

Molly Graham: [00:00] This is an oral history interview with Dr. Varanasi on April 4, 2023, for the NOAA Heritage Oral History Project. The interviewer is Molly Graham. It's a remote interview with Dr. Varanasi in Seattle, Washington, and I'm in Scarborough, Maine. We left off at a really exciting point. You had arrived in California, and you were getting ready to go to school. In the write-up that you sent me, you said that an Indian couple greeted you at the airport. Who were they?

Usha Varanasi: [00:35] He was a postdoctoral fellow in physics. I'm trying to remember his name. Anyway, it's best I don't remember his name because our encounter was short and somewhat depressing – they didn't mean to – they didn't realize what they were doing to my mood, which was already apprehensive– they themselves were perhaps not happy in that place and were very traditional so that the wife hardly spoke. He was of a somewhat pessimistic disposition. That time, of course, I had no idea why they were – they didn't say anything bad about Caltech as an institution; they just felt it wasn't appropriate for me because there were no Indian girls, obviously, but there were only a few women students. Perhaps they also meant Caltech was very, very hard. It was one of those hard-driven, technical institutions. They were just warning me of pitfalls that I may encounter. I got a little bit scared because this was my first trip, and that last leg from New York to Pasadena, Los Angeles, was already difficult. My host family was from the northern part of India, so we could speak in Hindi. We spoke in Hindi and English, a little bit of English because I couldn't really speak that much at that time. But otherwise, they were kind to me. I mean, they housed me for a day or two while Caltech appointed somebody from the secretarial pool or somebody to take me around to see if there were any places to rent. They had a listing of where students are welcome and things like that. They took me around, and then I found this house where there were two single rooms to rent. The first thing I needed to do was just have my own place to stay, which was close to the campus. And it was not very expensive. I didn't know much about cooking, especially with Western-style appliances.

MG: [03:17] I didn't realize you were the first Indian woman student there at the time.

UV: [03:22] I was the first Indian woman student. They admitted two women students in 1960. This was only in graduate school. The undergraduate was still not co-ed. Graduate school, they took two women in, I think, 1960, which could be a little earlier because I think Dorothy – somebody named Dorothy was almost finishing her Ph.D. Dorothy and Carole. I met Carole because she was in chemistry, but I forgot her last name. Then, five of us were admitted in September 1961. I was the first female Indian student. There were eight male Indian students. There was one married student – I'm trying to remember his name. There [was] another postdoc. And then there was perhaps one visiting professor. I think that's all [the] Indian population in Caltech.

MG: [04:51] What was it like being the first Indian woman in this position?

UV: [04:55] Well, at that time, I didn't realize how singular it was. All I was trying to figure out was how to navigate this strange place. By the end of September, I already felt the weather was cooler because I was so used to Mumbai's weather. I don't think it dawned upon me that I was the first Indian woman. The main thing I knew, according to this host [who] told me already,

but also I realized that it was all boys. That was more challenging than whether I was the Indian girl. Actually, it was lucky because I was the first Indian girl, so I met my husband-to-be, Suryanarayana Rao Varanasi, who was an Engineering student and took a summer class in Economics. My admission to Caltech immediately drew attention. I was talked about in that summer class by Professor Gilbert, who I think was also the student advisor. He announced that I was coming, and this would be the first for Caltech to have an Indian woman student. In those days, we just called girls – girl students from India. It was a big deal, except I did not actually absorb that part of it. But when I went to the cafeteria – since I was a strict vegetarian then and had not even eaten eggs or anything, it was very difficult to know what to eat at lunchtime. I think almost everybody went there to lunch, so I started going, but Rao, my future husband, had a different schedule, and he did different things. I mean, he had just met me. I stood out because I was wearing Indian clothes and was – am – kind of cute-looking and lost. All of those drew compassion from at least the older people. Even the faculty was so nice to me. The faculty I met – there were especially two faculty: [Richard] Feynman and [Murray] Gell-Mann. Professor Feynman got a Nobel Prize in 1965, and Professor Gell-Mann got a Nobel in 1969 (Please check the years). They both were teaching physics. They had gone to India, to Bangalore, for some conference. They had some [collaboration], so they kind of understood my being a strict vegetarian because the cook behind the counter could hardly understand what I was saying. I did not know all about broth or lard. I did not know what that meant. So, if they had some Mexican kind of thing, and if I said, “Is it vegetarian,” the cook would say, “There is lard in it.” But I didn’t understand what that meant. So, they would come, and one of them would tell [the cook], “Give her tomato rice soup.” I got used to tomato rice soup because it already had rice in it and tomato, and then later Rao introduced me to Pizza with melted cheese. So I used to order a small sandwich – grilled cheese. I didn’t like the cheese that stuck in my – I never had cheese. At first, I just ate lettuce and tomato. They would tell them, “Leave the bacon out.” Those were small acts of kindness. I think they may have been more disappointed at my intellectual ability because when we were sitting – they sat with me a few times at the table, but their conversation was so very complex compared to where I was in my studies. I was just grappling with being in a strange land and not understanding. In some ways, I think if I had gone to Caltech later, I would have gotten more out of those encounters academically. But I think I would have also been awestruck because, in 1961, I did not know that these two kind people were potential Nobel Prize winners. I just talked to them like I would to my uncle. [laughter] That way, I was able to have conversations and share some laughs with these amazing scientists. I don’t know whether the reverse would have perhaps frightened me even more because then I would have known what I was facing. There were so many times I wrote letters. I really wanted to go back because I just didn’t think I could make it. My father said, “It’s okay. You can come back.” But then I realized it was with such fanfare I had come; I could not go back. Luckily, when I met Rao, he started to show me what to buy in the grocery store. He’s very kind and he had a used car. He turned out to be one of the best things in my life. I stayed for about four months in that rooming house. But I found that both Mrs. King, the owner, and Nan, who rented the other room, were becoming very protective of me or almost possessive of me because I was like a little toy, right? I’m so different. I didn’t know much. It was a little stifling. They didn’t preach about religion because I don’t know if they even went to church, but there was, at that time, in Pasadena – and I think even now – Pasadena is very conservative. I did not know that. Going to church was a big deal. I didn’t have any major religious – what do I call it? – stand against anything because, by birth, I’m Jain, but my family

