know well what happens in various ghetto schools around Boston. A similar sort of situation happens in these schools today; the teachers

are happy just to keep order, and the level of the education transfer is extremely variable from school to school. I mean, there's nothing that the state can do; you can't legislate education.

BEGIN TAPE ONE, SIDE TWO

Sherkow: When you were in junior high school and high school, you did a lot of tutoring. I was wondering if there was an influence of this kind of environment on you?

Dresselhaus: There was an influence--? I don't understand the question.

Sherkow: Of this environment on you. You mentioned that the people that you tutored tended to be very well-off people.

Dresselhaus: Oh, yes. Let me qualify this. I started tutoring when I was very young. My first job was when I was still in grade school--my first student, that is. Now, the people for whom I taught when I was pre-high school were very poor people; I got paid very little for the tutoring, but it was good experience--it was experience. The social influence happened when I was in high school; it was then I started getting tutoring jobs [where] I was hired by people who lived outside the neighborhood. Those people tended to be very well-off, if they could afford to hire a tutor. Throughout my college career--most of the tutoring I did was while I was in college--I met very wealthy people through my tutoring jobs.

I wouldn't say that all of those contacts had a very good influence

on me. As a matter of fact, they had a mixed influence on me. When I was young, I used to think that all wealthy people were very intelligent because all the wealthy people whom I'd ever met when I was a kid, all were intelligent; they all were doing fabulous things, or they seemed fabulous to me. As for example, through music school. But when I was a tutor, I met all these wealthy people who just couldn't keep up academically with any of my own poor friends, and here they were with all these means, and the kids often had so little motivation! I found it completely amazing to meet people who had all of this opportunity and weren't making use of it. Well, that's the way the world is, but I wasn't aware of that when I was a kid; I just found out about that in the process of growing up.

So, the people whom I met that had a positive motivation on my development--let us say, people from the other side of the tracks--were parents of the kids from the music school and the high school, but not the parents of the kids that I tutored. And had I met this kind of wealthy person earlier, I might have been less motivated to go on for higher education; that is, had things been different, life on the other side of the tracks wouldn't have seemed so bright as it did. That is, the people who hired me as tutors were often people that had many problems, in addition to having children who had educational problems. These people often had a lot of family problems, and I found out through them that wealthy people had problems just like poor people. So it was educational in that sense, but my contact with wealthy employers was quite a different experience from the other kinds of wealthy people that I had known as a child.

Sherkow: So that might have served to not be an incentive to go on.

Dresselhaus: Yes, that was more of a disincentive, yes. Also, my relationship with some of those people was sort of strange; you get to be taken like the servant of the house. I remember one time I worked for a family [where] there was a contagious disease going on--I don't remember exactly what the disease was--we can call it chicken pox or measles, or something. One of the children had this disease, and the other one whom I was tutoring didn't. But the particular disease that was going around the house was a contagious disease that I had never had. Very likely, I would have contracted the disease, had I come to give the lesson. The family expected me to show up for the lesson just like a regular, normal day. I was a little bit uncertain whether I should go there and give the lesson; I asked my mother what she thought (laughs), and she thought I ought not to go, so I phoned up that I was going to miss this lesson because of the disease in the family. My employer was pretty outraged that I didn't want to come.

Sherkow: That's amazing.

Dresselhaus: So there were things like this that kind of shocked me; I remember this particular incident to this day. I may have lost that student from my fold, I don't remember the outcome of my job. I just remember that I didn't go to teach that day. I had more lessons than I knew what to do with, so I could pick and choose.

Sherkow: I had just thought that the influence of that particular environment might have been similar to the influence of the music students and their parents, [but] it wasn't (laughs).

Dresselhaus: It was the opposite; it was very opposite. My tutoring sort of made me very much aware of how unfair the world was because I saw all these people with fantastic opportunity that was wasted; it bothered me.

Sherkow: That could be an incentive, though, in itself, to not be like them but still be successful.

Dresselhaus: Oh, I used to like my students; we had a good relationship. But it just made me aware of a different aspect of life that I'd been totally blinded to before.

Sherkow: Did it make you bitter or anything like that?

Dresselhaus: No, no! I'm not a bitter person (laughs); I'm not bitter about anything.

Sherkow: It was educational. Okay.

Dresselhaus: Well, they did me a lot of good, all these people; tutoring was a good source of income for me, and I'd say most of my employers treated me well. There were a few that treated me like a servant, but I'd say most of them were very thankful for my service, which was often beyond the call of duty; I often helped my students in many ways beyond the lessons.

Sherkow: At another point, you mentioned that your neighborhood was very rough, and there were tensions of many kinds beyond the racial tension.

On a day-to-day basis, what kind of an effect did this have on you?

