

Molly Graham: This begins an oral history interview with Dr. Russell Schnell for the NOAA 50th Oral History Collection. It's our second session. The date is March 29, 2022. The interviewer is Molly Graham. It's a remote interview with Dr. Schnell in Boulder, Colorado, and I'm in Scarborough, Maine. We talked about a lot last time. I was curious if we could pick up today with your time in the Scouts. I was curious how old you were. Was it the Boy Scouts or Scouts Canada that you were involved in?

Russell Schnell: We knew it as Boy Scouts. I don't know what it's really called.

MG: How old were you when you joined the Boy Scouts?

RS: I would say nine.

MG: Do you remember the trips you took or the structure of the organization? Is there anything that stands out to you about that experience?

RS: It was a pretty loose organization. It was run by two volunteers in the town. We would meet weekly on Friday nights for a few hours. The leaders, on two occasions, took us to a scout camp about a hundred miles away on a lake. That was quite nice. We rented an old school bus and camped out in tents.

I remember it being a little wet and rainy. We made our own meals outside. So we had a fire and cooked. Things were pretty loose in that respect. The ultimate aim for getting into Scouts was to get to a Scout jamboree. There was one that was going to be held a couple of years ahead of time that we knew about. So we got in, and as I mentioned, we got a Scout Hall for free from the school division. Then we worked on getting into the Jamboree, but since we were such a small group – we were only twelve people – we had to join up with another town about forty miles away so that we could go with them. It was really quite interesting to be in an international camp. Scouts from all over the world came to Banff, Alberta; it's a very nice resort area in the mountains. We had our own little camp. There were thousands of people there. We covered acres and acres of tents. There were activities every day – hikes. There are two highlights of the whole camp. One was they took us to a hot spring to swim in Banff. I had never swam in warm water. Normally, we swam in very cold water or waded in cold water. That was such a delight that you could actually go into water that was really warm, just like a bathtub. The second thing was the forestry/fire service brought big pumping systems, and we had water fights with these huge hoses that were used for fire. So we'd be forty, fifty feet apart, but it would take six or eight scouts just to hold the thing. Then, we'd spray up and knock the other people and vice versa. That was so exciting. It was a little dangerous because the water was coming pretty heavy. But, in those days, people weren't too concerned about things like that – liability. To get back to our town – we were about two hundred and fifty miles from where we lived – we took a train about half the way there, and then we caught a ride with one of the other scouts from the other town. Their parents had come to meet the train. So it was like an eighty-mile trip to the town they were in. Then, when we got to that town, I telephoned my father, who was another forty miles away, and he came to pick us up. We got home on a Saturday night. So he worked until ten o'clock on Saturdays. Then he drove up. So he picked us up about 11:30 at night and

took us back home. Then, that following fall, about two, three, or four weeks later, we both quit scouts and joined something called the Royal Canadian Air Cadets. We started that right away.

MG: I was curious if there were ways in which the Boy Scouts prepared you for the Air Cadets.

RS: Maybe. Being in an organization and being one of the patrol leaders there gave you a heads up on all that. You weren't a coward when you went into an organization like the Royal Canadian Air Cadets; you already were used to an organization; you already knew everybody. You had some respect and things like that.

MG: Were there Cadet organizations for the other military branches, like the Army?

RS: No, it was just the Air Force. The reason they had that was because in our town, during the Second World War, when Britain went to war in 1939, automatically Canada went to war, but they weren't fighting on the ground; they were fighting [with] bombing. So everybody joined the Air Force. The Air Force fought until 1943 or '44 – actually until '44 when they did D-Day. So there were four years of active fighting, but it was done with the Air Force. When those people came back, they started an Air Force related squadron.

MG: Did you join at age twelve, as early as you could? And did you stay in for all six years?

RS: Yes, I did. I stayed as long as they'd keep me. I started before I was even legally – you had to be thirteen, but I started at twelve, but my birthday was in December, so they let me.

MG: Just tell me a little bit more about that experience. What were you required to do? Where was your training base? The training was in a local community hall. It was every Monday night, from 7:30 until 10:00. We stayed up late in that area for whatever reason. As I may have mentioned, the national news didn't come on until eleven at night, and our school didn't start until nine in the morning. So everything was shifted. The training was two parts each evening because it lasted so long. First of all, it would be drill and inspection and then drill. Then we would have a band. We had a band. So we'd have band practice, and then there would be a break. After that, we'd be taught a lesson, something about aircraft flight maintenance, da-da-da. Every month, someone from the regular Air Force, [which] had a base a couple hundred miles away, would come and check up on us and make sure that the place was running well. The leaders of this squadron were all paid people. They were paid a regular military salary for one or two days a week. We also had rifle practice. We all had to learn how to use rifles and shoot. In the basement, there was a shooting range. Then, in the spring, there would be a big inspection by high-level officers from the Air Force who would come, and we'd do a drill outside in a big school yard, and they would inspect us, and then the Air Force would do a flyby with different types of aircraft as a training mission. There was a training base some hundred miles away. So those pilots would come and fly over and do aerobatics. It was quite exciting. Then, in the summer, there was a summer camp in British Columbia, which is on the Pacific coast. You could go there for two weeks. It was all paid for, and you had your good uniforms. While you were there, you've got training, you got to fly in airplanes – you didn't fly them, but you got trips in airplanes. Then you got a trip to another island, Vancouver Island. It was really pretty amazing. You were treated very well. You lived on an airbase and ate in the mess.

MG: This was something that was done in conjunction with the school year. Was it on weekends and evenings?

RS: The summer was during the vacation. Vacation in Alberta or Canada is much shorter than in the US. We had to go until July 1st, and then we had to be back September 1st.

MG: When you were sixteen, you were awarded a scholarship. Was that through the cadet program?

RS: Yes, a flying scholarship to learn how to fly a plane.

MG: Talk to me about that process. What was it like for a teenager to learn to fly a plane?

RS: It was pretty interesting. But since I've been driving a car for years, it wasn't that different. We were allowed to drive a car at fourteen. It was a very rural area, and you needed to know how to drive. You weren't legally licensed, but you had a permit. If you had somebody else in the car who was older than you or permitted, you could drive, so we'd all be driving at twelve, thirteen, fourteen. So flying an airplane wasn't really that much different.

MG: When we spoke last week, you alluded to the interview process for the scholarship and that it was advantageous you were from a rural background; it made you stand out. Yeah, I think so, because the city boys were well-educated in certain things, but they weren't educated in outdoor activities or things where they had to have a lot of responsibility at home. At that point, I was a printer's apprentice. I'd had a couple of years of printing experience. Living in a community, we had a lot of relatives around, so a lot of the people that were interviewing us at one time had lived in rural communities. So they related to a neophyte kid who'd hardly ever been to a city in his life, compared to city kids who talked about girlfriends and going to the mall and buying clothes and stuff like that, which wasn't much. We had no experience in that.

MG: What were the kinds of questions you were being asked?

RS: A lot about your schooling, your structure, and your family structure, how you handle problems. What if you're in a plane and all of a sudden your engine stops? What do you think you do? Things like that just to see if you'd stress out. I don't remember all the questions, but some of them were to see if they could stress you and get you to say stupid things. Having been [driving] a car for many years and working in a printing shop where my responsibility was to run the presses, you were always attentive to noise; you understood what was going on in the machinery because it was a huge machine, and it could screw up in a moment, and you had to react. So I think that all helped.

MG: There were two scholarships you were awarded around this time. One was for training, and then another was to go to Israel. Is that correct?

RS: The next year, there was another competition across Canada. Again, I asked my local commander if he would allow me to submit, which you had to do. He said yes, but I was a very

low – our squadron was so small that we couldn't have all of the levels of promotion. So I was a sergeant, which was fairly low in the system compared to the other ones. So he helped me study real hard before the actual interviews, and I managed to get a promotion in that. Then the review process was at least three different interviews with different levels; the first level was very open, and they just wanted to see if you were really alive, how you were, if you were a good student, and how you carried yourself. Then it went up because this was Canada-wide. The next level was much higher people who then passed you on to a top level. These were all done in a city a couple hundred miles from where I lived. I think the fact that I was one of the few people from a small squadron in a remote area, I was a fairly good student at school, and I already knew how to fly a plane – I think that all worked together. So, the other cadet was from a community in the East, and he was from a similar immigrant background as I was. His people had come over from Poland a half a generation before. His last name was David Jurkowski. People getting this scholarship were kind of – not coerced, but it was assumed that you'd join the Air Force, and that's why they selected you and also gave you the experience in Israel. I was going to join, but I got delayed, as I've told you before. I was going to use the Air Force to get my medical training and then stay in the Air Force. David Jurkowski did stay in and he became a general in the Air Force. If I'd stayed in, I'd have been his boss because I was two years ahead of him, and I had much higher marks in my grade – if I'd stayed in the Air Force, but we all take different paths.

MG: Well, tell me about this time in Israel. Where did you first go? I know you traveled around the country. Who was supporting this trip?

