VOICE EXPEDITION INTERVIEW TRANSCRIPT
The Oral History of Nephrology

Richard Drake, MD
Interviewed by Dugan W. Maddux, MD
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DWM: Today is Thursday, January 31, 2008, and today I am talking to Dr. Richard Drake and we are conducting this interview in Dr. Drake's home in Portland, Oregon. Dr. Drake attended medical school at the University of Oregon and graduated from there in 1959. While practicing nephrology in 1963, he worked with Charles Willock to design a new dialysis machine. The Drake Willock machine was subsequently used around the world for dialysis therapy. And Dr. Drake, I thank you for letting me come today to talk to you about the history of nephrology. So, I'd like to start with just where you were born and raised and then how you ended up in medical school, so...

RD: I was born in Washington, DC, and I lived in an apartment building right across from the Supreme Court. My father was a manager of that building and when I was 11 years old, we came west. And my Dad was from Portland here, so we ended up back in Portland, and I went to high school here in Portland, and then I went to college in Salem, Oregon at Oregon University and then the University of Oregon Medical School. Some of my training was in Minneapolis, and my training in dialysis really was with Dr. Scribner in Seattle.

DWM: All right. So you finished up medical school at Oregon.

RD: Uh huh.

DWM: And then did you do what you would consider like an internship and residency...

RD: Yes.

DWM: ...in Minneapolis?

RD: Yes. Right.

DWM: Okay. And then what brought you back, what got you interested in kidney disease and what brought you back to Seattle?

RD: That's interesting. I got involved with kidney disease and I was just a chief of medicine as a resident when I got involved and the reason I got involved was I got interested in kidney disease and also dialysis, and I became sort of the expert in the hospital on peritoneal dialysis.

DWM: And this is in Minneapolis?

RD: No this was here.

DWM: Here.

RD: I was a resident at Good Samaritan Hospital here in Portland.

DWM: In Portland.

RD: In medicine.

DWM: So you were in Minneapolis for a couple of years...

RD: Yes.

DWM: ...and then came back to Portland.

RD: Right.

DWM: What year would that have been that you were back at Portland?

RD: Um, oh boy, uh, probably '61. '61 to '63 I was a medical resident at Good Sam in Portland.

DWM: So were they doing dialysis here at that time?

RD: Not chronic dialysis. Acute dialysis was done with the twin-coil dialyzer and the open tank, mostly up at the university and we didn't do any at the private hospitals much at all. It was a major procedure when you did hemodialysis.

DWM: Can you tell me what you remember about dialysis at that time in the 1960-1961, for acute dialysis? What was it like?

RD: Well, many of the patients with acute renal failure, if you could dialyze them peritoneally, that was a much easier procedure because Baxter made a catheter, a Trocath, that you could put in and dialyze them. The catch was the fittings were all FDA approved and they all are easy to contaminate, so early on I figured out I had to change it and wrapped them all with Betadine to keep from getting peritonitis. But I got real experienced at peritoneal dialysis, so in the hospital we had a certain number of patients with acute renal failure. Obviously they weren't too catabolic. If they were, they went up to the university and were run on the artificial kidney. The major change in dialysis, because it's so much easier to get the procedure going, they are

dialyzed earlier. Saves many more lives. Then they were dialyzed late and it was a big procedure on hemodialysis. They had a tank procedure and usually there were one or two doctors involved.

DWM: Well. So when you say they were late, they were pretty sick? I mean these were...

RD: Oh, oh, they were...

DWM: ...what kind of patients? What did they look like when you saw them? Do you remember numbers, and...

RD: No, I don't remember too many of the numbers. Most of the patients who were really sick ended up at the University Hospital and the patients who went to surgery and then all of a sudden had no urine output and were in renal failure, we'd dialyze them peritoneally.

DWM: Okay. Very good, and how did you do with peritoneal dialysis at that time? Was it successful?

RD: You know, we did pretty well and I was getting to that's how I got involved. My chief of medicine at the hospital was also a practicing internist and diabetologist. I was also trained as a diabetologist and worked with diabetic group for quite a while. Went to diabetic children's camp every summer and took care of kids and shuffled their insulin, which was always a challenge because they are so active at camp and the insulin dose just plummets, but he got a call about a Presbyterian minister in McMinville, Oregon, who was very sick with kidney failure. Well typical, as we still have this today, don't tell you when it started. So you'll get a patient in very sick and you know, is this a chronic or is this somebody with acute renal failure? Usually you can figure out somebody that's had kidney disease for some time and, but he came in in a coma, and he had a BUN over 200, and so the chief of medicine asked me if I was willing to dialyze the patient and I said I was, but I thought I knew what sort of a difficult situation I'd be in, because if he really got well, he has no kidneys and so we decided we'd treat him. And of course, he turned out to be really a nice person. He was a 40-year-old Presbyterian minister and it took about 3 days to where we could take a history. And um, he you know in severe metabolic acidosis and everything that was wrong in uremia, he had. And then he walked around. I changed the protocol for hookups so he didn't get peritonitis and he walked around the hospital with a peritoneal catheter in and feeling fine, but then we were in the predicament, how are we going to treat this person chronically? At the same time I was treating him, Dr. Scribner came to Good Samaritin Hospital to give a lecture and my chief of medicine told him about this case and he said, um, "Dr. Drake, why don't you come to Seattle." And so I went to Seattle related to that. I was still chief of medicine. I was still in my medical residency and um, in Seattle, because I knew I had to set up a center here in Portland, which turned out

to be the first chronic dialysis center in Portland, I worked as a technician, I worked as a nurse and I worked as a doctor. So I did all three. I set up the machines and did the whole procedure.

DWM: So how long were you in Seattle?

RD: I was there for a year.

DWM: And so when you say you started out as a technician, tell me what it was like to be a technician? What jobs did you have?

RD: Well I did all three sometimes in the same day. I would set up the machines and hook the patient up. The nurses were there watching me. They knew that I, what I was doing. Um, and uh, but uh...

DWM: What did it take to set up a machine?