Dresselhaus: Oh, well, I stayed at home whenever I could. It had the following effect: it was kind of dangerous in the streets, and my parents were always very much fearful about having us out of sight. So, if we were going to play out-of-doors--this was so from my earliest age--if my mother or father couldn't be right there, watching the action, we weren't allowed out-of-doors.

Sherkow: Was this when you were very young?

Dresselhaus: No, this was all the time; this wasn't just when I was very young. Now this only applied to play activities. I'll tell you some of the dichotomies that, looking back at it now, don't make any sense at all to me. For playing ball or recreational-type child activities, I was only allowed out when I was under the surveillance of either my own parents or a trusted person, which was usually the parent of the other child with whom the activity was going on. And this meant that the amount of activity that I could have out-of-doors was extremely limited because of the unavailability of watching parents. Now, the ages I'm talking about is through junior-high school age. I'm talking about times when I was a teen-ager; the neighborhood was so rough that a child couldn't take care of himself without help. Now, my parents weren't very strong on athletics, and they kind of discouraged us from being in sports so the combination of the neighborhood I grew up in [and] my parental attitudes meant that a lot of playing activities that other kids get into--or middle-class kids get into--were completely absent from my

upbringing. Well, that gave me even more time to do serious things because there was so little opportunity to be outside playing with kids. Even if I had the time, it would have been difficult.

Now, on the other hand, despite the fact that I say that it was all so rough, and you couldn't do this, that, and the other thing, I was allowed to go by myself on the subways for very long trips when I was very, very small. At age eight or nine, I started going by myself across New York City on the subways on trips with many train changes. Now, how my parents allowed that operation and not the other is a little hard to understand, looking back at it. But the long subway trips involved an educational activity, when I was on the subway going for a music lesson or whatever; this had a purpose. Nevertheless, I was still going through the same dangerous places, still going by myself.

Sherkow: So, do you think maybe it was not as dangerous as perhaps your parents thought?

Dresselhaus: Well, yes and no. I think they probably were too doting and too careful. On the other hand, the neighborhood I grew up in has had and still has one of the highest crime rates in the country, and, I guess, the chance of survival through adulthood, without proper precaution, is pretty small in these neighborhoods. Homicide rates are just very, very high. Not only homicide, but robbery and attack, and sexual attack, and all of that, are just pervasive everywhere. Now the thing that helped me a lot was [that] I was friendly with a lot of the gang people in the neighborhood. The gang people let me go unmolested in the streets. Thus

I had a little bit more freedom than the average person. I wasn't, myself, a member of any of the gangs. You know what a gang is? Organized crime? (laughs)

Sherkow: Yes. (laughs)

Dresselhaus: We had a whole bunch of those gangs in the neighborhood, and I used to know a lot of the gang leaders. The gangs used to fight each other, but if you weren't a member of any gang and you were on good terms with everybody, they would let you pass without attack; I was living in that sort of status when I was a kid, so I suffered relatively little combat compared to a lot of the other kids I knew.

Sherkow: But you did some?

Dresselhaus: Oh, I was beaten up. Oh, yes. Of course.

Sherkow: You were beaten up?

Dresselhaus: Oh, people were beaten up all the time; that's part of living in a rough neighborhood. But I wasn't beaten up really badly; there was no loss of limb. But I was attacked by gangs of kids a few times and bruised here and there; [I] sometimes came home a bloody mess.

Sherkow: How did you get in good terms with some of the leaders?

Dresselhaus: Oh, I knew them from our neighborhood school, and when I got into Hunter High, I was sort of a neighborhood heroine. And there was another thing that helped a lot. As a kid, I was very active in interracial affairs, trying to get the blacks and the whites to work better together. I advocated community facilities. I was one of the kid leaders in setting up an interracial settlement house for both blacks

and whites. I had a lot of black friends, good black friends. One black used to tell another about white people who were okay. And so it was that I had friends in both the black community and also in the white community; these contacts helped me with walking through the streets safely at night.

Sherkow: This settlement house was set up?

Dresselhaus: Yes. When I was in junior high school, this interracial settlement house was set up, and I was active in trying to raise money for the settlement house. But later on, when I got into high school activities, I got less involved in this kind of thing. But I still had the respect of neighborhood people; I had my Brownie points that lasted for many years afterwards, because people in the neighborhood remembered me.

Sherkow: What was the long-term effect of growing up in this kind of a tension-filled environment?

Dresselhaus: This environment, in itself, made me very aware of people and what they were doing. Later on, I again had occasion to live in another violence-ridden place; that was when I was a student at the University of Chicago, and that neighborhood was very similar to the neighborhood I grew up in. A lot of the things that I learned about taking care of myself in a hostile environment served me very well, like walking in the street with "your eyes behind your head," so you can watch everybody and their motions as they walk along the street.