had Hindu friends, and my grandmother has Muslim neighbors. Rao and one married student and his wife – they all realized that I needed to get out of this place because this could become a little emotionally sticky – and I needed to study all the time. I don't remember sleeping at all because I was so scared [of] whether I'll make it in the first quarter. English was different; the usage of English, as well as the pronunciations and subjects, were taught differently. I did not have that much knowledge of the way they were teaching in the USA, although I liked it better than the system in India, with one final exam at the end of an academic year, so you have only one chance. But in Caltech, they said in [the] first week or second week that we are going to have a quiz, and I didn't know what that even meant. I was clueless. Going back to my living space, my wellwishers all said, "In the next couple of months, let's start looking for a place." I would walk around with them, and there would be an announcement on a student bulletin – there would be some little posts. There is something posted saying, "Room available." This is really an interesting thing. I went in, and there was a very beautiful house. Pasadena is very well-to-do, as you know. This was a very nice large house, and in the back, there was a small apartment with one room that was for rent. I liked it because it was a large room and had bookshelves and whatever the students needed. The owner and I were talking about my renting it, and then this old woman, the owner, said to me, "Do you have any Negroid blood?" I did not understand the question. But then, politics, even when I was growing up, was not a big feature in my life – and human rights. I was just a kid studying. So, when she asked that question, I said to her, "I don't know." In India, there are people of all racial and ethnic backgrounds who settled many, many generations ago. So, I don't know all the races I had in my bloodstream. My answer to her was, "I don't know." Then, there was silence, and she went inside, and when she came back, she said, "Well, I just heard that the room is rented." I said, "Okay." I came out. Then I'm telling this to Rao and the couple who were helping me with the search. They said, "Oh, you should say you are from India." This incident stuck in my brain. I remember this so clearly. I did not know how big the racial thing and racial prejudices were. The secretary in the chemistry department was a Dutch woman, and she was also taking some classes. She had a boyfriend who was from some African country, I think, maybe Nigeria. His name was Zeke. They used to have lots of parties. She was a secretary, so she didn't have that many classes. All foreign students would go to those parties. She said every time after a big party, the landlord would come down and say, "You need to move." She thought it was because of the noise. But Pasadena is a university town; they are used to students making all these noises. But then, finally, one person said, "You got too many Black students coming." As she was leaving – she was given notice. This was a Japanese landlord. It's just weird that one minority is against – he said the other tenants were complaining there were too many Black people and whatever words they used those days. I forget. This is the most subtle part of racism. She said, "These are all students from Africa." "Oh," he said, "Why didn't you say that these are foreign students?" So there was a difference between students coming from [abroad] and our own – when she was telling us – and we kept in touch with her for thirty years or so after we graduated. She settled in Paris. We met her in Paris. We used to wonder, "How weird is that? That, if the Black students were from foreign countries, that was okay." Anyway, that's my little encounter [with] racism without even grasping it.

MG: [17:56] Yeah, that's so interesting. You arrived in the United States at a very politically, racially, and socially turbulent time in its history.

UV: [18:07] Actually, for science and technology and space, it was a golden era. But I think for race – and Martin Luther King and everything was happening. So lots of – as you said – but I was unaware. I remember these two incidents must have imprinted somewhere in my heart because it's still quite vivid.

MG: [18:42] I was so interested to learn that you knew Dr. Richard Feynman. Did you also know his sister, Joan? She was also a very impressive physicist herself.

UV: [18:51] I just met him in the cafeteria. He was such a fantastic teacher that even the secretarial staff used to go when he gave a lecture just to listen to him. And people sat – in those days, fire codes were not a big deal, so people sat in the aisles, on the steps of the aisles. It was – what do they say? – filled to the rafters. He was amazing. Then, what happens to my search for housing – I'll go to this – what would happen if I don't find anything, but then – somebody suggested that since there were five girls that had come that year, I should check with them. One was married. One was engaged. Then there were two single girls and me. So, three of us. They were looking for a roommate because they wanted to get an apartment that would be in a quiet place and close to the library. They were both physics students. I said that was perfect. Rao also met them, both Melinda Flory and Jean Hebb. And we kept in touch all these years. Melinda Flory – her father also got a Nobel Prize in the '90s in physics. She was a very brilliant physics student, but she didn't really want to follow all the family pressure. She actually wanted to get married, and she loved cooking and setting up dinner tables. She was my encounter with a perfect homemaker. She knew everything. She taught me how to iron a shirt. I had never ironed because we had full-time help at home. I had done nothing. I didn't know how to clean dishes and dry them. Anyway, she was my teacher in all-American homemaking. Jean was another physics student, and she was a typical scientist who just focused on [the] degree and science and things like that. I only recently reconnected with her because Melinda passed away in 2022, and her husband contacted me to say that she is no more. All these years, we exchanged New Year cards. Then, in the later years, they came over here a couple of times, and we went to California; they had settled there. Those two were wonderful roommates to have because I was very messy. I was not used to taking care of my things. They gave me one room, and they shared another room because they knew that nobody could stay with me. They taught me how to put – because I did not know [about] closets. We had just drawers. I did not know how to – and I'm by nature not that organized. That's [the] beginning of my time. Rao, because he had a car, used to take us to the grocery store. Melinda used to say he is good husband material. We were not thinking about any such thing. She said, "He is very kind. He thinks about unromantic things like taking people to the grocery store, so he is a keeper."

MG: [22:57] Can you tell me the story of how you met Rao and how your relationship developed?

UV: [23:01] So, you read that last story. The last one I sent you was in collaboration with my grandnephew. That's why it's written in the third person because he said, "Let's write as if I'm interviewing you." Then he wrote some, and then he got busy, so I finished it. That's why it's in the third person. [Rao] heard from the foreign student advisor, who was also a professor of economics. They were taking a class in economics. He said, "By the way, an Indian girl – first one – is coming this September for next academic year." Rao was very curious. He was curious