RD: Well that's interesting, too. Dr. Scribner's contribution was in a number of areas. Of course he had to prove that a patient who had total kidney failure could live on dialysis, but he recognized one of the most important things was to make it a nurse/technician procedure and so the big breakthrough in dialysis really was related to making a nurse/technician procedure. No longer a doctor had to stand over an open tank. And in order to do that, he decided to have technicians add the chemicals to the baths. We made up the bath and the dialysis solution. Uh, the next thing he decided was, many of the patients on the twin-coil, would be in trouble with air embolus, so we decided the blood pump wasn't a good idea. The next thing that was a problem with the open tanks, they were 100 liter tanks for the twin-coil, uh, was bacteriology and even though you tried to sterilize those tanks, Pseudomonas grows down in the pumps, down in the bottoms, so the bacteria count grows because the bath is warm and so he decided that the best way to do it was refrigerate the bath and so he called the Sweden Freezer Company in Seattle, ice cream freezer company, and all the tanks that we prepared were ice cream freezers and you'd fill them up to a mark. Well because we knew exactly what the volume was, all our chemicals were made out in little bags, so the technician, you'd be there with a gram scale weighing out salt, bicarb. Um, we didn't use acetate or anything like, because we just added it all together, and we'd have, you know, a milliequivalent of magnesium and very low amounts of potassium. They were in little bags and so most labs that we worked with, had shelves with these little bags and hopefully you didn't get mixed up and add the bag twice, which of course, can happen. But then you would check the bath and because it was at the university hospital, they checked the electrolytes in the bath every run, but that's the technician part of it, would be to make up the bath. Then you'd put on top of that, the Kiil flat dialyzer. Well, that was another chore, making, building the Kiil flat dialyzer. You'd have to cut, you'd have the cellophane sheet, put it on and then you had to cut out where the port was for the dialysis solution. If you didn't get that cut out, the dialysis solution would blow the thing up,

so that you'd blow out the side and um, and then seal it each time. And then all the lines, we didn't have companies making blood sets, they all had to be made. We made those out of tubing. We had the tubing, um, and then there was the connection to the cannulas. The cannulas were a big breakthrough.

RD: The cannulas the technicians also worked with but they uh, the cannulas were made out of Silastic rubber. They were designed by Quinton, engineer in Seattle and he worked with Scribner, and uh, um, you would have to, at the end of the line we'd have a piece of Teflon that fit over the Teflon and the cannula. We'd have to take a warm metal. We warmed the metal and make it big enough to fit over the other because that part we had to make every time, and so that was part of the technician job. So you'd hook up all the lines. Then you had to rinse it. So you sterilized the thing either with a chlorine solution or formaldehyde and then you'd have to rinse it, so the technician would rinse it. The whole setup was by the technician, up until the time the nurse hooked up the machine. Even hanging up the IV bottle. Now, from then on it was a nursing procedure. One of the things that was a problem was that because it was a refrigerated tank, you had to rewarm the patient's blood, so you wound the line, the arterial line around the, or the venous line around a rewarmer. Well the problem was a rewarmer was not as sophisticated as the electronics today, so occasionally it would overheat and then we had breakdown products of protein, but that's the bad news. The good news was it was cannulas, we didn't have fast blood flows, so if we had anything go wrong, we just clamped the lines and disconnected. Um, one of, related to that, one of the episodes I'll get into home dialysis, one of my patients was in an escalator in Meier and Frank's, a big department store downtown, which is now Macy's, um, and the cannula, normally when you are through with the run, you hook the cannula around in a loop and so it was continuously running. Well it came apart on the escalator in Meier and Frank's. Well he had his teenaged daughter with him and she knew what to do. She knew how to clamp this. She just clamped it and other people didn't do too well on the escalator, but he did really, he did fine and um, what we'd have to do then is usually we had to declot it, um but the cannulas were really very safe in that sense. But uh, the nursing procedure was to hook up the patient. Of course, they had to hang up their saline and saline prime they use just like we do now and uh, or, and at the end of the run, they rinsed it. Now one thing they had to do to get all the blood back they could, remember these patients were all anemic - we didn't have erythropoietin, right, and uh, the Kiil dialyzer had to be tilted up, so you had to lift up the Kiil dialyzer, these boards and uh, so one of the things we did when we designed the machine, we put a hydraulic lift on a deck and the nurse just pushed a button and the water lifted it with the hydraulic lift-up and that we thought would be a real advantage for home patients. It turned out it was.

DWM: Yeh.

RD: Um, so that, and then they'd rinse the blood back and then they'd disconnect. And in between times, they would rinse and we did reuse the dialyzers, but uh, the uh, setting up a lab

in Good Sam was what I initially did, with the help of technicians from Seattle and at the time, um, there were two Mennonite orderlies. They were serving their service duties in the hospital and agreed to work with the artificial kidney. Well interestingly enough at that time, nobody paid for the care of these patients, so even though the hospital was really proud of the fact that they were the only center in Oregon that did dialysis and the first center to use a nurse/technician procedure and I became so experienced, I became the one they referred to for the state of Oregon and it turned out because of the machine, I got referrals from overseas, too. At any rate, they were really proud of it, except for the administrator. He had the business end of it, so he and I were always in little arguments about, he would cut off supplies every so often, so we'd have a, we'd be short some forceps to clamp lines or something and I'd have to go down and talk to him, and because it was a negative cashflow, and dialysis, and then that word got out to the other hospitals and they were kind of glad, in a way, that a different hospital had this procedure and so the idea of center dialysis was something that the hospital administrators didn't want it at all. The insurance companies wouldn't pay. It was "an experimental procedure." And at the same time there were still doctors in the area and other places that felt that this was definitely an experimental procedure and probably wouldn't work.

DWM: What did you think about it? Did you think at that time, we're 1962-63, did you think it was an experimental procedure?

RD: I definitely thought it was experimental in the sense of learning. I thought there were things that we would be learning for years and one of the doctors I worked with was doing research with platelets and I was working with him on platelet aggregation at the time and we were trying to figure out okay, well what do you measure in these patients to decide if they are adequately dialyzed? That will sound familiar. Uh, and um, so that there is a lot of ignorance about uremia, about what happens in kidney failure, and I figured we'd be learning that for a long, long time.

DWM: Still today.