And if somebody is doing something that is a little out of the ordinary, I would be aware of where they were and what their velocity and direction happened to be. So you adjust your velocity and direction appropriately so that you wouldn't intersect with the suspicious people. As a youngster I learned all sorts of things like this. I learned when I needed help from the police in a particular situation. So my upbringing in New York turned out to be very useful when I was a graduate student in Chicago. I learned to live with danger around me; living in a dangerous environment was part of the game of life.

Sherkow: What about now?

Dresselhaus: Oh, well, I don't think this is a dangerous environment around Boston, no.

Sherkow: Certain places.

Dresselhaus: Well--yes, but it's nothing compared with what I have been talking about. There's really no place in Boston that scares me too much. When I'm out in some of the bad neighborhoods of Roxbury I walk fast, but I don't worry about being there by myself in the night; I park my car on the other side of the Mass. Turnpike if I'm looking for a parking space when going to the theater and I don't worry too much about it; without my New York upbringing, I might not do such things.

Sherkow: Not do that?

Dresselhaus: I might worry about it. I come to MIT at night, by myself, oftentimes, and I don't worry too much about that, either. I think other

people who didn't have this background might worry about walking in desolate places.

Sherkow: Yes, or they might avoid being in that kind of situation. Now I was wondering about an indirect influence of your brother and his activities on your own ideas and values and activities. I was thinking along the lines of setting some kind of an example or--

Dresselhaus: Yes, well, I think of all the people--role models--he was probably the biggest role model I ever had because he was right there at home, and everything he did always worked out well. So he was a big inspiration, and he was a frustrating inspiration at the same time because he was just so inordinately gifted. He still remains one of the brightest people I've ever met. And there I had him at home all the time when I was a child, so--

Sherkow: That could have discouraged you, though; it might have discouraged other people.

Dresselhaus: I never thought I could compete with him, so I didn't especially try. Thus I went into things that were different from the things that he went into. I wanted to go to a different high school, and I wanted to come in contact with different people; in some ways I was off to a disadvantage from the beginning because everybody who ever met him remembered what an outstanding person he was. I thought I had to live up to their expectations, and I couldn't, so I tried to avoid that situation.

Sherkow: It turned out that way, right?

Dresselhaus: I deliberately took a different tack, so I could be myself, I didn't want to be my brother's sister. That attitude was a big help. He was a very positive influence, not a negative influence, and I think he was an encouragement, himself; I think he always thought I could do something, too.

Sherkow: I was wondering if you could summarize this early home environment. The way I pictured it was to describe the early home environment and early educational experiences which led to the development of your own high self-esteem and confidence.

Dresselhaus: High self-esteem is the wrong word because I didn't have a very high opinion of what I could do when I was a kid. As a matter of fact, I had a very mediocre opinion of what I could do, and I had many, many doubts about myself. I think my environment provided a very big stimulation and motivation for trying to do better than what I saw around me. I wanted to better myself in every conceivable way. I think the main thing to my success, whatever it is, is motivation. I think it's more motivation than ability. I didn't always know in which direction to point, but I did have some ideas--I had some general ideas but not specific ideas; beyond the general ideas, I had a great deal of drive. And I had help from people on the way; at every stage, there was somebody who came out of the woodwork and helped me make the right decision at the right time.

Sherkow: Are you thinking in terms of teachers?

Dresselhaus: No, not necessarily teachers; colleagues, just random people. What I was saying is they pointed me in the right direction; they pointed me in a direction which turned out to be fruitful. One never knows what the right direction is. In life there are many, many options, and you take on^e of the many, and that's the one you test; you don't know, really, what the other options would have led to. But they did help me along fruitful directions, and I'm very thankful to the many, many people that did.

Sherkow: Maybe [I found] an example of this. I read that when you graduated from Hunter College, at the graduation a famous mathematician spoke, and she specifically singled you out and said something.

Dresselhaus: Yes, after the ceremony, she talked to me; that's an example of personal help that I remember until now. This incident did have some influence on me. It was a one-shot thing, but I still remember it now, and it was a very positive stimulation to go on with my education.

Sherkow: Who was this?

Dresselhaus: Mina Rees, who was a well-known mathematician and also college administrator.

Sherkow: Did she single you out in a speech addressed to a whole group of people?

Dresselhaus: No. no. Just after the commencement, she congratulated a few of the graduates; I was one of a very small number. I thought that was very nice, but Hunter College, as a whole, was like that; it was a very, very big place, but still there was a lot of personal attention to individuals. MIT is like that, too. MIT is a very big place, but through the individual research projects that students do--for example, the UROP and other programs that they have--students do have opportunity for a lot of faculty contact. And they have a lot of opportunity for personal attention. This is much better than my experience with Mina Rees, because it's a sustained activity.