RS: The Israeli government, the Israeli Air Force. We were the first exchange cadets from Canada to ever be sent to Israel. We were very fortunate. That was one of the most unique places you could go. Other cadets were selected to go to Britain or Germany or something like that. But this was the most unique [and] far-ranging. I may have mentioned – we flew on a Canadian military plane to Germany and then a US plane to Greece. In Greece, for whatever reason, we were transferred at the end of a runway; there was no official anything. The Israelis sent up a plane to pick us up at the far end of the Greece airport, and then we flew into Israel. Then, in Israel, both of us had host families, local civilians, [who] we met with there. Then they took us home. The people that I stayed with had recently immigrated from Russia after the war. This was 1963. A lot of the people emigrated in '48, '49 to Israel, when it became a country. So, it was a young country. The wife did not speak English, and she didn't speak Hebrew; she only spoke Russian. The husband spoke Russian, Hebrew, and fairly good English. He was a policeman. They had no children. I stayed in their house for a few days. We were picked up by military bus and then taken all over the country. We'd be gone for three or four days and then come home for a day and then go back. So we actually stayed at our host families [for] only a few days during the whole summer. Every time they took us out, they'd take us to some other part of the country. Then we would stay at either a hotel or at a military camp. They have a similar program in Israel for young people. It's not really in the military, but it's kind of like a cadet corps called the Gadna, and we would stay at a Gadna camp occasionally. I also got to fly a glider while I was there up along the Lebanese border. As I say, things were kind of interesting and wide open. The only time we really flew in Israeli military planes within Israel, was when they brought us back from the south end of Israel: Eliat, right on the Red Sea. We drove down there through the Negev desert with an armed guard in a big jeep with a machine gun mounted on the front. So, we saw nearly every inch of the country.

MG: Were you able to get a sense of the political mood there at the time?

RS: Yes. In my particular case, I was very offended by how they were treating the Palestinians. We went by one Palestinian camp where they wouldn't take us in. That's one of the reasons why I never would go back to Israel. I was invited back by universities and government agencies, but I just couldn't relate to how they were treating the Palestinians. They were really looked down upon and mistreated in many respects. So, that was the most negative part of the whole trip. The rest was fantastic.

MG: This was maybe a couple years after the Eichmann trials. Were people talking about that and the aftermath of the Holocaust?

RS: Not much. All of the young people we associated with either just got out of the military, or were just going in. Everybody was concerned because the military training was pretty tough, and everybody had to do it. When they didn't have a lot of transport for these people, so there were hitchhikers all over the country in military uniforms – dozens and dozens of them hitchhiking home or going back to their camp. A lot of them were carrying rifles. A lot of women were in the military, hitchhiking, too. It was the younger people that we were associated with. It was always, “When are you going to go? How long? What are you going to do? Are you going to be in the Army? Are you going to try to go to the Air Force?” Most of them were abducted into the – conscripted is a better word – into the Army, but certain skilled people were taken into the Air Force.

MG: So, when you came back from Israel, were you entering your senior year of high school then?

RS: No, I went to university then.

MG: Okay. Well, talk to me a little bit about that process. How were you thinking about colleges and your next steps? What did you want to study?

RS: My family and my school didn't know much about university. I just knew it was somewhere you went, and it was hundreds of miles away. I had saved up enough money for tuition from my job as the printer in the printing shop. So, I just hitchhiked to the city, and then I found a place to sleep that night. The next day, I went in to register. I didn't know what to do. There was no guidance. I guess, in the cities and big schools, you had some idea of what you were doing, but I just wanted to be in science, so I just signed up for a bunch of science courses. Then I got a room in a residence, which was good, on campus. I didn't have to walk and cook my meals. Everything was available, and I could study a lot.

MG: Did you always consider going to the University of Alberta, or did you consider other places?

RS: I never even knew you could go anywhere else. It was the only university in the province. Either that, or I would have gone to the Royal Canadian Military Academy if I'd have joined the Air Force at that time, but I didn't.

MG: In your interview with Sonya, you talked about how it was only the schoolteachers and doctors in your community that were educated. So, I wanted to ask what other industries were in your town besides farming.

RS: Nothing. Everything was supporting the farming. Oil and Gas had not been discovered yet. Ninety percent of the whole people in the county lived on farms, and there was no other industry. The food stores were there because the farmers needed them. My father and grandfather and family businesses were there because they needed machinery fixed. Most of the machinery was quite old because it was kind of a poor area. My grandparents and all the other people like that were immigrants basically. They came with nothing. It was hardscrabble for a long time.

MG: There wasn't a guidance counselor in your school to help you through this process?

RS: Counselors?

MG: A guidance counselor.

RS: No, no such thing. Nobody even knew what they were. Most of the teachers had never been to university.

MG: Who was it that wanted you to become a doctor? Was it your parents who were encouraging you in that direction?

RS: Yes, and one of the doctors suggested – in town, there were two doctors in the town. One of them said it might be a good idea. My parents and the other people said, “That would be a good thing if you could do it.” They never held me to it.

MG: Tell me a little bit more about your first semester freshman year and adjusting to college life.

RS: It was – I'll say the word – interesting because other kids in the dorm on the weekends would try to get beer and go out and drink or join a fraternity. Whereas I would go to the library and study, and I thought that's what you should do. A lot of kids were there not so much for the studying as for the social effects. I never dated at all. In the years I was there, I only went to one movie ever. I studied, and I took extra courses. I didn't know how many credit hours you had to take. Nobody ever checked on you. It was kind of weird. The first year was a little tough in that – we went for a whole year, not a semester, and you had one big exam after your year there. In the English class, we had a teacher who would rarely show up. It was crazy. So, we'd sit there. We were all freshmen. We didn't know any better. [He] didn't show; we'd go away. Finally, because we were all going to have an exam – there were many English classes, of course, because each one was held to about twenty or thirty people. We all knew that we would be having an exam competing against all the other students who were getting good training. So, a

couple of us finally went to the head of the English department and said, "There's something wrong here. This person has never come." They never knew it; they never checked up on them. So, then we had good teaching, but it was way late in the year. So most of us didn't have really good marks in that particular class.

MG: You hitchhiked the two-hundred miles it took to get to your school. So talk to me a little bit about hitchhiking and the places you'd go hitching a ride.

RS: Oh, it was very easy because no kid – at least kids in our town didn't have cars. So if you had to go to the next town, you needed to find somebody who was going or stand on the highway – and it was a dirt highway, not paved – with your finger out, and away you'd go. I found out later it was much better to make a big sign as to where you were going. Then people would look at that and say, "Okay, I'm going almost there or to that," and it was much, much easier to do that.

MG: I've read a lot about hitchhiking. I'm sort of fascinated by it. It's an era that I missed out on. It seemed like a very efficient way to travel around the country. Do you have any good hitchhiking stories or places you went?

RS: Oh, all kinds of good stories. I met a lot of interesting people. The one hitchhiking story that occurred later in my life was when I was in Europe, hitchhiking in the Netherlands, the northern part of the Netherlands, going up to Denmark. It was wet and cold. It was September. I had a Canadian flag on my jacket. An older couple drove by, and I saw them look at me. I didn't think anything about it. And about fifteen minutes later, they came back. They had gone around, and they stopped and said, "Are you from Canada?" I said, "Yes." They said, "Come, we'll give you a ride." While we were driving, they said that during the Second World War, Canadian soldiers were the ones that went into the Netherlands and fought with the Germans. They told me after the war that the Canadian soldiers stayed around for a while to help them get settled. They would house some of these people on the weekends and give them food. They said one of them that they knew was from Alberta, where I was from. Actually, he was trained in an Army camp well within a hundred miles of where I lived. So, they took me a long way and thanked me. They were an older couple at that time. That was really quite impressive that they would do something like that.

MG: I think when we talked last week you mentioned your first car. What kind of car was it?

RS: It was a Dodge Dart, red outside, black inside. It was bought second hand in our town. A schoolteacher had sold it to the local car dealer and then he sold it to me. I got that after I'd graduated and come back to the town.

MG: For how long were you planning to be a medical student?

RS: Well, I was accepted, and then they said, "When you're ready, come back." Probably, I assumed I was a medical student for about four years. [laughter] But it got less and less interesting as time went along. It's one of the regrets I have, not doing it. So, later on, I set up a scholarship fund in our town for any student who wanted to become a doctor; I would pay for

them. The first one was a really good student, so I paid for his undergraduate education also. He did very well in university but he never came back. I didn't write in his contract that he'd have to come back. So, the next one will have to come back.

MG: You earned two undergraduate degrees in how many years? Were the degrees from the University of Alberta and the Memorial University of Newfoundland?

RS: Yes, in about three and a half years.

MG: What were those two degrees?

RS: One was in chemistry and one was in biology.

MG: Can you explain to me again the schooling in Newfoundland? Did you go there at the end of your time in Alberta or during your time in Alberta?

RS: During my time. I went as an exchange student. So, Alberta said, if you do really well, bring back and show us your marks. But I took so many courses in Alberta and so many Newfoundland that Newfoundland said we'll transfer your courses here, and you did well. I was one of the top students. So, they gave me a degree a year later. I had to go back to Alberta and take two more courses to fulfill their requirements. I did those at night school as I worked in the day.

MG: After earning those two degrees, you still at that point planned to go to medical school?

RS: Yes.