RD: Yeh, yeh. And we did learn some things up front, which were interesting and they are still pertinent today. One is related to phosphorus. Of the first five patients, which I worked with in Seattle, Clyde Shields being one of them, one was grossly underdialyzed and developed severe neuropathy, and he was a college student. Another one developed the typical amorphous precipitant of calcium and phosphorus and there were big bump and they'd turn red. I had another patient with this and the surgeons think, well it might be an abscess and they open it up and it just oozes this calcium-phosphorus material. So it was at that time that in Scribner's departments, somebody had noticed that ulcer patients have a lower phosphorus level, and that started the idea of using binders. Well the problem with the binders is simple. Who wants to eat, if you are eating a lot of those things, you know? And basically somebody who has too high a phosphorus, in my opinion now, is underdialyzed. The best approach is to, because it is a

slow-moving molecule to me, is dialyze for phosphorus and most of the other things seem to follow. Um, urea is a smaller molecule and it is easier to measure, but uh, it probably is not a good index of adequate dialysis. Well, we figured that, we knew that early. We didn't know what to do about it. Because one of the first things we've got into, okay how many hours you run? And we had another problem and that was the cannulas didn't always have the same flow. Remember, Dr. Scribner didn't like blood pumps and we thought that was a good idea to get rid of them and so we had different flows in different patients and obviously there were patients we'd run them 16 hours twice a week, all night long, and they were run at the university, so I was working at night at the university. They'd run 16 hours and um, each one of those first five patients. And then we decided that maybe it would be better to run them eight hours three times a week and interestingly enough, the three times a week became accepted and at the same time, in 1973 when the government passed the act...

DWM: Right.

RD: ...so they assumed that three times a week, eight hours, would be what they'd pay for. In other words, the whole thing was set up around, at that time, economics, so that the three time-a-week probably had nothing to do with what you really should be doing, but it did have to do with what they were paying.

DWM: Right.

RD: And um, and so from then on we were, the center patients, which we didn't have any center patients. All of our patients early on, that's the other big thing, we learned early on the best technique seemed to be to train the patient on what was going on and train them about fluid overload, and there was more than one patient, that they saved their own life by recognizing something wrong. I'll give you a classic. We had a home patient we trained and they delivered the wrong concentrate to him and this was back when they were mixing an acid bath, we still have this bath that was more acid, but we didn't have a detector for the acid bath on that machine, and uh, and he just felt terrible at the end of a run. He was in severe metabolic acidosis in retrospect, but he felt worse on the run, so he disconnected himself and he thought something was wrong. Well we recognized something was wrong and got him the correct bath and just got him dialyzed but the home patients themselves contributed a huge amount to our knowledge of what was going on. And that's where the company was interesting. The um, when I came back to Portland, we were using a tank system, you've got a refrigerated tank. The tanks were extremely heavy. I went to a company that made stainless steel equipment and tanks and had one designed that was over 300 liters. The only trouble was pushing it, and so we could, we had lines on it and we used it. The other thing was the hospital administrator wouldn't let us use any of the wards in the hospital that were usually used. We were in an old part of the hospital. Old wiring and our lab was up in an old bathroom, which we had rebuilt, but it was still uh, we were sort of relegated to a different section of the hospital.

DWM: Were you relegated to this old part of the hospital because you were losing money? Because you didn't have much respect...

RD: Yes.

DWM: ...from the people who thought this was sort of crazy and experimental?

RD: It was all economics.

DWM: All economics.

RD: It was a part of the hospital they didn't normally use and to show you how much trouble we had, we couldn't plug in a machine, particularly with the refrigerating unit, without blowing a fuse. So I had, we had to drop a heavy-duty wire out the window of a floor up above, which we hooked in to one that didn't blow the fuse, bring it in through another window and run it on the lower floor. We just got used to doing this. It was a...

DWM: How many people could you dialyze by doing this kind of old-hospital, makeshift...

RD: Well for hemodialysis, we really could only dialyze one patient, the first patient, but as time went by, particularly when we developed the new machine, um, we were into ICU and other places that were in the main hospital.

DWM: So when you came back from Seattle, you started a chronic dialysis program.

RD: Right.

DWM: And how many patients do you think you had early on and were some of them at home and some of them in-center?

RD: Well early on we had one patient, and then we went to more than one, but we quickly realized because of the economics, the insurance would not pay, that we would have to dialyze them at home. And in order to do that, we had to get rid of this big tank. We knew that wasn't going to work. We had other things that because the patient ran at night, we felt we had to have some minimum monitoring.

DWM: Right.

RD: So we developed a machine that had a way to watch the blood flow. Remember we didn't have any blood pumps so that if their blood pressure dropped or the stream in the drip bulb got

down to nothing, we had an electric eye looking at that all night long but we had, because the bath was a new idea, the new idea was developed, we worked on it the same time that Scribner was working on it with a company called Milton Roy, where they would mix concentrate of a bath with water and what we decided to do was to mix the concentrate and water and use as our metering device, a piston and the piston was machined 34 part to 1, as far as the size, so it was driven by water. There was no electrical pump in it at all, and when it moved back and forth, it had a cam on top that would shift it back and forth, it would make the bath mixture just right because it was machined to that ratio. We uh, designed that, well, this is another interesting thing to me and that is that I didn't know Mr. Willock, I had no idea, but his daughter went to the same nursery school as my daughter, my oldest daughter, and they invited us out - my daughter invited us out to his house because he had a swimming pool, and that was the motive in going out there. So we went out to his house to see his swimming pool, and I went down in the basement with Charlie and um, here he had a machine. He was a machine inventor, who is another really interesting person and I discovered he never went to college, and he was told in high school he wouldn't amount to much, but he was a genius, as far as machines go. And uh, primarily, well all kinds of machines, but hydraulics, and he had a machine that was stamping labels on something and the bottles would come through and just right, turn and electric eye would see them. I saw this machine and I realized he could really design something. So I told him the problem that we really needed something to mix the dialysis solution, at the same time monitor the patients, so the first design of the machine we did at the swimming pool with the girls swimming in the pool and he drew it out. He made the first machine in his basement in a garage, in one month. Normally today in doing research, we're talking about years.

DWM: That's brilliant.

RD: We're talking about all kinds of money. The other thing, of course, was different - we didn't have to deal with the FDA. All the patients died. There was no treatment for these patients and so the FDA just didn't get involved and uh, uh, we became sort of the standard. Well we designed this machine. It was much, much lighter than a, you know, a 300-liter tank and much more compact underneath but we had to build a strong enough machine to hold the Kiil dialyzer.

DWM: Right.

RD: So our first machine was a cart on wheels and I've got some pictures here you can see, uh, that um, had all these monitors in it. We had a conductivity monitor. We had a blood leak detector on the outflow. We had an electric eye on the blood flow, and we discovered we could train a patient on it and go home. And that changed the situation because then we had more patients coming in and we trained them all for home dialysis. So they were in the hospital maybe, in a training program for four weeks or five weeks and then went home. Well the

economics was still a problem. We had the supplies to deal with. The machines weren't that expensive compared to today. In fact our machine was the least expensive of machines that were subsequently developed, like in, in uh, England, they had the Lucas machine, um, which uh, was more expensive but at any rate, uh, we were one of the first machines ever to use this ratio of concentrate and wash. That was a new concept. We trained a number of home patients, maybe 20 or more during an era of a couple years, but they had to be financed, so I worked with the state of Oregon with the medical society and also a Dr. Page, who was at the hospital, and he helped us with the medical society, and we got the state of Oregon to contribute, I think $100,000 a year to this project and then we raised money. So each patient had to raise money. So each town where a patient came from, had usually, a fund drive for that patient and that usually paid for the supplies and the things required to dialyze the patient.