about two things: an Indian girl and then I'm coming from Bombay. He comes from a small town in the South. He had this vision of girls from Bombay. All boys have some visions in their minds. That's why he was very curious. All the graduate students who lived in a dorm and didn't have apartments or families there had a mailbox in the main lobby of a place where they also had registration. He came down on the pretext of getting his mail [and] was kind of waiting around. I'm very easy to recognize when I turn up there looking totally lost. He took me around, and he showed me how to register – and you read that he asked me to Caltech's first dance of the year – I loved to dance, actually, but I didn't know that that was appropriate, boys and girls dancing and all that. From the beginning, I knew he was somebody I could trust. Being good-looking helped, but he had better qualities than just being good-looking. We didn't exactly know – I mean, we obviously were smitten. He's just two years older than me. I was twenty. He had just become twenty-two; he's one and a half years older. We were very young; neither of us had marriage actually on the mind. But it was already romantic enough. We missed each other when we were not together. But mostly, it was very domestic, showing me where to buy [inaudible] and taking my roommates and me around to do shopping, like grocery shopping. Most of the time, I was needier because I had not gone – he always lived in a hostel, even in India, because he was from a small town in the South. He always lived in dorms. So he's very comfortable with the setting, whereas I am totally lost. I think I was perhaps more clinging, but he was very nice. We didn't think about it – since he was ahead of me, he had already finished his master's. I had gone to do my Masters (M.S.). That was the plan. Two years in the United States, get master's, come back to India, and then work with my father and his partner to do maybe a pharmaceutical company because they had some money to invest, and they thought I could help and all that. That was the plan. Perhaps he had a similar plan. He finished his master's. That was the time of space [exploration]. That was the time with all these science initiatives with Kennedy, and things were going on. He wanted to go into aerospace. Caltech didn't have a well-developed department. At the time, he got his degree in mechanical engineering. He was then looking around where to go to do [his] Ph.D. because he decided he didn't want to go home that fast because he was just twenty-two. He wanted to get some work experience and things like that. We were together there only for one year because during the second year when he had some internship, and he was looking for – and got admission at the University of Washington, aeronautics, with a very famous professor, John Bollard. Rao also knew that he could then do an internship with Boeing, and that would be a good way to get a job. About eight months or so after we knew each other, he said he had to leave. That was a major calamity for me. And he also, by then, was really feeling the pull of not wanting to go. But we are still not talking about marriage because we are both still focused on finishing our education and still focused on what our parents wanted or what should be. We were romantically involved, as you'd say, but in a very children-like way because there were no co-ed graduate schools – I mean, everything was very sedate that way or whatever word you want to use. I was devastated. By that time, Melinda got engaged to one of the physics students because that's what she had always wanted to do. She wanted to get married. She had a couple of boyfriends, but she said, "I want to get married." Don Groom proposed to her. He was a physics student. Then they got married. I got to meet Melinda's father, another Nobel Prize person, and the family. The family is so highly educated, but they were a little disappointed that she wanted to get married, but she really did. That was the first American wedding I attended. Then Melinda moved out, and Jean said that she really needed to study a lot on her thesis. She and I were not that compatible, especially in the homemaking aspect. It was Melinda who was the glue that kept us both connected. Then, we

both moved out and into our own apartments. By that time, I had a research assistantship, and I had a little bit of money to have my own – after the first quarter, actually, I had a research assistantship, so I could afford it; the rent was \$125 a month, which was big money. I had a one-bedroom apartment, not even a studio. One bedroom, lightly furnished – there was a bed, a couple of rickety chairs, and a small table, but it was only 125, which is like, wow. Now, you can't think of even a day for \$125. That's what happened. Then he (Rao) went. That year, [from] 1962 September to 1963, I remember as a major crying phase of missing him. And then, a couple of times, we met. There was a rotary club. That was a very big factor in all foreign students' lives at that time. They took us to different places – it was a cultural introduction to the United States. We, foreign students, were taken [on] small trips, long trips. In 1962, Seattle had a World Fair. That's where the Space Needle was built. Rao was already in Seattle because he had already joined his Ph.D. program. Then, meanwhile (in Pasadena), we were told that there was a trip. If we pay a certain amount of money, we can go all the way to Seattle to see the World Fair. For me, Seattle was a big attraction because Rao was there. That was one time we met. We stayed in each – he was not with me, but the students got to stay with each host family. I am not very sensitive or touchy. I don't mind if people ask me a lot of questions; some of them are even prying. I didn't mind because I thought, "They don't know, and they want to know." I'm happy to tell them. However, some students found it very demeaning because they would ask some questions. Some people. The Rotary Club members were pretty educated – they knew what India was. But if I go to a restaurant or something, people will ask me things like if I have seen an elephant. I sometimes laugh and say, "Actually, I have one in my backyard." How do you answer people who are truly ignorant? They feel that they have a right to ask intrusive questions. But I never thought – I just thought they were funny questions. There were always those encounters where people ask whether we have banks and [if] I know how to write a check and whether I understand what checking account and savings account [is]. Well, actually, I didn't understand that because I didn't have a bank account when I was in India. You just learned. One of my hidden abilities that I was not aware of is to absorb knowledge and learn and not take offense. I think those things made me survive and grow because I never took offense at whatever people said because, most of the time, they loved to know – I had very long hair. Sometimes, the boys used to pull my hair. I decided I would wear a lab coat because I was a chemistry student, so my hair would be inside instead of going all ballistic on them. Because I just felt like half of the time, even a long time ago, people are more unaware and ignorant and not hostile. They shouldn't be, but they are. It's up to you how you respond to slights. As I wrote in my essay, if you take [offense to] every slight, I think your life will be so miserable. Then, only you suffer. Who cares? Half of the time, these people are of no consequence, and you learn something from each encounter. So, as I'm going around answering all these questions people are asking and going to stay in their houses that were amazingly beautiful to me – in my mind because I was just living in one room and [doing] the Rotary Club charitable things. Some students felt they put us in a little show because [in the] evening, each rotary club member [host] invited friends to meet, in a way, this novelty. If you take it like that, that they are treating you like a novelty, then it's not a pleasant encounter. I love to tell stories, so I'm okay. I learned from them – how they cook, what they did, what they thought was vegetarian, etc. Okay. Anyway, so I got to see him once – because we are on how the relationship developed. I got to see Rao once, and I saw where he was staying near the university. That's when he was telling me, "When you finish your master's, maybe you want to come here." We are not committing. I'm ready to commit by then. But he was a young boy. Then, we met one more time – because