MG: I'll ask you about what happens next in a second. But I also wanted to ask about the social and cultural movements of the 1960s. What did that look like at the University of Alberta or in Canada at the time?

RS: The number and percentage of students that went to college was very low. It was in the teens at the most. In our school, only two people in our classroom that I knew of – myself and another one – went to college. You went there to work, and you had to have good marks or you were kicked out. So there was no turmoil whatsoever. We watched the Vietnam War on TV every night, but that was about it.

MG: It sounds like you were studying all the time and taking classes all the time. Did you have any time for fun or activities outside of your studies?

RS: No, because classes would start at 7:30 or eight. Then, in the afternoon, you'd have to do your 3 hour chemistry or biology labs. And then at night, you had to study – and also on weekends. I loved the weekends because it gave me more time to study.

MG: Tell me now about what happened after you graduated. This is a really fascinating story. You were planning to go to medical school. But what happened instead?

RS: It was a really cold winter. It was after my first year. I had an uncle who was sick in a hospital, and I went to visit him. It was really a cold day. So, on the way back to my dorm, I was freezing, and there was a government building. It looked like the door was open. So, I went in and sat down in a foyer to get warm. After a while, a guard came by and said, "What are you doing here?" I looked kind of panicked. "I've come to apply for a job." He looked at me, disappeared, came back, and gave me an application. I didn't even know what the government job would be, but it was time to keep warm. The building was the Alberta Research Council, which is a government research organization. About a month or two later, I got a call at my dorm. We didn't have a phone, but there was a common phone. Someone said, "You have a call," which had never happened. They talked to me and said, "Would you please come over for an interview?" And I did. They offered me a job with Alberta Hail Studies that summer because they needed somebody who'd be willing to fly a light airplane after a hailstorm and look at the damage on the crops because Alberta was basically agriculture, and hail was a terribly hard thing. If a farmer got hailed out, he was out of business or in trouble. So, they had a program to study and to seed the clouds. I loved the job because it allowed me to drive all over the country between hailstorms, watch the storms form, and then after the storms, fly a little plane, look around to see the crop damage. I had that job for a number of summers. If I'd have gone into medical school, I wouldn't have been able to do that. So I did that job instead. Then I finally graduated. Instead of going into medical school, they offered me a job at the hail studies. I couldn't turn that down, so I took that for a year. That's when I met Dr. Don Veal from the University of Wyoming, and he invited me to come to Laramie.

MG: Can you say a little bit more about that? It was in the summer of 1966 that you started working on the hail studies program.

RS: It was probably summer of '64 my first year. Then I went to work with them permanently in 1966. Fall of '66, I went to work for the hail studies.

MG: What was the understanding of hail up to that point, or the history of hail research up to that point?

RS: Well, it was embryonic, let's say, in that they were trying to see if they could predict when it was going to hail, where the hailstorms would go, and if cloud seeding would stop them. There was a company seeding the clouds, but nobody knew if it was being effective or not. The program grew a lot after I left. They got very good radars and stuff like that. But then they found out that the cities were growing very rapidly at that time and towns, that a hailstorm, if it hit a city, caused way more damage than if it caused crop loss. You might have thirty bushels of wheat per acre, and you only get two dollars; that's sixty dollars per acre. It takes a lot of acreage to equal one house getting destroyed. So, the focus then became on watching where they're going to hit the cities and seeding them from there. Eventually, it was realized that the program got too expensive. They weren't really able to do much, so it was terminated.

MG: Can you say what cloud seeding is? Can you explain that?

RS: Cumulus clouds are those puffy fat clouds you see that go up high. They grow that way. A cumulus cloud is driven by warm air rising. It's like if you took a balloon and put it underwater in a swimming pool and let it go; it would rise up fast. That's exactly what happens in a cumulus cloud. It rises very fast, and as it goes up, it cools. As it cools, the water vapor condenses. Then it produces cloud droplets. The cloud droplets – there's millions and millions and millions of them in a little centimeter. You've been in a fog. You can't see the size of the drops, but they're there. That's just a cloud that came down to earth. For them to produce rain or hail, you'd have to go through a freezing process. But water does not freeze at thirty-two Fahrenheit or zero centigrade; it will go to minus thirty-eight centigrade before it freezes if there's nothing in it. That's very, very cool. So you have this cloud that's made of something called supercooled water. The water might be ten or fifteen degrees below freezing, but still water. Then an ice nucleus will trigger a freezing event that's a foreign particle in one of these little drops. As soon as it does that, that little drop acts like a magnet, and it just sucks up all of the water vapor around it. So you have this microscopic thing and then all of a sudden, it's a snowflake or an ice crystal. Then, if the air is still going up, this forms the center of a hailstorm. It might cycle around a couple times because the air can be going up a hundred miles an hour, so it can support the hail. It goes up, it grows, and it finally gets too big, goes out the side, and comes down as a hailstorm. It's the same in winter. All snow is, is a – let's go back in the summer. All the raindrop is, is a snowflake that melted. All rain in the US over land, away from the edge of the ocean, has to go through an ice phase process, and has to be a snowflake first. Even in the Mojave Desert, that rain that comes down, if it even gets there, it started as a snowflake. That's hard to believe. So the idea was if you could put a lot of these foreign nuclei into the base of the cloud, they would make ice crystals really early, take all the water, and then there'll be no water left to make a hailstorm. In theory, it should work. Now they're getting good, where they can predict how to do that and make snow. In the Rocky Mountains they make snow every winter now, but you have to have the right clouds at the right time, and that was the work that we were doing, trying to figure out that. Occasionally, the University of Wyoming, aircraft would fly through these cumulus clouds to see how much ice crystal there was in, or if there was a lot of water. You've often heard, I'm sure, about planes getting iced, ice on the wings on the plane. How would that ever happen if the cloud was cold enough to make ice? Why was there still water enough to get on the plane? Well, it's supercooled water. It's just waiting for a nucleus. Here comes this plane. Within minutes, it's an ice cube, and it drops out the bottom of the cloud because the water is just waiting, and the minute the plane comes, it freezes on the plane, and then more and more and more and more. It's incredible how fast you can put ice on a plane, flying through there.

MG: Where was the hail studies program based?

RS: It was based at an airbase – Penhold – P-E-N-H-O-L-D – Alberta. It's a small training military airbase at that time, but it was being deactivated so that there was space for the hail studies program.

MG: When you'd go out in the field, what kind of instrumentation were you using?

RS: We were usually just collecting hail and rainwater because we would go out towards the mountains where the storms would start and then collect the water and hail as it fell, and then

follow the storms to see how many ice nuclei there was in the rain because once you collected the rain very cleanly, you could then test it to see if it had these little particles or didn't have the particles in it – the ice nuclei as they were called. It was important to know that there were not very many ice nuclei in there. That means that clouds could be seeded. But then the hail, when you melted it, it had a lot of these nuclei in it. So that told you that some of these nuclei were very active, and they were coming from the west. That then became my graduate work because one of the scientists asked me – he said, “Well, what do you think are the nuclei,” and I said, “Obviously, it's plant material because the storms are all starting over forested areas, and they grow over these areas and then move out. The only thing underneath them is a few hay fields and a lot of trees.” So he said, “Prove it.” So I did very quickly by testing the leaves and the debris, and there were the nuclei.

MG: Folks were very skeptical that this was the case. You made a pretty major discovery there.

RS: Yes, and it took a while for people to believe that because they were all taught in school that it was volcanic dust or dust from deserts. Because when you looked at the center of hailstones, often you saw a dust particle with an electron microscope. So therefore, the dust caused the nuclei. But no, I showed later on that plant material had deposited on the material and that you couldn't see the plant, and that's what was causing it. Because if you took those small particles and heated them, they no longer worked as nuclei because you burnt off the plant material the active ice nuclei.

MG: Keeping in mind that I'm an oral historian, and some of this is making my eyes cross. Does that mean you can't have a hailstorm over a city because there isn't enough vegetation?

RS: It may be difficult for it to start over a city, yes, but there is a lot of vegetation. A lot of cities have a lot of [vegetation], and also, they suck in these particles from the fields around. A storm is a really big thing. There's a lot of energy in a cumulus cloud, and it sucks up the air just like a big vacuum cleaner. That's why gliders go under these storms, and then they'll follow them for hundreds of miles because it's just sucking up the air, and they're just floating along with it. They circle around. You've seen hawks and birds go up there. They're flying on these hot thermals. There may not be a cloud right there, but above them somewhere there'll be one. They know, and they just fly along.

MG: It sounds like this was an exciting job. I'm curious how the work would unfold. Were you communicating with someone monitoring the radar to let you know where to go?

RS: We had our own meteorologists. In the morning, they would say, “Okay, it looks like it's going to be a good hail day. The wind is right, and the temperatures are right. There were two or three of us crews. We had vehicles – trucks. So we'd go out and wait for the storm to start. Then we would put up plastic bags and hail collectors and wait for them. If it was a different day, and we wanted to see when it was devastating, we'd go downwind and wait for the storm. We could see them coming. So we would drive and then just be waiting – hail. Collect it all. Oh, it was terribly exciting. Very exhilarating and fun, actually. We used to drive hundreds of miles in a day, chasing these things. Sometimes, you'd get behind one and try to catch it. If it was going thirty, forty miles an hour, you'd have a hard time getting in front of it.