DWM: How much would they have to raise on their own, you think, versus...

RD: Usually they raised about $5000.

DWM: Okay.

RD: And sometimes a little bit more, but they were taken anyway, no matter what was raised. It didn't make any difference, but this was the era of the medical screening committees and there was a major one in Seattle and we had one in Portland, and in retrospect, there were cases that we could have taken that wouldn't have cost a lot more. The main goal in this was twofold, one is not to preserve a patient's life who would be otherwise miserable, but the other one was certainly not disguised at all and that is that you could take one patient that would cost as much as seven, who had heart disease, many other problems andsoforth. So we wanted to avoid patients that would end up back in the hospital frequently in that we didn't have any money, and there was no insurance for them, once they were in the hospital. And that screened out a lot of patients including many patients with diabetes, which is the number one cause of renal failure, as you know. And, so that, and I know my friend, who was also chief of nephrology at the medical school, Bill Bennett, who is now, runs a transplant program at Legacy. Bill still, his one case, I thought he'd forget about it but he never has, a girl with lupus that we should have treated. Well didn't. We turned her down - the committee did and there was a number on the committee, and uh, but that was the era where once the committee approved them, then they were accepted and the financial responsibility went to the Kidney Association of Oregon, and then they had to finance taking care of them. The Kidney Association of Oregon, ironically got into the situation where they owned all the machines, and then Medicare started paying for it, and as you know today many corporations recognize that that was a profitable business. So the Kidney Association actually had government funds and eventually turned it over to the hospital and it's made a cycle since then. But all the patients had to be screened, up until Medicare started paying, which was in the '70s, '73, um, and um, once they were screened, they were trained as home patients. And we trained home patients

also from overseas. Uh, Scribner trained a lot of patients from overseas and because our machine became used of course here in Portland and all over Oregon, it was also used in Spokane, Washington, and a doctor who trained at the University of Washington Medical School, became chief of their dialysis program, nephrology over there, Peter Ivanovich. I don't know if you know Peter at all?

DWM: I don't, but I've heard of him, yes.

RD: Yeh, well Peter played a major role in that he really understood the importance of the machine at that time. Spokane center started using our machine and then Scribner, who had been using some Milton Roy machines, decided to use ours and from then on, it went all over the world. So our machine became the number one machine I think, used for chronic dialysis.

DWM: So there wasn't really any sales and marketing in the sense that you all were using it, and it spread from here just by use and word of mouth, and...

RD: Right. And that was the other thing, we didn't think of making any money. We were just trying to figure out how we were going to pay for the thing.

DWM: Right.

RD: The first machine, the second machine and then it became profitable as time went by, but um, now our marketing was different. What we decided was that what people needed was education on how to use the machine and about dialysis, so we developed early on a training program at the factory, for all technicians, and we'd bring, if anybody bought a machine, Mr. Willock would always come to me and say, "I've got a machine sold here." And I would say well we're not going to send it there unless we know they understand dialysis.

DWM: Right.

RD: Because, with one exception, we did have a machine go into Russia and they wouldn't, they don't tell us anything, so you know, and but in general, the centers learned how to dialyze the patients and learned about the machine. We had a number of home patients in different areas where there was no doctor that understood what was going on. We had one patient in Mamou, Louisiana, which I remember, that we were going to stop by and see them because I got drafted because of Viet Nam, and I was at Fort Polk, Louisiana, for two years. Um, during the two years I was there, Charlie Willock called me up and said we had a patient who had some minor problems and questions in Mamou, Louisiana. So we decided one evening, we'd just drive over there and went into this small bar in Mamou, and they're all talking and you walk in and there is no noise. It all stops and everybody is staring at us, and we're thinking, we're not really acceptable in here. And then all of a sudden there was a cop in there and he said, I'll take you

there. So he turned on his light and we were just going to help these people and went by, they were very nice people and they had some legitimate questions, but uh, I was going to say, the main thing that happened during that era with all these home patients is that they all had ideas about what was going on. If they got fluid overloaded, they'd dialyze an extra run, and in Europe, there were a number of studies, and there still are every year, on survival rates. The home patients always survive longer. One of the reasons I think is because they didn't wait two days to dialyze and be fluid overloaded. They just dialyzed.

DWM: Knew themselves.

RD: Um, and so, and they were all trained on fluid overload, and all these things, but they had suggestions. I remember one man, his wife was on dialysis in Klamath Falls, Oregon. We trained him at the center and uh, he would always start out, "Dr. Drake, I'm just a layman." I knew as soon as he said that, it was coming and he'd say, "Now you know we use heparin and you know heparin is manufactured and it comes from two basic sources, beef lung and gut heparin, but you know, I think my wife is allergic to the gut heparin, and I'll tell you why." And he went through the manufacture of heparin for me and this was a description two years before I saw a medical artical on heparin allergy.

DWM: Allergy, yeh.

RD: And uh, uh, he was right. And, uh...

DWM: Tell me how, back up just a minute, and tell me how you got from talking to Charlie Willock on that day at the swimming pool and making a machine in his garage and basement to having like a plant, or a place where you actually made the machines. When did you begin to sort of ramp up and say, "Gosh, we don't need one or two machines, we need 100 machines?"

RD: Right. We um, once it switched over to home dialysis and they started having more machines, we realized we had to manufacture more machines.

DWM: About what year would that have been?

RD: Um, this was in the uh, mid '60s, so probably '64 and '65.

DWM: So you made a couple of machines and then realized...

RD: Then we realized we did, so we bought some property right here in Portland, over on the East Side, and put up a steel building and kept adding steel buildings because of the number of machines we were having to make, and uh, and the factory grew. We had a room there for education. We'd bring in technicians from wherever they were and nurses. We had people

coming from all over the world to the education courses there. The other thing we did was we realized that in designing a machine, we tried to keep it simple because we thought we might get into countries where, get in to computers and other things, which were really not along far enough at the time. We couldn't fix them.

DWM: Right.