we found our phone bill was so high because, those days, only the landline, and it was very expensive, even long-distance between states. We suddenly found we had such a huge phone bill. Somehow, the year passed, I finished my master's, and he said, "Come and study in Seattle." What had happened – while he was in California, quite often people came – my relatives. Not often, but occasionally, a relative came to California primarily for Disneyland or things like that. Came to Los Angeles, then go to Disneyland and things like that. One time, some relatives came, and my parents wrote that I should go meet them without realizing that from Pasadena to Los Angeles was pretty far. But since Rao had a car, he said he'd take me there. It never occurred to him or to me that this word would go back (to my family) that Usha is with a boy. Right? It never occurred to me. It's like, "Okay, give me a ride, and we can go, and then we'll do something else, and then we'll come back." We both loved movies. The movies used to be fifty cents or something like that. We thought we'd make a day of it. We'll meet these people, and then we'll watch some movies because it was the weekend. My parents heard. Then, another uncle who was closer to me, my mother's cousin, came, and then again, the news went back because Rao took me there, and he met them and everything. It never occurred to me that he should drop me and then go away and not meet my relatives. That's when my parents started to get really worried. They started to show me – I started getting calls from the strange boys from Denver and New York and others saying, "My mother ...". Those guys were also not interested in me. "My mother says I need to give you a call, and we should get together." All of them were, I felt like, not really anything I wanted. Not only because I was interested in Rao, but I had him for comparison as [to] how these boys were behaving, and I didn't care for it. I didn't do anything. Then, I applied to the University of Washington because I finished [my] master's, and then I didn't want to go home. When I applied, I got no answer, which surprised me because I had pretty good grades and I had finished my master's thesis. This is still the old time when you could just pick up the phone and call the chair of the department. Finally, Rao said, "What's going on?" "I don't know." I picked up the phone. I didn't have a phone, but I went – yeah, I had a phone at home, but I think I did it from my Dutch friend Nel's office because she was there and it was a long distance. Anyway, I talked to him. He said to me – Professor Cady – he was a very kind, nice man. He was the chair. He said, "We are wondering as to why you are coming from such a good school. Why don't you do your Ph.D. there? Why are you coming?" I said, "Because I have a boyfriend there." "Oh, that explains [it]. Make plans on coming," he said. Everything about my resume is just fine. I had a letter of recommendation from my thesis advisor, and I finished everything. They were just wondering why he was advising me to do a Ph.D. there. But I had said to my advisor that my boyfriend is in aeronautics there – so I came. That's how I ended up in Seattle. How far do you want to go?

MG: [41:44] Well, before we get to Seattle, tell me a little bit about your course of study at Caltech and the classes you were taking. In your notes, you alluded to struggling a little bit.

UV: [42:13] Quite a bit. What happened is physics – physical chemistry, most of the classes were – the first quarter was what they call makeup classes where you have to show that you are up to Caltech standard – because graduate students are coming from all over different parts of different schools. We had to take courses that were actually fifth-year undergraduate courses. We actually had a lot of undergraduates in our class. They were so bright. When I was living in my apartment – now, I have a place myself – upstairs, several undergraduates were sharing rooms, and they all found me an interesting creature. They would come down, and I would be

struggling. Actually, they were very good teachers. They would translate things. They would give me their notes and things like that. I managed. But of all the chemistry, physical chemistry was the hardest for me. Maybe it was the teacher who was not sympathetic but also had an accent – it was very fast. I couldn't understand what he was saying. First, when I didn't get very good grades, I got very frightened. Then, just by sheer coincidence, luck – whatever – there was a graduate student who was a TA [teaching assistant] [in] one of the classes, the second quarter, and his name was Alvin Kwiram. The reason I'm saying it is he was so good in – he was a graduate student in physical chemistry. He was so good [at] explaining quantum mechanics to me with examples and with compassion. I won't say, at the time, he knew we were becoming friends, but I became his fan. He was very nice to me. Then Rao helped me with Math classes like vector analysis. [The] first year, Rao helped me with some of the notes and where to get the books – one thing was the library was open twenty-four hours, and most of the time, there was not a librarian. It was like an honor [system] library. You check out books. You put a little note and take the books home, or there are books that are called reference books you can't check out, so you sit there and read. Then, Jean and I and sometimes Melinda – but Jean and I sometimes worked until two, three o'clock, and then we walked back. There were no worries about safety. She and I walked together. I don't remember walking by myself alone, but we didn't have any worries at three o'clock at night that we were walking from the library to our apartment. I would say I don't remember sleeping. I remember working until five o'clock in the morning just working. Practically, I perhaps ruined my health during that period. I hardly ate because I didn't care for whatever it was – cottage cheese and pineapple, whatever. Whatever I could eat because there was no time to cook and there was no time to do anything else. There were some students flunking, so I was really frightened. If I wanted to go home without a degree – I wanted to go home because I wanted to go home, not because I flunked out and they said, "You can't do another quarter." Because they could say that if I didn't get good grades. What will they do? They perhaps get rid of me. I was very frightened. I was studying all the time. I was not eating. It was, I think, a very stressful time. But because I had a couple of TAs who were graduate students who really understood [and] were very helpful to me, somehow, I managed. In the second quarter, my grade went from C to B in physical chemistry and then [from] B to A in the last quarter. Even my teacher, [Professor Robinson], said, "What?" I said, "Well, your TA has been teaching me more graphically as to what quantum mechanics explains, which is almost like theology." You are here, and you are there – the electrons – and you have space in between. I suddenly found it very interesting. [In] organic chemistry, I always did well somehow. You had to take humanities; that was a requirement for any degree. You had to have certain credits in humanities. Well, Caltech doesn't have liberal arts. Economics used to count as humanities, which it is really – economists will be very upset because they consider themselves scientists. So, Professor Gilbert said, "Okay, now what can we do?" He said, "Why don't you write about different religions in India? Why don't you research and then write a paper for each [religion], and I will look at the paper, and that will be your requirement." I wrote about Hinduism, Jainism, and Buddhism because that is what I knew! But that was very good for me because, [in] those days, you had to go to an encyclopedia and reference books because there was no Google to give you information. I feel humanities should be a requirement for any science degree because it just adds to some broader thinking. So, the year is kind of in a whirl. I don't know how I managed it. There were experiments to be done. There was my research. I had a master's thesis to finish. I don't think they had a course-only master's; they had a master's with a thesis. The research had to be done in the lab.