MG: You said it was the best job you ever had.

RS: Yes. Because you could get up in the morning, jump in a vehicle. Nobody to boss you. Do what you want. Stop for lunch. Go visit people and drive all over the country, get to see the country and covered bridges and cross streams without bridges and chase around at eighty miles an hour. What's better?

MG: At this point still, you had planned to go to medical school. Where did you plan to go?

RS: Only the University of Alberta. It surprised me when I came to the states that kids looked at colleges all over the place. There, that wasn't [the case]. You were there. You were a student. That was where you went. The concept of traveling somewhere else – first of all, you didn't have the money to go to another place. At least, rural kids didn't. City kids might have. So that was the only place you'd go.

MG: I have a note from your CV that says in 1968 you spent time at the University of Hawaii studying climatology.

RS: Yes. It was so cold in Alberta that winter. I was working at Alberta Hail Studies. It was so cold, I said, "This is ridiculous." It was minus-forty Fahrenheit for days on end. So I sent a quick letter to the University of Hawaii and asked if I could be a grad student there. Lo and behold, "Yes," they said, "come on over." I had very good marks. I don't know if you use percentages or A's, B's, and C's, but I was a straight-A student. I was one of the two top students at tea University of Alberta when I graduated. Tuition in Hawaii at that time was only ninety dollars a year because they wanted to bring in students from other places. So it was fantastic. I had a great year there. But then, while I was there, I won a scholarship to any university in the world. I wanted to join the sexual revolution in Sweden but ended up in Swansea, S-W-A-N-S-E-A, instead of S-W-E-D-E-N. I had an interesting year there. Yes.

MG: Did you actually earn a degree in Hawaii in climatology?

RS: No, I just took courses. I didn't earn a degree in Wales either because I wasn't there long enough.

MG: Well, tell me about that year in Swansea. You told me a little bit about your roommate and the woman he married. What was your course of study there?

RS: It was pretty loose. I studied mostly computers and also some chemistry but we weren't required to take a full course load because I had to go on speaking engagements every week to different Rotary Clubs in Wales. So, regularly, I would drive myself and the other lady who was there also on the scholarship. We'd drive up to a club somewhere in Wales and speak. It would either be during the week or weekend. We had to visit every Rotary Club and tell them about ourselves and also then learn about the community we were in. We quite often would stay overnight in a community, and so we learned a lot about Wales. We went to probably thirty or

forty different little towns over the year and met people there and stayed with them. It was really more an exchange and a social event than a college.

MG: In your interview with Sonja, you said you didn't learn much academically but you had a great year. What were you supposed to have learned?

RS: I learned a lot about people, and I still have friends there I visit whenever I go to Europe. I learned a lot about Welsh culture. In Wales, it was just at a time when the Welsh language, which was just about dead, was being revitalized. They were thinking of teaching it in the schools; it hadn't been. So, there was a lot of agitation for that. There was a lot of dislike of the British Royal Family. So, when Prince Charles, who was the Prince of Wales, came to Swansea to speak, there were – not riots, but people were very against him and had signs and stuff like that. There was a period in time when he had to be officially crowned as the Prince of Wales. I belonged to a Welsh dance group in the Geography Department, where I was with people who were doing Welsh dances and revitalizing them. So, we practiced twice a week for a couple of hours a night. One of the people played an accordion. We would go around to different bars and different places and dance, and then we'd get free drinks. We were really quite good. We were invited then to come to the prince's investiture up in northern Wales. But some of the people who were in the group got jobs because they were graduate students. In the end, we couldn't do it as a group. But I went anyway, to the investiture. That was quite interesting. [Richard] Nixon's daughter was there. She was one of the prized guests. You got to see her up close. I think people thought maybe she and the prince would get together, but that never happened. But I remember she was in the brightest yellow dress with a matching yellow hat you could ever believe. She wasn't riding with the prince, but she was in a couple of carriages behind him.

MG: What was Nixon's role at that point? Was he President at that point?

RS: I didn't pay much attention to politics, but he was either President or Vice President. Tricia was her name – Tricia Nixon, I think.

MG: You were in a program for studying agricultural climatology.

RS: Yes. The reason for that was because Wales is agricultural – basically, the mining system was falling apart. Coal mining was becoming a passé thing because they had to dig under the ground; it was easier to have big open-pit mines. You didn't need all the people with picks. So, agriculture was a very big thing. I did a lot of research on how cattle in the spring, when the grass came, and how much their milk increased. I submitted a paper on that, but it wasn't accepted. It wasn't quite done right.

MG: Maybe it was your spelling.

RS: Could be. [laughter]

MG: How did you take to public speaking, going around and talking in front of crowds?

RS: When I was younger, in our church, we had to speak occasionally in front of large groups and at school, so I was very comfortable with public speaking. The other girl on a scholarship in Swansea and I, when we spoke, I would speak first, and I'd be very frivolous and jump around and tell stories. Then she'd get up, and she'd talk about family, and actually, I'd see Rotarians crying when she was finished. She spoke so eloquently. So, we had this show we would put on. [laughter] It was fun.

MG: You talked with Sonja about an exchange program in Russia. Was it around this time that that had happened?

RS: Yes, that happened in Easter of that year. Again, I saw an ad somewhere saying applications can be made to be guests of the Russian Komsomol, which was the Young Communist League, for a month, and please apply here. I applied, and I was accepted eventually. There was a group of about twelve of us from different British universities. We were taken to Russia for a month. There we were treated fantastic because the young Komsomol were the people who would eventually be the leaders in the country because they were pre-selected. They took us all over the country, took us to businesses, they took us to manufacturing plants. We went to great museums – the Hermitage. We went into parts of museums most people never get into. Every night, we had some party and with younger people and drinking and dancing – a great life.

MG: This was not the trip, though, where you traveled by train collecting soil samples?

RS: No. I went straight from Wales to Wyoming. After I did my master's degree – it took me a little less than a two years – I was burned out because I'd worked so hard. I took a semester off and went to Europe and then got on the train. I stopped every once in a while. I would get off the train for a day or so and collect soil samples. Then, when the train got to the east coast of the USSR, we got on a boat. Back up a little bit. On the train, when I started out, I was the only Westerner that I saw for a while. Then, when we got to Lake Baikal at about week number two – this trip took almost a month – other Westerners had collected there too. Then we got on a train car where we were all put together, and we got to know each other very well. One of the people on the train was from the Netherlands, and he'd been a military officer. He spoke Russian perfectly – read, write, and spoke Russian. So that helped a lot. We did a lot of fiddles with currency; you could sell dollars for two to three times what they were worth in rubles. So, we all had a lot of rubles on the train. We could buy caviar for fifty cents a serving, and champagne for a dollar a bottle. So, we were always eating caviar and bread and drinking champagne and singing and jumping around. We exchanged, of course, our addresses and stuff, and then we departed each other when we got to Japan off the boat. But a Swiss girl was on the trip, and she and I traveled around Japan for a little while. She was on her way to Nepal to work for the Swiss that were helping the Dalai Lama people learn to make carpets so they could have some income. After we traveled for about a week, then she went off, and I went off to somewhere, Hong Kong maybe. Then I went from Hong Kong to Burma to Thailand to East Pakistan, India. And then Nepal. In East Pakistan there was the Bangladesh War, so things were kind of chaotic there. All the cities at night had no lights; the trains had no lights. It was interesting. The tanks were going back and forth. They were shooting around; it was kind of a mess. I tried to go to the Taj Mahal, and I got there on a bus eventually, but it was all covered in

shrouds. They had put burlap up because the West Pakistanis were using the Taj Mahal because it was so big and white and bright as a landmark when they came down to bomb, so the Indians had it all shrouded up so you couldn't see anything there. Then when I got to Bombay – it's called Mumbai now – I was supposed to have a plane ticket waiting for me, but it wasn't there. I was out of money, essentially, and I had no way of getting out. But there was a charter flight. I was at the airport for a couple of days. A British Airways charter flight was coming to pick up seamen who'd got off their boat in Bombay. I had some checks still with me from Wales, from the Lloyds bank there where I had about 10 pounds on deposit. I was out of money, so I wrote a check to get on this plane knowing it was no good. Of course, they contacted Britain by telex, and then British Airways contacted the bank. The bank said, "Yes, it's good." Unbelievable. It was like three hundred pounds or something. It was a high price because it was a charter flight. I just couldn't believe it. It must be some mistake, but I was desperate. So, I got on the flight and eventually got to England after we stopped in Iran for a while. I went down to the bank in Wales, in Swansea. I went out there, and I went to the bank. I said, "Why did you do that?" He said, "Well, obviously, you were in trouble, and there was a war on. Since you'd been here as a Rotary Scholar, I figured you were trustworthy." I eventually paid him off. Then I wrote a very nice letter to the head of Lloyds Bank. I found out a year later that he got a promotion because he had done such a good thing. In Britain, the Rotary is a very big deal at that time. If you were a Rotarian, you were cream of the crop, and that type of thing. They really took it seriously. I assume that his leader in London was a Rotarian, or something, and it all connected. Small world.