RD: And one of the big worries with all types of medical equipment is how are you going to fix it, or if you can't fix it, how are you going to back it up. And so we focused on that a lot. The other thing we did was, when somebody had trouble, say some patient was home dialyzing in North Dakota or something, and they have an electrical problem. The head of our electrical department that did the wiring and everything else would be talking to them. They got, so the manufacturing people got direct contact with the problems and could hear what went wrong, something pulled out here or something, and um, the other thing was Mr. Willock, one of his areas of expertise was going out and studying a problem, and figuring it out. And from that we learned a lot. Now we also created a nightmare and the nightmare was a manufacturing one in that a machine say, in Texas or a center there, they wanted a certain machine with certain things on it, so we had different models and trying to keep track of them all and where they were became really difficult when you had to...

DWM: Well and it certainly sounds like, I mean the FDA wasn't involved, so you could make changes, almost willy-nilly, I mean...

RD: You could.

DWM: ...so how often do you think you were making changes and upgrading, and...

RD: Well, if it was a, a uh, problem that was going to be repeated, it was changed immediately, so those were done, if there was something in the wiring that didn't look right. As far as special models go, I'd say once every year there would be one or two different models. There were some people that wanted to run a, still wanted to run a twin-coil canister, and so we had, with single packs, and so we'd have a little canister for that. Uh, we had machines going to Australia, New Zealand, and uh, those machines were generally all the same, the ones that went there. But then the other big category machines was that the big corporate areas where, actually at the time it was insurance companies and some doctors who had ownership in BMA, and these centers discovered that they could use our basic machine. We could build a central system. So we went ahead and built central systems. Well I always insisted they have two machines, two of the central system machines, one as a backup...

DWM: Right.

RD: In case one, because you have all these patients coming in, you want to be sure you can run them. Well wouldn't you know they are thinking of dollars so they just ran more patients, and so we hooked up, we did a lot of central systems for them and then that required a different console at the bedside, so we had to build consoles for the bedsides, which we did.

DWM: And so this, when you're, you're really then talking about after the law passed in 1972, implemented in '73...

RD: Right, right.

DWM: ...because there were not that many probably centers that were buying machines, I would guess, before there was government support.

RD: There wasn't. No. There wasn't.

DWM: So, yeh.

RD: And also, there were very few centers in Europe using machines but they started often with a professor, and then he would call us because again, Scribner was using the machine, and they were sending patients all over, home training them up there.

DWM: Right.

RD: And they had a, they had a major home training program. So we were in parallel with them, but actually working with them whenever we could, and uh, Charlie Willock, because he checked all the machines, he got to know all these people and at meetings, we knew you know almost all of these doctors.

DWM: What meetings were you going to?

RD: Well that's interesting. Initially there was no nephrology meeting per se but there was a meeting of the Internal Artificial Organ Society, and I always thought it was a bunch of weirdos. I would go there and uh, listen to their discussions on artificial livers and artificial hearts and so forth, and one guy I remember sitting there wanting to show me some pictures and I didn't know what in the world he was going to show me, and he showed me some pictures of a poor cow laying on the ground, and he was running an artificial heart. And he was part of Kolff's program in Utah. And he was so happy because the cow lived - it was a calf - lived 30 days. Well that was a big deal, without throwing emboli and so forth, but on the other hand, the calf didn't look like it was doing real well. But those were the early meetings and that was where the machine was introduced. Then we went to the nephrology meetings but the primary meeting I went to in Europe was the European, EDTA in Europe and I was always a member of that. And

we went to that every year. Um, we uh, uh, had machines all over Europe. Um, we did look for a um, company to supply the machines and uh, to uh, maintain them in Europe and elsewhere, and we met a company, people in a company that was called Fresenius...

DWM: Yes.

RD: ...which now is probably number one in the world in this field, and Fresenius was interesting. They were not in this field but they were into IV solutions and we met the owners of the company, the Kröners, got to know the pretty well. They escaped from East Germany and came over to the west and set up this IV solution business all over Europe, and then they started marketing the machine for us and then they made their own machine. And of course, then they started buying centers in the years subsequent to that. Um, and uh, there was a man who worked for that company, Hans Rudolf, who really was a visionary, for a company, obviously a very valuable employee, and he realized that the dialysis field was going to grow and that it was big field. And he was the one that contacted us at different times in the company and he was always looking around, and the meetings always had the companies there with exhibits like they do today, and he was always looking at new things for the Fresenius company. But of course, he is no longer with them, but the company really grew.

DWM: One of the things that we were just talking about, as I hear this story, is that during this time, there was a lot of change. I mean from Dr. Kolff in the '40s with his rotating drum, and recognizing that he could clean blood through this membrane using the rotating drum, to you all recognizing that you could make a better machine that was more user friend. I mean, this is a time of huge innovation and yet a lot of it was happening with observation, not as much science. What is your thinking about that? Do you think that's true, or...

RD: I think it's definitely true, uh, mostly because we didn't know what, for example, if you knew what you wanted to remove from the patient, in a uremic patient, we didn't know so we had to use the membranes that were available.

DWM: Right.

RD: It was also during that era, we got to know the people at Cordis-Dow, who in Walnut Creek, California, designed the hollow fiber.

DWM: Yeh.

RD: And um, and that, that was a major change in the dialyzer.

DWM: How was that, what made that a big change?

RD: Um, up until, well, up until then, of course initially we had to build the Kiil, and that was a nightmare. It took, I mean as far as to time it and so forth. Then came the flat-plate dialyzers and Gambro made a flat-plate dialyzer that worked pretty well but its surface area was less than you could make with a hollow fiber, so the big change with the hollow fiber, it was a smaller device and yet had the same or bigger surface area, so it's efficiency was the same or bigger than the others. And it could be mass produced, and you completely did away with having to um, build a dialyzer. People today don't realize what it's like to build and artificial kidney, putting the membranes down and so forth, but, so it became a commercially available one.

DWM: It does sound, too, like these early membranes, the Kiil board, that you know, you could have problems. You could have a tear, or a burst, and it could be a big problem where the hollow-fiber dialyzer is more, stable in that sense?

RD: Well they are, of course the problem with the hollow fibers was they had to develop a technique for cutting the fibers without making them go flat and so when they pour the end of the, on the dialyzer there is a seal and the dialysis solution is on one side, as you know, and then they cut it. Well that cutting turned out to be a challenge.

DWM: Sure.