Another encounter. There were two professors who were actually in biochemistry, which was just starting. There was not a Biochemistry department at Caltech. There was chemistry and then biological chemistry, but it was not a separate department. Their offices were in an annex between pure chemistry and, I think, biology or something. All the instruments were in these corridors. Every time I go to do some spectroscopy and things like that with my stuff, I would meet Professor Linus Pauling because his office was somewhere there. He always smiled at me, always said, "Good morning, good afternoon," and gave me the hugest smile. I will always remember it. Now, you see, I did not know who he was because he was not in chemistry. He was in biochemistry. I was so focused on surviving that – I must say, Rao was much more broadly aware. I was like, "I'm going to die if I don't pass," so I wasn't doing anything but studying. I always remember how kind he [Professor Pauling] was. Then, there was another professor called Dr. Dan H. Campbell, in immunochemistry. He was another one who had a big cigar in his mouth, no matter whether he was smoking or not. He always [said], "Good morning," like that. Then, there was *Caltech Magazine* (January 1963). There was a photographer. He was taking photos of personalities at Caltech, big names, or something like that. He took my picture because I am different, right? On that one page, Dr. Campbell is on the bottom, and my photo is on the top. He calls me as I'm walking through the annex. "Come." I go to his room, and he opens the issue – because I had not seen the magazine. He opens this one. "Sign it here. I want your autograph." [laughter] It was the funniest thing. He had several copies. He gave me one [that] he signed and gave it to me. It was an interesting little pleasure – my meeting these two people who did not totally know what I was doing and perhaps even thought I was not smart enough. But I remember them as two people who were very kind to me. What else can I say? This is how I moved from Caltech to Seattle.

MG: [52:15] At this point, how were you thinking about your education goals and the next steps in your career? What did you plan to do?

UV: [52:22] I had no education goals because I was going to do [my] master's and go home. But now that I met Rao – I was doing a Ph.D., but I must tell you, I never thought about jobs or careers or anything partly because of my background. I could always go home. The only reason I didn't want to go home was that I didn't want to marry somebody, even before I met Rao. I didn't want to marry some stranger, which is what arranged marriage would do; you marry a stranger, and then you make life [together], which is (can be) quite successful in many cases, but I knew it wasn't for me, even when I was sixteen years old. I did not want to go back anymore without finishing my degree and, perhaps, hopefully, marrying Rao. At that time, he was still not sure, and I was also not sure. Then my parents are totally panicking. So, I went to chemistry – I enrolled there. In the first year, you need to choose your thesis advisor. Since I already had a master's, I knew what kind of research I would continue. Some people had told me two names in the chemistry department. Dr. Schubert – Wolfgang Manfred Schubert, and another one was Y. Pocker. I think his first name – I don't remember. Those were two in my field. Dr. Pocker was very charming, and I think most students chose him. But somehow, when I saw Dr. Schubert – and everybody used to call him Fred because his name was Manfred – German. He was very gruff, but something there was kind about him. He was not very talkative. He was very gruff. But I talked to a couple of his students, and they said if you work with him, he will look after you. He looked after his graduate students. He went out of his way to take care of them. Rao agreed, so I joined that. Then, the first year there, you had to prepare for the qualifying exams

for the doctorate degree, and you had to do quite a lot of work to prepare. It was a pretty hard time. I had a very nice location. Rao had already scouted where I could stay. Right across the entrance to the University of Washington, there is a nine-story building called Commodore Duchess Apartments. It's still there. That's the only thing still there even though everything around the university has changed because it's the most convenient apartment. The first year, in the first quarter, all I got was a teaching assistantship because you had to have your thesis advisor before you get a research assistantship. Teaching assistantship means you have to grade these gazillion exam papers. And usually, we graded them [at] night because during the daytime, we had classes, and we had to start working on meeting professors. Again, it was so safe. At night, after grading papers – there was one other girl when I was there in the beginning, Alice – she was going to do a master's – and me. The rest of them were all boys. I think undergraduates – there were girls coming in. Anyway, while I was doing that, being a teaching assistant, really one of the funniest things was I was the TA for the lab instructor. There was an experiment, and there were these two very tall boys – they must be six-foot or something – [who] tell me that they can't be in the next experiment, the exam, or something. I said, "What do you mean you can't be?" They said they have training or something. They were actually basketball players, and they were on the UW basketball team. I knew nothing [about] basketball. I know they were very tall, and I was only 61" tall. I said, "Forget it. There is an exam, and you've got to be in there." They both looked at me like, "What in the world? What is this woman telling us?" Because they have an athletic scholarship, and they get this thing to go. I said, "No, you have to be here." They went to my teacher, and the lab instructor came and said, "Usha, this university makes a lot of money with their athletes. So, they got to go. We have to give them special leave...". That was my first experience [of] how all students are not alike and that there are different rules for different sets of students. Six months into – I chose Dr. Schubert, and he was very happy. We were just starting, and I had just passed the first of the four [cumulative qualifying] exams that we had to pass. If you pass four exams in the first year, you are qualified for a Ph.D. If you don't pass four exams, then you have to pass five exams within the next two years, and so on. After six, if you don't [pass] – three years, you have to do six, and if you don't do six, you are out. I took one, and I did quite well. I was happy. But my parents were getting frantic. My mother was not well. They are saying my father was not [well]. See, I don't know. I think the emotional strain was too much for them. I had to go to India because they just couldn't handle it. I was the oldest child. I think my younger sister got engaged or married to somebody without their permission, so they were worried that that's what I'm going to do and what society would say. I went to Dr. Schubert and said, "I have to go because they sent me [here], and they need me." That is when I got another [major] break. He said, "Usha, don't quit. Do not quit. Just take leave of absence, and then when you are ready to come back" – because I know I wanted to come back very badly. "When you are ready to come back, either you tell me, send me a letter, or tell your friend" – because Rao and I both went to see him – "and we will make sure that you don't need to do anything. I will make sure to reactivate your Ph.D. program. If you come in the middle of the quarter, I will give you a research assistantship or scholarship or something, so you don't need to worry about money." Now, can you imagine? Because I would have just quit. If I quit, I had to reapply. I don't think I would have ever come back. The kindness of people at the right time, small or big ...

MG: [1:00:52] I wanted to ask quickly, what was the topic of your thesis?