MG: So many things that you've talked about in our conversations and with Sonya just would not happen today.

RS: Oh, that's true. Random opportunities would occur, and I would take them without fear.

MG: Who was supporting this work and this travel? Was it the University of Wyoming or another institution?

RS: I paid for it myself. It was cheap. You could buy a trip across Russia for under a hundred dollars with food included on the train. If you didn't get off the train, it would be only about seven or eight days. The trip on the boat was incredibly cheap. Plus, with all of the fiddles with the money, we were rich. Everybody was doing it. The Russians would come to you – "You got dollars, dollars, dollars?" You'd have a wad of rubles and stick it in your pocket.

MG: What were you doing with the soil samples? What were you looking at?

RS: I was trying to see if the ice nuclei that we had found in Alberta were unique or if it was everywhere. I thought it had to be everywhere, but you couldn't just assume that. So, I collected hundreds of samples all over. It turned out that in the end, different climate zones produced different nucleus levels. The best ones were produced in climates like Alberta and Russia. Then the lesser ones were from warmer climates. Then, in tropical climates, there were hardly any produced. That came from that sampling. I never thought that would be the case. In testing that, that came out right away that there are three completely different climates. So, after a while, if somebody gave me a sample of decayed tree leaves, I could tell them what climate zone

it came from, from its spectra because it has a signature in it. Then, eventually, I took rain samples from all these different areas and found they matched the pattern in the leaf samples. Over tropical areas, they had very few nuclei. It just matched. The vegetation ice nuclei closed the loop on the story.

MG: That research went into your Ph.D. dissertation.

RS: Yes.

MG: This may be a silly question. But considering all the time you spent in Russia, have you ever come under scrutiny from the US government from your time and your relations there?

RS: Oh, every once in a while, yes. [laughter] More so when I was going to China. I went to China as one of the first scientific exchanges or scientific visits in 1983. One of the people I was working with at that time had grown up in China. She had left, and she was invited back, and she invited myself and my wife, who was also Chinese, to go there. When we got back, there were men in nice suits talking to us. Coming out of Russia, it was a little less obvious, but yes. I've been to Russia maybe twenty times that I can think of. I've been everywhere – north, south, east. Then when Russia was falling apart, I told you about [how] we managed to rent Russian military planes for a handful of cash to go look at what was happening on this remote island where the intelligence agencies thought that they were dumping nuclear reactors, and it was just a normal cloud event.

MG: Tell me again how you came to the University of Wyoming. It was, again, happenstance.

RS: Totally. I was working at hail studies, and Don Veal and his aircraft – he had an aircraft from the University of Wyoming – were studying atmosphere. He talked to me, and we met. He said, "I'm starting a department. I want you to come down and be my first student." I said, "I'm going to medical school in the fall." He said, "Well, I'll pay you." "How much?" *Bing*. "I'll pay your tuition, and I'll give you a salary." "Okay, that sounds rather good. I'll give it a try anyway." So I got down there. I thought that's what all the students did. I bought a new house, bought a new car, and rented out rooms to other students. Really, I thought that's the way life was.

MG: Did you have an opportunity to teach as part of this position? In talking to you, I keep thinking what a wonderful teacher you would be.

RS: No, I worked too hard. I've never taught per se, but I've given a lot of lectures and presentataioins. I don't think I could be a good professor because you have to know a lot of things, and you have to know it well. I just know a few things.

MG: You talk about these things with such excitement that it gets someone like me, who's a real novice to these kinds of topics, excited and interested.

RS: It's incredible how nature works. Those little bacteria are the ice nuclei in the vegetation. There's another process early on when the leaves are being devoured by bacteria. They make

really good ice nuclei. Long story short, eventually, people found that these bacteria could be killed and put into big vats and then sprayed on ski hills. It's called SNOWMAX. You could probably look it up – S-N-O-M-A-X. It's made out of these bacteria I discovered, and all of the ski hills in the world use it now because now you can make snow by just spraying it out from a garden hose; you don't have to have your compressors and your compressed air. It saved them millions and millions of dollars because you don't have electricity issues anymore, and you don't have to run all these big, heavy, high-pressure lines up on a ski hill because you run a hose and blow water and the bacteria out.

MG: Do you wish you had patented that?

RS: Yes, I would have been a rich person. But when I got to Boulder after my postdoc, I met a unique person. We were always poor and had big debts, and had to pay off my wife's loan to her government. I met him, and we decided to invest in real estate. Either we'd go bankrupt, or we'd become rich. We almost went bankrupt in the first five years. But then later on, as you know, real estate you bought for forty-thousand is now selling for up to a million. So, things worked out well in the end.

MG: Tell me about working under Dr. Gabor Vali and meeting him. He's also a fellow Canadian. Is that right?

RS: Yes. Well, he was an immigrant from Hungary. He fought in the [Hungarian Revolution] in the '50s when the Russians came in. He was one of the young students dropping Molotov cocktails from high buildings, but he realized it was a hopeless cause. So he and his girlfriend, who became his wife right away, got on a train that went towards the border, and the train was run by Hungarians, so at a certain point, they just stopped and said, "The border is that way. Go." He managed to get out. Then he went to Canada because Canada was taking immigrants. He was a very smart man. He eventually went to McGill University, the Harvard of Canada, and as a student worked in atmospheric science. He was just about to graduate when I met him because he came to work at the Alberta Hail Studies in the summer. Then he graduated, and Don Veal hired him to be one of his first professors because he had a Ph.D., and some of the other people working with him didn't have Ph.Ds. Don Veal had a PhD, So Gabor was the real first highly qualified Ph.D. At the same time, he asked me if I'd come down because he'd watched Gabor and I working.

MG: Tell me a little bit about your professional relationship. Is he someone you're still in touch with?

RS: Oh, yes. We're writing two papers right now. We've published many papers together. He eventually divorced and remarried a younger lady from Spain, and he lives in northern Spain right now. We are writing papers that are the summary of all of our early work on the hail and the ice nuclei and how we opened up this whole field. There're literally hundreds of people working on it now. There're whole departments in different universities that do nothing but work on these nuclei because they're finding in the Arctic they're very, very important because in Arctic clouds, if they have ice and water mixed, they have a different way of holding heat than if they have all ice or all water. That is partially controlling the melting of the Arctic right now.

So, there are large huge programs in the Arctic trying to figure out how these ice nuclei – where they're coming out of the oceans, how they're affecting the clouds. In Europe and Denmark and Germany and France, there's whole departments just working on this now. There's one at Colorado State University; a couple people are also working on that. I also, along the way, found out the oceans produce the same nuclei in a slightly different manner, but you have to have growing phytoplankton. Then these bacteria produce these nuclei, and they're shot up into the air. You can find them above the ocean, or you can find them in fog. I found that out on a Naval cruise – the Naval Research Lab has a research ship that they work on, studying ocean effects for the military to see how laser beams work in fog and stuff like that. They had a program one summer on fog. They took this big ship, hundreds of people on it, and followed fog on the Grand Banks. We were out there for two weeks studying fog, and I found these bacteria in the fog and in the oceans. Another whole story there.

MG: When was that?

RS: '78.

MG: I'll ask you probably more about that when we get there. It was while you were at the University of Wyoming that you met your wife. You had an opportunity through the Rockefeller Foundation. Can you explain that story?

RS: Yes. In Williamsburg, Virginia each year, the US government, State Department and other similar agencies, hold a week long briefing on US culture and government, and they select one student from each country studying in the US and pay them to come for a week. I was selected from Canada. My wife was selected from Singapore. We met there near the end of this period. We talked one day on a bus trip. The next day we talked when we were back in Williamsburg. The third day, we were all leaving. She and her boyfriend were going to Boston. So, I called up the airlines and canceled his seat on the plane, and then took her with me. Then we talked and more or less agreed that it would be good to get married. I didn't really know her full name or her age, but it seemed like a good fit. We didn't get married right then, but we dated. She was in Washington University in St. Louis, and I was in Wyoming. We would have a date on a weekend. She'd fly to Denver. I would fly from Laramie to Denver, and then I'd fly back with her to St. Louis, and we'd have dinner on the plane because Frontier Airlines would serve big steaks. Then I would turn around and take another flight back. [laughter] We only saw each other about seven times before we got married – or six. But on that trip, that I had taken on the Russian train and stuff, I was going to go down to Singapore and see what it was like, but I didn't. When I did a different program after we got married – we got married in the US – I went to Africa, and then on the way home I stopped in Singapore and met her family.

MG: Can you explain why you had to compensate the Singapore government for marrying your wife?

RS: The Singapore government is one of the best in the world. It really is. They took a little island of a couple hundred square miles and made it one of the best places in the world for finance and education. It was run, at that time, extremely well. So, if you were a student – she was in a university – they paid for you. In her case, she was a Fulbright fellow to the US. There

was money tied in on that. S, they kept track of that. If you didn't come back and serve the government, you had to pay them up. That was good. That's smart. You don't send your best students – she was one of the top students because she was selected from the whole country; there was a competition to get a full Fulbright scholarship. The Singapore government said, “You received all this money. Thank you. But here's your bill.”