RD: And they've all figured it out now, the manufacturers. Well in a hollow fiber, if one of the fibers is too narrow, it just clots, so when you reuse a hollow fiber, you'll see blood in some of them. It just clotted those fibers, but yes, huge tears and bleeding from one of those is not present. Early on with the tears in the Kiil, because Dr. Scribner was so strong on not having blood pumps and we would have stuck to that except for a number of problems. One is variable blood flow rates, variable clearances, but number one was the cannulas themselves. The cannulas themselves were pretty crude in my estimation. We had a Teflon point that would go into an artery and a vein. The surgeon would put it in. Then they would put a tie around it. Unfortunately where they put the tie, often would kill the vessel and so they could pull back and when they pulled back there would be bleeding and a little aneurysm would develop there, and then that got infected. And if that ever blew out, then you'd have bleeding from that so the cannulas as a source of infection were a big problem and that problem was enough until, no one really solved the problem. We sort of went away from cannulas because we went to blood pumps and then we went to AV fistulas...

DWM: Fistulas, right.

RD: ...and other devices but, no at that time, when the Kiil had a tear, you didn't have a blood pump. If you had a blood pump, you know it's know it's really a problem.

DWM: Problem? In talking to people, there seems like there was also some tension between what was happening in Seattle and the sort of miracles of taking what had been a fatal disease before and offering, you know, dialysis to really keep people alive, with kidney disease, but a lot of tension in the nephrology community where some of the nephrologists thought that this was not real science. I mean this was that there was not a scientific approach to dialysis and that those of you who were doing these early dialyses were, you know, not real scientists in that sense. Did you notice any of that?

RD: They don't come out and visit us much but yeh, I understood that really well. And of course, we also understood very clearly we did not understand everything that was wrong in a uremic patient, and yet at the same time we felt that it was something we could treat and do, but we had to keep working at it to decide, to make it as comfortable for the patient as practical and yet adequately treat the patient, so that part is true. We also knew that if you waited until you figured out all the scientific part of it, you may never get it done and so it was a catch 22.

DWM: Yeh, it does sound like Scribner did not get a lot of respect from some of the nephrology community, at least early on, because of that, and...

RD: Well it um, that's right. I think Charlie Willock is a great example. He, and of course he's not a doctor, he's not an engineer, he didn't go to college, and so he really wouldn't be something you'd say would understand anything, but he was terribly bright and he designed equipment related to what the patient's needs were and I remember him sitting all night in the center watching the machine and watching what we were doing with the patient, trying to figure it out, and that's what was really needed to treat these patients and that's continuing to be needed. In other words, to sit and watch and see what they need. Now the way we discovered what they needed, was we'd talk to the patients all the time, and then the nurses, and so we worked a lot with the nurses. We felt that the nurses were critical, as far as understanding what the problems were in treating the patients and so we hired a nurse to be our marketing director of Europe. And she worked in Virginia and she worked for the government for a while, that's Bernice Hinkley, and it was an experiment because in Europe, most of the sales people are engineers, in this field, and um, most of them are men, and so this was something new. And this was really new going to the Arab world and she did extremely well. We had a salesman in, out of Beirut, Lebanon, who was a chronic dialysis patient. So he was distributing our machines to the few centers there that were using it. Well he never worried about kidney failure. He worried about being shot on the way to the next center. And um, and Bernice used to talk about this. We could never send Bernice to Israel and to Beirut at the same time. We had to reroute them and uh, we had a number of other interesting experiences. We, because we supplied machines through Trieste to Yugoslavia, the lady who was in charge of the company there, just really a nice lady, during the war, she helped smuggle Jewish people over the mountains and out of Germany. The people in her company didn't like a German Company. Fresenius exhibited at a meeting we had in Florence that was a nephrology meeting, and I had

to mediate between these two dealers' people. There were people who, fortunately we got it worked out but it was all related to the war.

DWM: Dialysis is this, has this funny, it's you know, it's patient care, it's medicine and yet it's impacted so greatly by economics and politics...

RD: Right.

DWM: ...and bureaucracy. It's...

RD: Oh yeh, and uh, well there have been more than one study showing the number of dialysis patients, chronic kidney patients treated directly relates to the GNP of the country.

DWM: Yeh.

RD: Um, and um, even in countries that don't have many dialysis patients, many of the politicians are treated. Our machine, we ended up with our machine treating Tito in Yugoslavia. He went into kidney failure. Um, the Philippine leader, um, also was, had kidney failure and he was treated. He was also transplanted by the University of Oregon here. So there are a number of leaders around the world that required dialysis and drop off, and diabetes required, too.

DWM: Yeh, it certainly sounds like in the late 1960s, you all were very, very progressive with home dialysis...

RD: Right.

DWM: ...which has just, just definitely has a proven track record and certainly I would say there were more, there was more plan on the west coast to keep people on dialysis, chronic dialysis versus transplant. Transplant, I gather, came here a little late, compared to the east coast and Boston, where you know, one of their thoughts about dialysis is "We can use dialysis until we can get the transplant done."

RD: Right.

DWM: Would that have been the philosophy in Oregon?

RD: It definitely was a philosophy, but you're right. Most of the transplants started on the east coast, but uh,...

DWM: When would you all have started really using dialysis to get to transplant?

RD: Well, we actually had a, there was a transplant, it was all done at the university. The main transplant program was the University of Oregon Medical School. And they were doing transplants even back in the '60s, and I remember them doing an identical twin, which is, that patient did really well, of course. Um, but as far as a major transplant program, it probably wasn't until the '80s that they really got involved.

DWM: And through the '70s, even once the federal law was passed, did you all really still focus on home dialysis? Or did you move to more in-center.

RD: We moved, we stayed with home dialysis primarily, um, rather than build the center. But the center built up in the, later on the in the '70s, so that we had more patients who for one reason or another we couldn't train, and so we did have a, we had a whole ward that was a center.

DWM: Did that, the not being able to train as many people, do you think that was because you were taking more people, um, sicker people?

RD: Absolutely.

DWM: Yeh.