UV: [1:00:55] It was about the structure of water when a small amount of organic compound is added to it, a dioxin-like thing. What it was was oxygen-hydrogen bonding. These are not bonded, but there is an electric force. When pure water is unstable, if you put a small amount of organic solution, it fits into all the holes, and the water becomes very structured. We measured kinetics. They were trying to figure it out because it makes – if there is a small amount of organic, you can dissolve very insoluble compounds in water. That is then made accessible for many applications. It measured the kinetics of this liquid water becoming structured. I wasn't that interested. I think the main thing I was interested in chemistry was learning about principles, but the specific research was never that exciting – I liked Dr. Schubert, and he was a wonderful teacher, so I did very well. But I knew this was not something – I think, inside, I knew this was not something I would spend my entire life studying. Because for the master's program, we were studying what they call metallocenes, which have become very big now. They are cyclopentadienyls. They're a big structure. There is a metal like manganese, and that makes – when it is mixed in paints, paint becomes very resistant to high temperatures encountered by space vehicles [inaudible]. It was for the spacecraft – during that time, all the research was for what you can do with space vehicles. So it was the paint for space vehicles. This structured water was also for dissolving certain things. They were all very important topics. But for me, they didn't 'rock my boat.' I liked chemistry classes. I liked some amazing teachers. I liked teaching undergraduates. I found that they asked such terrific questions, things that I didn't learn in my undergraduate work, that suddenly made it clear that I had to study to tell them. All those parts of learning I liked, but I don't think chemistry alone would have satisfied me. I did not know at that time. I didn't have a major goal as such about [my] career. I'm a very unplanned individual. I get an idea, and then I want to follow it, and then things fall around it, and I am in another step. Uncertainty doesn't bother me. I tell the students – there are two kinds of students. Some have planned out their career from [the] beginning, and if they don't do it, they will be very unhappy – and others are just discovering themselves continuously. That was the type of student I was. During this period, the emotional drama continues. I went home in '64 – April. I joined in '63 – September – to do [my] Ph.D. In those six months, my advisor must have seen something in me that he wanted me to come back. I feel like I perhaps would have done okay in chemistry if I ended up doing it, but I don't think I would have flourished the way I did, doing what I ended up doing[in NOAA]. So, I go home, and now this is all the emotional side of it or the social side of it. My parents were just so upset when I told them [about Rao] – before going, Rao and I talked. Rao is now twenty-three, not even twenty-five. Marriage is still not totally something he is ready got – and he comes from – we come from two different parts of India. Our languages are not the same. Even though there is Indian culture, it's still very different for us. He is Hindu. I'm Jain. I come from a big city. His family comes from a very small town, but they actually turned out to be much [more] broadminded than the big city people, but that is a different story altogether. Anyway, we didn't make any commitment. He kept telling me, "Come back," but [there was] no commitment. I wasn't sure when I was leaving whether I'd ever see him again. I think he was not sure. I go home. But he's writing to me. In those days, there were no telephone calls – writing to me practically every day. I'm writing to him almost every other day kind of thing. I went back [to Mumbai], and then I told my parents that I had met this young man from South India, and I would like to marry him. We are talking about it, but not yet [decided]. My father said, "I sent you, and you had promised to come back in two years. You are putting me to shame in my community. You just cannot marry him." I felt that he had the right to do (say?) that because he did take a really unique step to do that. Our

community is [the] business community. I told him, "The only thing I can do is not marry anybody." I do not plan to marry, and I'm very proud of that [statement]. I didn't realize that was quite unique. But I told him, "There are two choices. I don't marry, or I marry him because I am not going to ruin some other guy's life. He will be ruined. I will be ruined. Nobody will be happy." My father said, "Okay, then, don't marry. It's okay if you don't marry." I said, "Fine." Then, I have to show him that I meant that. He said, "You stay here. You don't marry. Everybody can see that you came back, and you are keeping up [the] family name." Okay. So I'm going around, looking for jobs because what else can I do? I have a master's. Everywhere I go, the first question is, "When are you going to get married? Come after you are married because the girls [who] come before marriage, we train them, and then they go away as soon as they marry." They were very open about it. "We have other [male] candidates. The second thing is, they are married, they have children, they need jobs." The job became given to the needy more than given to the qualified. Do you know what I'm saying? That was absolutely acceptable then. I ended up [with] many interviews but no jobs. Not that I was heartbroken, because who cares? I was still hoping to go back. After three months, they [my family] kept showing me different boys, but they didn't do a classic showing [of] boys and girls, but they will take me to a party, and then there will be a young man who would come and check me out. I was kind of cool looking because I come from America and all that. So, we talk, and then we come back; they say, "What do you think of him?" I said, "I didn't think of him anything because I told you. I don't think of anybody else that way." Then, my mother is watching all these letters come in. She can't tell my father anything, but she asked my grandmother – paternal and maternal, both grandmothers [to talk to my father]. They met and said, "What are we going to do?" If the oldest child doesn't get married, it's harder to get younger ones to marry because people think, "What's wrong with that family?" Also, my mother said, "What am I going to do [with] her sitting here? All she does is write letters, cry, and look for a job." I mean, it's not a good life for anyone. My younger sister had already gotten married, privately – didn't tell them. It was a major drama. Anyway, finally, three women helped me out because they went and talked to my father and said, "There is no choice. We better send her back. Let her do whatever. It seems like this is a good family [Rao's]. He seems like [he] comes from an educated family. At least he is not like somebody who has another wife in India or something like that." Because I knew his brother [who was in LaJolla] there. Then my father said, "You want to go back, you go back. I'm not helping you [this time] because I'm not interested in your life from now on." But that was just bravado. So, I did everything by myself and with sponsorship help from my [uncle's] friend, Rao, and my advisor. Because I had to get another I-20 form to go back to school and get a student visa. To get an I-20 form, you have to have sponsors. One of my younger uncle's friends felt that [it] was very romantic that I was going back. They said they would be the sponsor. I got sponsorship. I had to do everything. Then, Rao sent me the ticket because my father wasn't going to do anything. But my mother, who was kind of a romantic – and you read that story I wrote [about] my mother, so I don't need to spend time. She gave me a small trousseau and got me all organized. Then, I came back to Seattle in November 1964. I told Rao, "I'm now risking everything. I'm risking relations with my family. So, either we make a decision, and especially you make a decision because I think you are pretty cool. I want to marry you, and I am a hundred percent sure. If you're more than fifty percent sure, I think we will be successful." I hold that on him even now. I said, "That's the best decision I made, and it worked. I don't need to make any more decisions." Anyway, that's how I came back. This may be a good place to stop.

MG: [1:13:30] I was just going to ask – at some point, didn't your mother go visit his family just to get to know them a little bit?