Sherkow: Did she make any comment about going on in school?

Dresselhaus: Yes, well, but I was already planning to go on then, you remember. This incident occurred on graduating college, and I already was heading for Cambridge at that time. Mina Rees knew about many places and many things, and she thought that my going to Cambridge was a good thing to do, and said so.

Sherkow: Yes, that sounds like it could be nice.

Dresselhaus: Yes. It was, you know, just a nice pat on the back.

*Portion removed; see Appendix.

Sherkow: When you were in graduate school at Radcliffe, I've read that, in certain instances, you were the only woman in a class. Specifically,

I believe it was in the Cosmopolitan article. The class wasn't mentioned, but some professor knew your name and was always calling on you.

Dresselhaus: Oh, the professor was really a nice guy. Well, let's clarify that. At Radcliffe, there were more girls than in most other graduate environments and for many of the classes there were one or two other girls in the class, believe it or not; it was really pretty amazing, but it turned out like that. There was one course, however, that I took where I was, in fact, the only girl in the class, and the professor always got to know the names of the girls the first day, so he knew mine. He had the habit of not preparing himself very well for lectures; he was just a perfect genius but a rather poor lecturer and didn't spend any time preparing for his classes; it seemed like zero time for preparation. And the way he kept up with what he was supposed to do on a given day was by calling on someone to tell him what had happened the day before. Now, being pretty absent-minded and not knowing too many of the people in the class, he would always call on the same group of people. It so happened that when he only had one girl in the class; it was obvious that he would know my name from the beginning. So he called on me the first day or two of class, and I told him what happened last time. Then it got so that I knew chances were pretty high that he would call on me when the class started to review what happened last time, because I had done it the time before, and I answered all right. So it just went on like this, and for the whole semester it seemed that for about ninety percent of the classes, I was called on at the start of class to recite

what happened the time before. So I was prepared for this, and performed this service every time. But it was pretty devastating, because I didn't always understand exactly what had happened in the class before. So it put a lot of pressure on me; it was like taking an exam every time class met; that was the gist of it. It was sort of a joke and it was a well-meaning joke, but since the professor found somebody who could help him out, and he knew my name and didn't know too many other names in the class, that's the way the class went.

Sherkow: Glennys Farrar at the American Physical Society Committee on Women in Physics meeting in New York this February ["Career Profiles of Women in Physics", Feb. 6, 1976] indicated that she was married when she was a sophomore in undergraduate school, and she felt that going to school--she's in physics--

Dresselhaus: Oh, I know her.

Sherkow: Right, yes. Right, you were there.

Dresselhaus: Oh, I knew her, anyway.

Sherkow: But she felt that going to school as a married woman was a real advantage to her, because it was less threatening.

Dresselhaus: I agree with that. It's true. That's true.

*Portion removed, see Appendix.

Sherkow: So while you were at Radcliffe, was it seldom that you were the

only woman in a science class?

Dresselhaus: Yes, in most of them, there were others. But not a lot; there were some.

Sherkow: So you didn't feel particularly disadvantages, or--

Dresselhaus: No, I didn't feel that--

Sherkow: Unusual, or odd.

Dresselhaus: Yes, I felt a little odd because women were still very, very much in the minority and in some of the classes, I was the only one. And in one, in which I was the only one, I was so frequently called on; I was the person who was frequently called on, the one and only person that was almost always called on.

Sherkow: Did that serve as an incentive to you at all?

Dresselhaus: What?

Sherkow: Just being in a sort of select group. I mean, there can be disadvantages in that there was a pressure on you--

Dresselhaus: Oh, well, no, I don't think it made a whole lot of difference. Every student wants to do the best that he can, and I don't know that being a woman makes a lot of difference one way or another in terms of pressure. I think it made it easier in some ways; I said before that it made it easier to get fellowship support.

Sherkow: Yes, you've mentioned that already.

Dresselhaus: Because I think being the only one or one of a few just gives you a lot more visibility.

Sherkow: So that would be the advantage.

Dresselhaus: That would be an advantage, yes.

Sherkow: Now, Laura Roth was one of your fellow classmates.

Dresselhaus: Yes, we started together at Harvard. Thus she was in a number of my classes; that's why I say I wasn't the only woman.

Sherkow: Did you become friends?

Dresselhaus: Oh, yes. We've been life-long friends. I don't see her that often now, but I see her annually at the Physical Society meetings (the Solid State Meeting), and we always have a little chat. And there have also been occasions when we've helped each other, professionally, over the years; I think women colleagues tend to support each other.

Sherkow: That's important.

*Portion removed; see Appendix.

END OF SESSION