RD: Absolutely. It was, and once you offer center dialysis, patients are scared by the procedure normally. In fact even nurse are. Say you rotate a nurse out of another ward and you say, I want you to learn dialysis. They're really concerned at first and the big stopper is the needle stick that people don't get into, now I'd be thinking well what about if they drop into shock or if the line disconnects. No they're always thinking about, jeez, I'm not going to do that needle stick. So if we get away from the needle sticks, it wouldn't be quite as stressful to the patients who are starting out. Now once they get used to it and they realize they are going to have to have a needle stick every run, then they get so they can, some of them can put their own needle in, as you know. Well, um, we grew here with the center and then it grew to two centers. We got involved in training centers in Bend, Oregon, and other areas. My group that I work for, Northwest Renal Clinic, started with two nephrologists, myself and another, and it must have 12 or 14, and two or three are just nothing but transplant now. So it's grown and um, at the time though, um, our group was involved in dialyzing patients in almost every hospital in the city. Well that was the other thing I was going to say about home dialysis, but primarily this procedure, it really was a major innovation for acute renal failure because instead of having a big deal as far as well we are going to call doctors out and get a twin-coil and a tank, it was a nursing procedure, so I just picked up the phone and here the patient was in renal failure, we'd already seen a need to be dialyzed, call the nurse on call, technician on call, drop by and see the patient and it was done. I mean, we set up in ICU. So, it was a major benefit in patients with acute renal failure.

DWM: Sure. You know, Belding Scribner is not here, so the people I've been talking to, I've been asking them what they remember about Dr. Scribner in the sense that, I mean he really led the, he was very, he persevered in treating these patients at a time where you know, there were a lot of obstacles, including the shunt, which you know he finally solved, but access and everything. Do, what is your thought about Dr. Scribner?

RD: My first thought is he was one of these that didn't have a big ego. He was one of these that um, um, would listen to anybody and was um, very easy to get along with and very plain. He lived, as you know, in a floating house across from the university and would take a boat across over to the university, and yet he was dedicated and sincere in his belief and what he had learned about renal failure and about the kidneys, that you could maintain patients with dialysis and whenever he had a problem, he would listen to anybody trying to solve it, and they'd focus on it, like the calcium and phosphorus problem. They focused on that. Um, the um, they recognized under-dialysis, unfortunately they didn't approach under-dialysis from a molecular standpoint initially, but uh, they obviously did nerve conduction studies and realized that that was something you had to avoid. But uh, no my recollection of Scribner was he was very honest, down-to-earth, had no big ego and he didn't care if you know, he was well know, I don't think at all. I mean he think he just went to his job, which was teaching at the University of Washington Medical School and trying to solve these problems. I don't think he thought of himself as, you know, wanting to be important or anything else, which can happen, uh, and uh, yet out of it all, he really changed something big.

DWM: Yeh. And it certainly today, I think folks who practice medicine, we're all worried about making mistakes and it's very hard to stand up and say, gosh, this wasn't the right thing to do. But it sounds like in the 1960s, when you all were all working on dialysis and solving problems, that there was a very big open dialogue about well this works, this doesn't work, don't try this. Was that your experience, as well?

RD: Oh yes, right. And of course, it involved a huge area of input. Patients were right on that list. Uh, their input was critical. The nurses' input was critical, so that the treatment program certainly the machine company, we were talking to nurses all the time and we were talking to doctors, and of course, we got to know the different personalities. We got to know the different ones and incidentally, John Sadler is one really likable guy. We got to know him really well, and his stories, but the uh, they all had contributions to make and they all had ideas, and observations, which you know, we had to listen to.

DWM: Other than Dr. Scribner, is there anybody else that you can think back to at that time that gosh, really you know, things that they thought about or learned about made a difference for the dialysis patients and the dialysis therapy?

RD: Well of course, the big one, again back in Seattle at Northwest, Joe Eschbach and erythropoietin. You know, he was working with erythropoietin, and that got developed.

DWM: Yeh.

RD: Um, the uh, uh, as far as other techniques, there were some in Europe, uh, there was an outspoken nephrologist in Europe, in England, who um, I still remember some of his comments were just priceless, and um, uh, Stanley Shaldon. And Stanley would get up and the, the English Health Service was talking about the dangers of serum hepatitis, hepatitis B, and they all had to wear masks and all this, and he gave this, he was the chief of the health service in England and he gave this lecture on this in which he had to dress, and all the nurses had to wear this, and Stanley got up there and said, "That's just a bunch of poppycock." He said, "That doens't make any sense at all." And he said, "This is how the virus is spread. This is how it works, and it makes no sense to do that." And um, well, he was not really loved by the English Health Service. He eventually moved to France but his points about hepatitis B were all valid. And uh, and that was one of our problems with dialysis. One of our things we ran into that we didn't anticipate. We didn't anticipate AIDS, hepatitis B and of course, now all the so-called non-A/B hepatitises, hepatitis C. Those are major problems and we didn't, that was not even on the list back in the '60s. Uh, but doctors have, various doctors in Europe and this country, have kept exploring that, which is, is good.

DWM: Well let's talk about new things. What do you see happening for dialysis in the next 10-20 years? What's new on the horizon?

RD: Well the first thing that had to happen is really interesting, which I felt from the word go. You need more dialysis than just three times a week. And the other thing is the patients get sick between runs. If you have no kidneys and you don't run them for a couple days, they get what you get when you don't have kidneys, and that's fluid overload, acid-base imbalance, usually metabolic acidosis, usually your osmolarity changes because you're usually water overloaded, as well as salt overloaded, uh, uh, fluid overloaded, and all these things make you feel bad and then you can't eat. And so then the dietitian talks to you about eating. Well it just makes sense that you should be dialyzing much more frequently. That's the number one concept. Now once you decide that, then you're into the next series of things, how you solve that problem. Well that gets complicated because most dialysis centers can barely run three times a week, they are so crowded. And so if you say I want to run somebody on, you know, maybe they're on a Monday/Wednesday/Friday schedule and I'm going to run them on Saturday because you know, we're having trouble and, well no we've got Saturdays full. And uh, so it brings you back to home treatment. It brings you back to self care, and that brings you back to how can you treat more patients at home. And that requires a certain type of equipment. Looking down the road, the equipment will get so small you can attach the dialyzer, certainly attach a dialyzer that would remove extracellular fluid. Um, I know David Hume is working on a dialyzer that has cells

in it, that would remove urea and maybe other things, and I have trouble seeing it being totally implantable inside the person, but I definitely think the pumps will get very small. I've been talking and working somewhat but not a lot, with a program or a project at Oregon State...

DWM: Right.

RD: ...on nanotechnology and that is something that is promising in the future because I think that it will be, my thought would be the next step would be as you get into smaller dialyzers and so forth, that you don't have to deal with the blood lines, so you just hook up the dialysis lines, if you have to dialyze them more efficiently. And I think that will happen. I also have felt for a long time that healthcare in general, no matter what disease you have, and certainly one as complicated as renal failure, educating the patient is critical. We went through this, we've gone through this for years with diabetes. Um, the idea that we treat a patient with diabetes, I mean you educate the patient with diabetes and then they treat themselves, or not - whatever they decide to do, and I think the same with the kidney patients. They require education. Unfortunately, because we've accepted more and more patients who have multiple medical problems and they are really depressed, they get to where they really don't care in a way. They want to feel better but it's hard to educate them, but I think that's coming, so in the future I think they'll have to provide some funding, significant funding for educating all the patients who run in and out of a dialysis center, possibly their families, too. And that's what we started out with, we started out with education but the equipment will get smaller.