MG: And what's your wife's name?

RS: Suan, S-U-A-N. Sounds like the bird.

MG: Yes. Tell me a little bit about Suan's family background, her childhood, and what her life was like up until meeting you.

RS: Her family was in a group of people called the Peranakans. They were a group of people that had been in Singapore a long time, and they lost their Chinese language for the most part and spoke English. So, the British, when they colonized Singapore, used those people as their clerks and stuff. Her father was a clerk with the British colonial government. They lived a fairly astute life, not rich because they weren't paid very much. She was a schoolteacher, very young. She went to college for a year and then taught school. Then, eventually, she got a scholarship to go to the university. It's very hard to get into the university in those days, because university was expensive, and the country couldn't afford everybody going in and people quitting. They only took people who they knew would graduate and do well, so she did. That's how she got the Fulbright scholarship to Washington University to study sociology. She got her master's there. And then when we got married, she moved to Wyoming and then to Colorado with me.

MG: Did she stay in the field of sociology?

RS: No, because we started moving around a lot. We moved to Kenya fairly early on, not even a year after we were married. I went to Africa to a study in the Sahara. Then, the next year, I got a job with the UN [United Nations] in Kenya for a couple of years. Then came back, and then we were in Boulder for a while. Then I went to Spain for another job. So, she never really had a chance to do much in her field. Then we had a baby along the way.

MG: I want to ask a little bit about the research projects you were involved in when you were at the University of Wyoming. I have in my notes something about the National Hail Research Experiment.

RS: Yes, the Russians said that they were controlling hail. Well, let's back up. There was a Navy carrier in the North Atlantic – this is during the Cold War – doing exercises. There was a whole Russian fleet to the north of them, watching them. Then this big storm came in, and it rained and snowed and the radars couldn't look through it. After the storm was over, the Russian Navy was gone. They couldn't find them. They couldn't see them. At that time, there was a group in Russia doing cloud seeding. The intelligence community figured that's what had happened. They'd seeded a cloud system, caused a huge storm, and then the Russian Navy disappeared. So, there was a lot of money put into finding out about cloud seeding. One of the ways to test it was something called the National Hail Research Experiment in Colorado, where

they were seeding clouds and trying to study to see if this was really possible. The University of Wyoming had a program with them, and I worked on that in the summers because I knew a lot about hail.

MG: Did anything result from that project? Did you write about it?

RS: They found out they couldn't seed the clouds effectively. They eventually shut it down.

MG: Was this related to the Elk Mountain Orographic Cloud Studies?

RS: That was another different thing. That was supported by the Bureau of Reclamation. They were big. They owned a lot of land in the west, and they wanted to make more rain. A cap cloud on the Elk Mountain. There's a cloud that forms on the mountain just like a white hat all the time, where it blows up, and then it just makes a cloud and sits there. Don Veal convinced the Bureau of Reclamation to give him a lot of money to study that. They paid for aircraft, and he built a beautiful observatory up there. Then we would sit in clouds and study them. But it turned out, again, that you couldn't really seed those types of clouds well with the equipment and knowledge we had at the time. You had to have a different type of cloud. The observatory is still there; it's not used much. But to get there was a real program. You had to drive to Elk Mountain from Laramie, which was half a day. Then you had to take a caterpillar and go up thousands of feet until you hit snow. Then you had to take a over snow machine that ski hills used to get up to the top. You left early in the morning in Laramie, and you got there in the evening. Then you'd stay there a week or a few days studying the clouds and testing if you could seed them. It was fun. But also, we had another site down on the ground upwind of the mountain where you could seed the clouds from. So the air would flow up the mountain side with the seeding ice nuclei. I would work down there occasionally. One time, I was there with Don Veal and some others, and we brought trucks with snowmobiles, and then dropped the snowmobiles – or skidoos off. I was left [to] keep the trucks. So, when they came back, the trucks were there and food and water. So, I sat there all day long, watching the animals and birds. This Elk Mountain is aptly named because there's a lot of elk there. They were having babies at that time of the year. This was in March or April. I watched where a mother had had a baby elk. Within about an hour, a big eagle came down, a big golden eagle, and hit that baby with the claws closed and knocked it down and then jumped on it and started killing it, and it eventually killed the baby. The mother tried to save the baby, but a second eagle came, and they would fly away but come back. So that was their meal. They had killed that baby elk. Eventually, the mother left. This all happened within a couple hundred yards. I was sitting by a tree – it was forested area – and just watching all this. The eagle came down real fast. But it didn't claw him; it just hit the baby in the head and knocked it over because it was just getting ready, standing up. He waited until it stood up, I guess.

MG: I guess that's the circle of life.

RS: Yes.

MG: And then, what was Project METROMEX?

RS: METROMEX. This was something quite interesting. It was University of Wyoming and University of Chicago – to see why downwind of certain cities, you'd have a lot more rain than you did around it. The theory was that the city was warmer because of all of the pavement and stuff, and it would make these cumulus clouds. So, we had vehicles (mobile labs) that we'd go out before sunrise that were monitoring the temperature and humidity and pressure, and we'd drive around the outside of the city and then crisscross the city up until nightfall. You could actually see the city making this “heat island” as it was called. Then this heat island would rise up and cause the rain. That was actually also the city where my wife-to-be was a student, so that more or less cemented our relationship.

MG: When I was researching Project METROMEX, I kept coming across the name Stanley Changnon.

RS: He was a very well-known University of Chicago scientist, and he was the man who figured this out. He was well-known. The University of Chicago was one of the premier atmospheric science departments in the US. Many of the high-level NOAA and other government people who went through the University Chicago became leaders in the different fields of meteorology. They were just top notch in that field.

MG: Was he a NOAA person?

RS: I can't remember. But they always [said] they were from University of Chicago.

MG: This was around the time of your discovery of the biological ice nuclei. In your interview with Sonya you said that this really stands out to you as one of your greatest accomplishments or the thing you're most proud of.

RS: Oh, yes. It's really still because, at first, for the first five or ten years, it was an interesting novelty. Now it's a center of study. That's why we're writing this two-part paper. We're almost done now. We've been working on it for about six months. The first part – it's in two parts. Part one is essentially finished. I'll be working on part two, to send it back to him today or tomorrow. It shows the history of how this all developed, the serendipity, and the accidents and the little things that sparked it. The University of Wisconsin had people in agriculture. They kept noticing that certain corn crops were freezing very early in the spring and early in the fall. They couldn't figure out why these crops were freezing at very low supercoolings where other crops weren't. So, a student there, Steven Lindow, working separately and not knowing about us, and [us] not about him, found the same bacteria, but he did it two years after we had found it. Steve Lindow – you can look him up – became a famous scientist, became a professor at UC Berkeley to the point where he's now retired, but he's an emeritus professor, a very well known, world-renowned person. He worked in that area, and his work was part of [what] triggered the SNOWMAX patent from University of Wisconsin, where a lawyer figured out that using these bacteria would be great to make snow. So, he patented it, a lawyer not knowing any of the science – wrote up the patent and got it.

MG: You had written about this in *Natura* at the time, but maybe it didn't get as much attention as it deserved.

RS: It did, but people didn't twig on it. Within a certain area, it got a lot of excitement. And *Nature* wrote separate articles on it – hey, this is really neat and da-da-da, but again, it was in a smaller community. But now those papers are referenced a lot. But coming from a university in a small state with the lowest population in the US, it didn't garner a lot of – if that had been done at Chicago, it would have been fantastic.

MG: Were you thinking you needed to be a bigger fish in a bigger pond?

RS: Not really. I never really worried about that. I was getting paid. I had a nice house and a nice car. I had published 2 papers in *Nature* and 5 others.

MG: You stayed on for some more research after you earned your PhD. And then after that was when you came to Boulder for the first time. Is that right?

RS: Yes, to the National Center for Atmospheric Research [NCAR]. I got a one-year postdoc there. And then I got a postdoc at NOAA. But fairly soon thereafter, I took that job with the UN. But they kept the postdoc open for me, so when I came back later, I could just go back into NOAA.

MG: The postdoc with NCAR, was that when you went to Africa the first time?

RS: Yes, I was at NCAR for about three weeks or a month. The funding for going to Africa was arranged by the head of NCAR. I had come down and showed him what I was doing. Right then was the middle of the big drought in the African Sahel and he had a connection with, I guess it was the Rockefeller Foundation, too. So, they funded me to do that.

MG: Talk to me about that trip. Did you go by yourself to the Sahel?

RS: Yes. Now you don't go there without an armed guard. But being a young person – who cared? So, I showed up in Niger and didn't know anybody or anything. I just took it from there.

MG: Say more about what taking it from there looked like?