UV: [1:13:37] Right. What happened is I had brought lots of things for Rao's family because Rao had bought shirts – he has a big family – shirts for brothers and [gifts for his mother, sister, and sister-in-law]. I had a whole suitcase that was packed with his stuff, his gifts to send to his parents in a very small town. Once it was decided that I was returning – I didn't know how to send the suitcase. My mother says, "Listen, before you go back, let us, you and I, go to this town, a small village in the South. We can deliver this thing, and we get to meet [his family]." I said, "Are you kidding?" I mean, Rao has not told his parents yet because until I came back, he wasn't going to tell his parents. And that is a small South Indian town where women wear saris differently. We would stick out like sore thumbs, two Gujarati women. But my mother is so cute because she said, "That way, we'll know." I said, "See, he didn't tell me he was a very rich man." I know his brother, so I know Rao is not a married man. He doesn't have a wife anywhere. "What else am I going to find out? And I don't want to go and give his parents a permanent shock because they will feel betrayed by him not telling them. It is his prerogative to tell them." I squashed that idea very quickly, and we shipped it. We figured out somewhere to ship state to state. When my suitcase landed there, it said, "From Usha Shah" – the suitcase said. The younger brothers all knew that (Rao, whose first name is Suryam) Suryam had a girlfriend. Who would bring this many things for anybody? But that was just younger people – then, Rao wrote a letter to his eldest brother, telling him, "This is what he wants to do. This girl is from a different religion, different place, but we love each other, and we know we'll have a good life." "I'm not asking your permission," he said. "I'm just asking [for] your blessings because I'm planning to do this." How should I make parents who are coming from a small town understand –? They had never traveled outside South India. They are very orthodox – they live in a small town. After the eldest brother got this one letter, he said, "You write the same letter that you wrote to me to Father, and Father will ask me to go to him." The eldest brother is a cancer surgeon, so he was in a big town. "He will ask me to go and visit them because they will not know what to do." He [Rao] wrote that letter. The letter took two weeks to go and come. You had to have a lot [more] patience than we have now. You send an email and email back. There is no such thing. So, he sent that letter. Exactly as predicted, his eldest brother [was asked by the parents, and he] went there, and then he said, "Listen, the only thing we have to know is that we have brought him up very well – if he says this is what he wants to do, we must abide by it." You see, my parents' behavior – because I'm the oldest child, so maybe they have no experience. Rao is the fifth in the line of eight. Maybe they have more experience. But also, there are different values, that you always support your child even though they may be making a mistake. My parents felt more like they were losing face. Do you see what I'm saying? It's a little different. But my grandmothers were just very cool. So, he wrote. By the time in November of '64, when I returned – Rao didn't want me to come back until he finished his qualifiers for a Ph.D. So, he had finished his qualifier. I am returning. I have a one-month scholarship or whatever money from my professor, so I can then join in January back to TA and RA [resident assistant] and all that. This is why my life with him [Rao] is so amazing. After I reached Seattle, he finished his qualifying exam for Ph.D. . It would be six more months, or eight at the most, for him to finish his thesis. I came back. I'm already one year behind him [to start with]. Now, I'm set back another at least six months, and mine [is] experimental research and not

theoretical, so I may have all kinds of delays. He knew it would take a minimum of two years to finish my Ph.D. if we were lucky. He felt that if he finished his Ph.D. and got a job somewhere else, then we would need to move because, [in] those days, we didn't think about marrying and living in different places. He said there were two reasons for him to stop his studies. One big one was so that I could catch up. Another [was] he said, "I want to get a job because I don't have enough money to support a family, and one should not marry without having a job," which was a very good decision because, I'll tell you later, that I did not find a job after my Ph.D. for almost fifteen months. One person had to be a breadwinner, which he decided to do. He, in '65 – July – went to Boeing. In those days, you could just pick up a phone and visit the Boeing Company executive. – somebody told him, his professor perhaps, that there was a group that was looking for an engineer. He went to just meet with them. Rao went to meet with him because his professor called and said [he] could look for a job. He went to meet with them, and it just turned out that the engineer they had hired in that group was from Iran. He went to visit his mother, and he got conscripted in the army because they were supposed to do two years in the army. Suddenly, Boeing is sitting with a vacancy – and this young man walks in. Rao's thesis was more theoretical. This group was doing very practical, hands-on engineering work. so they gave him a problem. Rao showed them how – he said he had never seen the inside of a propeller. He didn't even know how it looked. But they gave him that propeller and said, "The following things are not working. Can you look into it by doing some mathematical analysis?" Anyway, he went there on July 6th of 1965, and he got a job on July 6th. So, that got done. Then, we got married on September 14, 1965. So two things he has done – two big sacrifices – one, to delay his getting Ph.D., so I can catch up. This will be my third break if that happens. And second, he gave us a steady income so that [if] we had some economic difficulties, we could survive. I mean, those are quality actions, and that comes from inside. I was sold. I mean, I knew already, but that is how – we were so young, but we kind of had some degree of core that resonated with each other. That's how I started to – then, somehow, maybe because I was so happy now, all my research was going well. I cleared all the qualifying exams pretty fast. I was just doing well. I think this definitely tells you that happiness, or a feeling of satisfaction, makes you perform better. Because before, it was just such a struggle. I don't know. Once this was happening, I had a partner, I had a friend, [and] I was settled and working away. When I was just six months away from my degree, I came home one day and told Rao that my Ph.D. committee said the research was done and that I should start writing. I told him it may take six months or eight months, and he said, "Oops, I don't want to get a degree after you." He talked to his boss, but they were busy [and said he couldn't go on extended leave]. He came home and told him, "Okay, they just gave him a little leeway [flexibility]." He worked full-time. And then until night, two o'clock or so, he would be working on research that involved computers – I remember going to the campus at night – we lived nearby – we went to the campus because they used to have these huge computers that used big cards with holes. I would carry a box of cards, and he carried a few boxes. Because I felt I needed to now support him while he was doing his Ph.D. research. We both graduated at the same time. We both graduated [at] the end of 1967. When we both graduated, I should say the convocation was in June 1968. We wanted to walk together. I am in chemistry and [have] different colors of my cap. He is in engineering. We approached both departments, saying, "We want to walk together in the convocation and sit together." The Chemistry department said we wouldn't be called at the same time. But engineering said that was wonderful because this is something unique, two Indian students – in those days, not anymore. When we got married, we had a host family. Those days, foreign students used to