RS: Well, first of all, I had to collect plants out in the hinterland, but I didn't have any vehicle, and there were no buses or much there. There was one bus that, when it got enough people in it, went across the Sahel from Niamey to Zinder, which is in the east side. I managed to get a seat on this bus. It was supposed to go one morning, but it didn't until they had enough people the next day. So, I just sat and waited there and slept – not a bus depot. There was no bus depot. You just stayed in a market area and waited. Then on the bus, I fortunately met a couple, a man from France who could speak French obviously and English, and then his girlfriend from Algeria, who could speak French and Arabic. So, I made a deal with him that I would travel with them and vice versa, but I'd pay for their transport, their hotel and food, if they would be an interpreter and help me get through. So that was really fortunate. The bus would only go and stop at certain areas, and then they'd run out of gas or there were some problems. So, we'd stay in a little place for a day or so, and then the bus would load up and go. I'd collect all of the

leaves all along the way like this. Where we slept was kind of interesting. It was a little lean-to on the back of a shed. It wasn't very high; it was just some metal roof and kind of a door, but it was open. They must have kept chickens in there at one time. That was where we slept one night. Another night, we slept out in [the middle of] nowhere out in the hinterland area, just laid on the ground beside the bus, this is a pretty wild area we were in. Then when we got to Zinder, which is in eastern Niger, this man who could speak French spoke to his girlfriend who could speak the local language – she also spoke a local language, Hausa. We managed to rent a four-wheel-drive vehicle from a policeman; it was probably a police vehicle, but we didn't know. He took a lot of cash, which I happened to have – and then a driver – and then we drove up into the north, going from where it was semi-vegetated right up into the Sahara collecting samples. That worked out quite well. Then we got up to a place near Agadez. You can look it up on the map; that's where the Sahara Desert is. This couple had come down a road in their car, a Citroen, on this road, not paved, crossing the Sahara. The car had broken down. So they had hitchhiked a ride with some other people who were in a German Second World War half-track vehicle, and they had got a ride down to where they could get a bus out. While we were in this town, here comes this half-track down. It had been delayed farther up. He had given them some of his oil and his clothing and stuff he couldn't carry, so there was a real reunion we had in the middle of the desert with these entrepreneurial people. I mean, they were unbelievable to take a German half-track across the Sahara, and they managed to get to this town; you can look up Agadez. So, at that point, they told him that there was another group going the other way. So that couple got off, and we said goodbye. I've never been in touch with them because I never had any address but they were heading back across the Sahara, going north. That group had actually even brought his spare oil that he had in his car, and they gave him his oil. I don't know what he was going to do with it. Then they went down south, and I went one direction. Again, I went back alone with this vehicle. I couldn't speak the language, but I knew I would get back to Zinder eventually, which I did because I'm here [laughter].

MG: Dr. Schnell, do you have just a remarkable memory or did you keep a journal?

RS: Memory and a little journal. Not enough. I should have done a lot more. I had a camera that didn't work, so I never had any pictures. I had been in a vehicle and train collision about two or three weeks before I was scheduled to go away on the trip. So I was in a hospital for a while. In this vehicle, I'd had a really good camera, but it got either destroyed or somebody stole it when they came to get the vehicle because I never got it back. So I borrowed a camera that I thought would work, but it didn't work.

MG: You had mentioned something about making your own compressed CO₂ from soda or beer bottles.

RS: Yes, you had to run this ice nucleus tester with – you had to be cold, and you had to get down to really cold temperatures. You can do that anywhere in the world because I discovered that people drink beer and drink carbonated beverages everywhere in the world. If there is any type of little town, they'll either make it or where to get carbon dioxide in cylinders. But, if you turn a carbon dioxide cylinder upside down and vent it, the CO₂ comes out and it gets so cold that it makes dry ice. So I would go and rent a tank, turn it upside down, make the dry ice, and run the system to do the drop freezing because you'd have to do freezing down and Fahrenheit

down to zero to -20 Centigrade, which is pretty cold. Yeah, so anywhere in the world, I had this little drop freezer, and you could make dry ice and do this. It was totally fortunate. I thought I could buy dry ice, but you can't buy dry ice in most places in the world away from big cities. But you can get these cylinders because they make carbonated beverages, and they make beer, and they use the CO₂ to bubble in some types of beer.

MG: How did this research project turn out? I know you were able to prove one part of your thesis.

RS: Yes. The hypothesis was that the overgrazing – because veterinarians had gone into this area and the people – their sole way of living was [as] cattle nomads, and they would have cattle, but the cattle would die from different diseases. So, veterinarians from the UN would come in and teach them how to inoculate. “Oh, okay, now you got cattle that are living.” Other agencies would come in and, “Hey, well, you're a little short on water.” They would dig a hole in the ground, a dugout, and when it rained it filled– or they'd get down and put wells in. So, all of a sudden, these people instead of having forty cattle had a hundred. A hundred of them ate a lot of grass, ate a lot of trees. It got to the point where the goats were climbing trees to eat. Pretty soon you had no vegetation, and the drought came. So, I hypothesized that these ice nuclei had been removed. In the Sahara Desert, your only rain comes from the ice phase. Again, counterintuitive. So, I got money to test if I go into areas where there was vegetation, would there be nuclei [inaudible] and yes, that proved out very well. The graphs are very distinct. You look at the graph. Okay, that spectra came from where there was overgrazing and they are poor in ice nuclei. This one came from where all the cows died and the vegetation was recovering – lots of nuclei. But that didn't prove that they escaped from the surface. That didn't prove they went into the clouds. So, I did the first part and proved that conclusively.

MG: Was there anything else you wanted to say about your time in Sahel?

RS: It was dynamic, to say the least, but interesting. That was life, I guess.

MG: The next thing I have in my notes is that you were on the US Navy HAYES Atlantic Fog Research Cruise. Was that what you were talking about earlier with the fog?

RS: Yes.

MG: Was that related to Project DUSTSTORM, which I couldn't find anything out about?

RS: That was a different project.

MG: What was that?

RS: That was a project where, in Texas, each spring, you'd get really big dust storms. They were predictable because there was air coming from the stratosphere. A scientist at NCAR hypothesized that when these storms came down, you could predict them; they would hit the ground, stir up all of this dust, go up, and make clouds that would produce rain. So, he produced a program at NCAR where planes would go out to study the processes. When he'd predict that

this storm would come and pick up the dust, that you could measure it. So, I was on a plane that would fly through these storms and collect the dust. But we would fly low down, and there was terrible turbulence. I would get so sick on the plane that I had big garbage sacks. I'd put the sack over my head, hold it at my neck, and barf into it because I didn't want to barf in the plane. There were only two of us in the plane, the pilot and me. I didn't want him to get sick from my vomit. So, I'd tie the bag up. It was terrible that way, but we got good samples. But then, that particular scientist at NCAR was a bit of a rogue. He had long hair, he was a hippie, and he smoked dope. He got into trouble with Dr. Peter Hobbs, who was one of the more prominent cloud physicist in the US at the University of Washington, and Hobbs more or less killed the program through his influence.

MG: Can you say what he did or who that was? I understand if you can't put that on the record.

RS: Ed Danielson was the name of the NCAR scientist. You can look him up. He left NCAR and move to the University of Oregon, I think. The scientist from the University of Washington was Peter Hobbs. At one meeting, they got into a shouting match with each other – at NCAR. But Hobbs prevailed because he could influence the money people. So, the program was nixed after it had been in place for a few months. For a young scientist just out of Wyoming, that was quite interesting to watch these eminent scientists shouting at each other with forty people in the room. Who do I listen to? Peter Hobbs was like that, though.

MG: What would they argue about?

RS: Hobbs said that [Danielson] wasn't doing the program right; he was wasting a lot of money. Hobbs was very offended that he wasn't hired to run it instead of Danielson. Hobbs had a very, very large ego. He died young, unfortunately. You can look up Peter Hobbs and Ed Danielson. I'm sure there are stories on the web.

MG: We have an oral history collection from UCAR [University Corporation for Atmospheric Research] and NCAR. So maybe there are some stories in there about it, too.

RS: Could be.

MG: So, next for you was another postdoc position in Boulder.

RS: Yes, at NOAA.

RS: Tell me a little bit about what that work entailed. Again, they let me do whatever I wanted. [laughter] It was very interesting. So, there was a big flood in Johnstown, Pennsylvania; you may have heard about that. It started – it looked like – right over a big power plant, one of the biggest power plants in that area. A coal-fired power plant was the Johnstown power plant. So, it was hypothesized that the plant was putting out all, of this – burning all this coal and was putting out ice nuclei that started the rainstorm. I didn't think that up. Dr. [Helmut K.] Weickmann, who was the head of the atmospheric group at NOAA, hypothesized that those nuclei could have been coming from that plant because it was such a huge storm, and it lasted so long, and it killed so many people. So, we started flying a small airplane through the plume of