have a host family. Rao's host family had practically adopted me once they knew I was his girlfriend/fiancee. We got married [at] their house. Invitations were just printed on cyclostyle paper. We asked all aeronautics and chemistry students and faculty – whoever wanted to come to our reception. It was in their house in Ballard. We said we'll pay. Rao said he'd pay all the money for food – eighty dollars. Rao asked me before marriage – because both families said, "Come to India," and I said, "That is the wrong thing to do. If we go to India, they'll all be crying. They all don't understand each other, and I don't want to ruin all my memories of a nice day." Rao said, "But girls like a big wedding." I am never for a big wedding. So, that was fine. His parents were very sweet and sent me a white gold silk sari because they found out that in the US, brides wore white. So they sent me – usually, I wouldn't be wearing white in India, but they sent me this gorgeous white Banarasi silk sari. My mother had given me a trousseau, so I had some jewelry. The reason I'm telling you this is that our host family called all the newspapers – *Seattle Times*, *Seattle PI* [Post-Intelligencer], and Tacoma Tribune – the three big newspapers. They actually came because this was a unique event of two Indian students getting married in their host family's house. Like, wow. But we didn't know because we were getting ready for marriage. A friend who was familiar with Indian tradition made me a very expensive, I'm sure, red garland of carnations because here, florists didn't make them. We get photographs. We don't know because many people are taking photographs. All our classmates are taking photographs. Everybody was taking photographs. So we didn't know [that] some people with big cameras were there, too, because we're too busy getting married and having a small party. We had classmates. We're sitting all on the floor– we had a nice happy time. The next day, we were going to – my professor said, "Take a month off and go and just relax and things like that." A month off was never heard of. Rao, of course, needed to ask for a leave – this marriage was in '65, so Rao had just joined his work. We were going to go to Wenatchee because it was going to be warm. [It was] September; we wanted to go. He had a used car. It didn't work. I said, "Okay, I'll cook some breakfast." He said, "No, not the first day. Let's go out." We go out. The only reason I'm telling you that – we go out, and we have our breakfast. Then, they bring this little cake with a sparkler. They are saying, "Congratulations." "What?" "Oh, you just married yesterday. Congratulations." I said, "How do you know?" There is this big spread in *Seattle Times*, page 1A. Not one column, not a little thing – it's a big article with huge photographs. Then there are three or four photos in other papers. They said they saw it. How many people, people like us, are turning up in a regular breakfast place? It was so cool. Those days, the newspaper used to give you your photographs. They gave us very high-quality black and white photographs. It's all done by our host family. The family was just wonderful. They lived to be ninety-two and ninety-five, Barbara and Bob Adams. Bob was a UW alumnus and Boeing engineer, and they had five children. All three girls wore my saris for the wedding. When they (Mr. and Mrs. Adams) died, we put a memorial bench on the [UW] campus with their name because they were so amazing to us. This one thing has been my life's – another principle is that while you mentor younger people, you should also remember to take care of your mentors because your mentors, when they get old, get lonely. People always think, "Oh, I don't want to take their time." Everybody wants to mentor young people and pay them forward, but paying backward is equally important. So this couple – and my professor, Dr. Schubert, lived to be ninety-seven. We kept in touch with him. I was like a daughter, kind of [since I was the first female student in his group]. We didn't do many things together. But now and then, we'll just connect with him and his wife and take them out to dinner. Every time he read about NOAA or

anything [was] written in the newspapers about me, he felt so proud because Fred definitely was the one who made my career possible because I wouldn't have come back.

MG: [1:31:05] There were so many big moments in those couple of years.

UV: [1:31:08] So many big moments and so many heartfelt actions by people, which some people take for granted and forget about. But, for me, I think that is what makes life rich. People sometimes say, "How did you make life in this culture, which is so different?" I said, "People are not different. People are the same everywhere." It's emotionally how you connect with people. Culturally, we may be different. They go to church; we don't go anywhere. Do you know what I'm saying? We have a small temple in the house in India, and people don't go as much every day or every Sunday. But good people are good people everywhere, those kinds of things. The students, when I give a talk – I give a talk every winter quarter in the psychology department. They use my biographical essay published in ICES 2021. Some people say, "Oh, you got so many breaks." I say, "The opportunities are just floating around everybody. It's how receptive you are to them." I had somebody in the wedding who thought of Barbara Adams as an ordinary middle-class woman who likes all this frivolity – they thought of her as ordinary. We thought of her as extraordinary because she went out of her way to host our wedding and include us in her large family – and when she had three daughters, she didn't need one more. Do you know what I'm saying? I was telling the students about this – and they got it – a lot of them wrote in their intellectual journal – opportunities are everywhere, but you need to recognize and appreciate them. People said, "Oh, you got so many breaks." Most breaks everybody gets; it's just how open and how receptive you are and how that can change your life. Good ending?

MG: [1:33:29] I think so. You've given me so much to think about. I just wanted to ask quickly: Do you have a copy of that photo that went into the newspaper?

UV: [1:33:38] Sure, I'll send you.

MG: [1:33:40] Good.

UV: [1:33:43] You saw that tribute video I sent you?

MG: [1:33:50] Yes.

UV: [1:33:51] About [inaudible]. There is one picture where we are cutting the cake, but I have [inaudible]. I'll send it to you.

MG: [1:33:58] Okay, good. Well, thank you for all your time again, and I'll send you some dates for when we can do this next.

UV: [1:34:08] Is this speed okay for you?

MG: [1:34:10] It's perfect. It works for me if it works for you.

UV: [1:34:13] Oh, yeah, it works for me because I think I would like it when it's written – at least, it will get written, right?

MG: [1:34:19] Yeah, it'll all be transcribed.

UV: [1:34:21] Yeah. Which is a good thing for my family. Okay. Wonderful.

MG: [1:34:28] So nice to see you again. Thanks for all your time.

UV: [1:34:31] Yeah, goodbye.

MG: [1:34:32] Bye-bye.

-----END OF INTERVIEW-----

Reviewed by Molly Graham 5/19/2023

Reviewed by Usha Varanasi 6/10/2023

Reviewed by Molly Graham 8/9/2023

M.S, Thesis-alpha carbonium Ion Stabilization in Derivatives of Cyclopentadienylmanganese Tricarbonyl (1963)

Ph. D.- A study of the Effect of Medium on Positive Ion Ground and Transition States (1968)