the powerplant to test the nuclei. Lo and behold, there were none. The power plant wasn't producing them, and it wasn't killing the natural ones. It was just totally benign. Huh? So, we then thought, well, maybe this was just this plant. Then we studied power plants in New Mexico, the huge coal-fired power plants in New Mexico. Again, no nuclei. So, then we went to California, where they have all of those refineries on the coast around Long Beach. Everybody thought, of course, that refineries are putting them out. They didn't put them out. We spent all our time looking at these types of things and found nothing. About that time, one of the scientists in the NOAA group was involved with the UN, and they wanted to see if Mount Kenya would be a good site to emulate the Mauna Loa Observatory. The scientist had me interviewed in New York. They sent over a scientist from the WMO [World Meteorological Organization] to New York to interview a number of people. I was one of them. I wasn't selected initially. The guy that was selected – there was a scientist in NOAA who said this guy is a complete charlatan. He talks a good story, dances a good dance, but he doesn't know anything. So the UN withdrew his offer, and I was then selected to go. But at that time, my wife was pregnant. I was still fairly young; I was only twenty eight or something. The Kenyan people who are going to be hosts said, "He's too young," so they stalled and stalled [in] giving me a permit to go there, and our baby grew more and more in my wife. Then we got rid of our house, and I sold my car, and we moved to the hotel, waiting for the okay. It didn't come, so finally, I sent a telegram to Kenya. I said, "If you don't accept me in a week, I'm not coming." They wanted the money from WMO, so the next day, I got permission. We jumped on a plane and went to Geneva to get into the WMO. My wife went into labor there, but it stopped, fortunately. So that night, we got on a plane and went to Kenya. But the plane stopped in Italy overnight because there was some problem with the airplane. The next day, we made it to Kenya. Then we arranged a place for her to have the baby that following weekend. There was a native hospital, and my job – because the British had built the hospital years before, in Britain, you don't put screens on building windows.. In Kenya, you don't put screens on. So, insects, of course, fly in to see the lights. Of course, the birds follow to eat the insects. My job was to chase the insects and the birds while my wife was in labor for thirty-six hours. The baby was born, and she turned out okay. But a couple of weeks later, I had to go up to Mount Kenya. I had to fly up there. So I took my wife and the baby with [us]. But we got up so high that we had to take oxygen, so I put the baby's head in its oxygen mask, fed her oxygen so she'd be okay. We took her with us all the time. She was always with us wherever we went, day and night. There were never any other kids around. If she started to cry, we immediately responded or told her not to cry. She never learned to cry. We were there for a couple of years. I took her back for another project years later when she was twelve. People remembered me, and then they said, "Oh, that's (Wanjiku?)." Because we named her after a Kenyan – "She's the baby that never cried." They would see her for days on end, and she just never cried. She didn't know how to cry. She never knew that crying got her something.

MG: Did that trait stay with her? Was she never a crier?

RS: She turned out to be a very mellow person. Yes. After she graduated, she joined the Peace Corps in Bolivia, and she was a "health professional," in quotation marks, in a little village high up in the Bolivia mountains, and she lived in a granary. They had chickens that were in the granary with her, too. Every once in a while, one of them would disappear while she was out working. She never figured that out until near the end when she saw this big snake coming out of the top of – the granary was made out of mud, sticks and grass. A snake would come down

and eat a chicken. That's where they were going. [laughter] She called the place "Oblivia." She was there for two years, and it was a tough, tough assignment. She could speak Spanish a bit before she went. But she speaks impeccable Spanish now with a South American accent when she left. So when she speaks – and she's, of course, a cross between me and a Chinese, so she has that swarthy dark hair – people just think she's a local – or did.

MG: Tell me a little bit about the work you were doing on Mount Kenya. Then we can probably take a break for today if that's okay with you.

RS: Certainly. The World Meteorological Organization wanted to find out what was happening to the atmosphere in the tropics. They thought that Mount Kenya, being a tall mountain like [Mauna Loa], which has a premier observatory on top, might be also a good place for an observatory. So, they hired me to find out if it was. Once I got there, there was equipment there, but it was not really what we needed. The people who designed this had never thought it through. A person in Sweden, who I'd been in contact with, was able to send the equipment down. The WMO hired one of his staff to do carbon dioxide measurements because we were really interested in carbon dioxide and methane. We actually did carbon dioxide measurements right there at the base of the hill so that we would send up glass flasks, a couple of liters, and then I hired porters, as they were called, who took tourists up to Mount Kenya to work for me, and we bought tents. They would go spend a week up at different heights, filling bottles of air, and then they would send them down with another person. He'd walk down to the bottom of the mountain, where we he would be met with a truck, which we had. Then we would take them to a tourist center, where there was electricity. Then we would do the analysis and then send the bottles up. We had probably eighty to a hundred bottles moving every day up and down, checking, and they would take the samples all night, all day – different people would take them. We found that at night when the air cooled around the mountain and came down, it brought air from higher up. So it was a good site to do that. We took other measurements too. We did a lot of aircraft measurements. We would take up instruments in the aircraft and measure what the atmosphere was like around Mount Kenya. Once we got above this inversion layer at night, we could see that the CO₂ was constant, and it represented air that had come in over the Indian Ocean. Eventually, the station was built there on one of the sites we selected. Many years later, they got money from the European Union. There's a station there operating now.

MG: Can you describe Mount Kenya and the cultures around there?

RS: Yes. Mount Kenya is a very large volcano. It's high enough that there's glaciers on the top. So there's permanent snow, and it rains on the upwind side every day as the wind blows up. On the leeward side, there's not much rain. So that's eventually where the station went. The area is the center of the Kikuyu group of people who the eventual leader of Kenya came from. That's where the Mau Mau freedom fighters – they were based in that area. So the British had built an airfield near there, where they had their fighters and bombers for fighting the Mau Mau in their camps around that mountain and out on another set of mountains called the Aberdares. But mainly, Mount Kenya was the center of the Mau Mau revolution. Those people eventually formed the government once the British had to leave. The first president Jomo Kenyatta came from that area, from that group of Kikuyu people. So those people were quite an aggressive group of people. But they were very hardworking people, too. So I hired them as porters. Their

fathers were the ones who were the Mau Mau freedom fighters. The British killed a lot of them, of course. The British had settled this whole area because it's very good agricultural land. So all of their old houses were there, but they were abandoned – the people who were driven out or killed – the British. So there were a lot of these relic houses around Mount Kenya – farms that they'd had. But one of them on the north side somehow had been maintained. It was a huge farm, had probably a hundred workers, but it was still British-run. So eventually, they were sold out to a Kenyan Kikuyu group of people. So that farm helped me a lot because I had to drive through that farm to get up into the mountains all the time. It was cold up there; it froze every night high up. That's how I noticed in the Lobelia, or the plants there, that they would freeze. Just as soon as it got cold enough, they would freeze, and then the next day, they would melt. Later on, I sold the idea to Kodak Company that I could find them a bacteria that was as good as the one they were using for SNOWMAX that wasn't affected by a disease that the bacteria were getting in the US because every living system has something that lives off of it or is a disease, and this disease could have destroyed SNOWMAX because it would have gotten into the bacteria. I sold them on the idea that I could find a bacteria that would not be killed by these pathogens. I didn't know there was one there, but I assumed that was the only thing that could possibly turn the water in these plants at such low supercoolings. The plants that evolved with these bacteria [survived] a frost every night of their life and the next day lived. So, yes, we found it. I went back later on, and we took the juice out of them and tested it immediately. Yes, there was the bacteria. I froze the Lobelia plants, froze the water, and brought them back to the US. Kodak was very pleased.

MG: Did they buy that idea or technology?

RS: Yes, and they paid me well to go and test it, and it worked out for them.

MG: Good. I also wanted to ask how your wife adapted to being in that area as a new mom.

RS: Do you want to talk to her? She's right here. It was fairly tough, but she was a very adaptable person. When I did the project, she came out with me. We lived in a tourist center for weeks at a time. So she would be there with the baby while I was out working. It worked. But as I say, she's right here. She can tell you if you want to hear firsthand.

MG: Is she willing to?

RS: She has to go to a meeting at ten. So here she is. Her name is Suan.

Suan Tan Schnell: Hello.

MG: Hello, Suan. I'm Molly. So nice to meet you. I've been hearing so much about you.

STS: Nice to meet you.

RS: She was asking me how you adapted to Kenya, the lifestyle, and the baby.

STS: Well, you adapt as needed.

RS: The baby was a very mellow child, which I think was good. Suan took very good care of her. She was always with either Suan or a servant or both of us. She just assumed that's how life was, I guess. We bought a basket for her. That was her bed. Wherever we went – a hotel or a meeting – we'd take her, and then we'd put her under the table. We told her to sleep, and she would sleep or just lay there.

STS: That's his story, right?

MG: You should write a parenting book.

STS: Well, it's nice to meet you. I've got to go and teach a class.

MG: Okay. Thank you. Nice to meet you.

RS: Suan teaches people English – foreign students and other scientists. Sometimes, she has two or three classes a day.

MG: Oh, wow.

RS: She does it voluntarily. Some of them go back to Peru, Japan, and Korea and she still teaches them on ZOOM. She has two classes today, one at ten and one at noon. Ten or fifteen students sign in to learn English.

MG: Oh, wow. Well, I won't take up any more of your bandwidth at home. I think if we could schedule one more session, we could probably get through everything if that's okay with you.

RS: Sure.

MG: This has been so fascinating and so much fun. After we hang up, I'll email you again with some dates, probably for next week, to check back in.

RS: Sure. I assume, and I hope that you edit some of this stuff and throw out the garbage and just keep the highlights.

MG: There's no garbage. I will transcribe our whole conversation. That part takes a little while, and you can edit as you see fit.

RS: Okay, thank you.

MG: All right. Talk to you soon. Bye-bye.

RS: Bye.

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