DWM: So maybe we need to really come back full circle, to really putting dialysis more in the hands of the patient, in their home and out of our in-center-type of environment.

RD: I think so, and then that requires certain changes in equipment.

DWM: Yes.

RD: Now what we learned was, if we could run them at home, we could run them in the center. We even had patients who were running, in an area where there was no center, and the doc there would say they had pneumonia or something, he'd just have them bring the machine in, and they'd run them. So we didn't have, we'd have a helper. We didn't have a nurse. We just had the family member. We'd go in the hospital like in Tillamook, Oregon, you know on the coast - there is a center in Tillamook now - so that the patient's families, you know played a major role and you know, I definitely think that's what's going to happen in the future. Now there will still be patients that really can't do it themselves. We have patients without families and we have many stories of patient families that were unreliable. I remember one girl who had a boyfriend. We trained him and trained her, and she rented her home. Remember now, we didn't have a blood pump so we didn't have the danger of the blood pump but we did have to hook up, and so he would hook her up but he didn't like to watch and he smoked marijuana a

lot, and we decided that, and she did, too, maybe helped her blood flow. I don't know, but he would leave her alone. Well we didn't want her left alone. We didn't like the fact that they were left alone and we would talk about we were going to bring her back and make her a center patient and she really did well. Never had an accident, as far as I know. Um, I think she might have eventually been transplanted. All of our patients that were home patients, with one exception or two, because in that era, all these patients were ideal transplant patients.

DWM: Right.

RD: They were not patients with other complicating medical problems. I had one girl who didn't want to change and there were some religious thoughts and different things, and she was over 30 years on home dialysis. So, um, um, but she had the calcium, the big calcium problem of course is when they start calcifying their vessels and you'll see it, and we had those, too.

DWM: I thank you very much for letting me come and I'm wondering if we can maybe just take a minute and while still recording, just look at some of the things in your scrapbook and talk about them a little bit.

RD: Sure, sure.

DWM: I'll just bring this over. Let's see what you have here.

RD: Well, this is the most popular model of machine ever made. It's the 4015 model. This was a smaller Kiil flat-like dialyzer. It was made by a different company. This was the original machine, which is very small inside, but we had to have a cart to hold the Kiil.

DWM: And there's the hydraulic lift on the Kiil.

RD: They hydraulic lift is there, and so they rinse at the end of the run. This is full of newspaper stories about patients here in Oregon who required funding and then there's some...

DWM: Were you pretty involved in fundraising? Did you have to speak to groups and...

RD: Yes. Yeh, I was really involved and then I became the president of the National Kidney, or actually it's now the National Kidney foundation but the Kidney Association of Oregon. And these are early pictures of patients we hooked up.

DWM: And these are 1967, late 1960s...

RD: '67, right.

DWM: Yeh, the Oregonian, Friday, May 19, 1967. And it does show, that would I guess be one of your really early cart machines with the Kiil board.

RD: Yeh, inside that machine, let's see if it looks in, let's see if it is in here. This is what it looked like inside. This was another thing we did. We recognized early on that you cannot run cold water and heat it without air going in along the membrane, so you got air into the blood lines. Um, incidentally the Kiil flat dialyzer was originally designed as an oxygenator. It wasn't real good as an oxygenator but it was, that's how it was designed, as a membrane oxygenator. Um, and so we decide to super heat the water coming in, cold water and then run a coil inside of it, which was a very efficient to heat, but it also turned out to be a way to kill bacteria, so as long as the water coming in was cold, it was, we used it as air removal. Now air removal is done with negative pressure, but um, it turned out to be a very efficient system and one of the doctors in Seattle at the VA, decided to use that system to sterilize water and make a peritoneal machine, so we designed a peritoneal machine that was an automatic cycler. It was a big thing. We had membranes in it and it was a problem to sterilize it after the run, but we had a much lower peritonitis rate than any of the peritoneal equipment at the time, but it was a bulky machine, but we used the heat exchanger, which you can super heat the water inside and again, we were using tap water, right out of the faucet.

DWM: And one of the reasons you could use the tap water right out of the faucet is your cuprophane membrane, and...

RD: Well that was part of it, and we uh, uh, the main part was that they had other membranes for the peritoneal machine that were bacterial filters.

DWM: Yeh. Now here's a headline that says Portland Kidney Victim Rejected Here, Saved In Baltimore. What was that about?

RD: Well that was what you ran into in that era, that if a committee turned them down, I can't remember what it was. One of the reasons they got turned down was if they had no helper, or the helper refused to treat them, because we couldn't run them in-center, and I think that she was one of those. Well, then she called the newspaper and then that became really a big deal, and as far as I was concerned, we'd treat her. And uh, so uh, the lady that wrote this was Anne Solomon at the Oregonian. We ended up treating her anyway.

DWM: So she didn't end up in Baltimore.

RD: But this was probably a diabetic patient. I wonder if she was. Yeh, there was one, there were several patients I'm sure, both in Seattle and here, that might have gone somewhere else if they could get treated.

DWM: But it does make the point here that demand is greater than production having to do with it. I guess you had more people who wanted to dialyze than you could quite...

RD: Oh absolutely. And of course when they passed the act, Congress passed the act, their estimate of the number of patients per thousand was totally wrong. It had nothing, it had to do with an era when the patients were screened, so it didn't get into the fact that we've known for years.

DWM: No one could anticipate how much screening had limited the number of patients coming.

RD: Right.

DWM: And I would imagine, too, that patients were being screened even before they got to you. I mean there surely were general practitioners who said, oh, you're, you know...

RD: Oh absolutely. And um, there was a lot of that because remember before, none of these patients were treated, so the doctors got used to telling them there was no treatment for this.

DWM: Right.

RD: Then, we had a very, we had a very rare case. I had one minister that refused to come in to be treated because he thought the money should be spent for other patients and he realized that if you spent it on him, somebody else might not be treated. Um, we had a long argument. I had, there were a number of times when we had discussions about religion and how it overlapped this, and occasionally we had a minister, we had one traveling minister who was an evangelist of one sort of another and I told them that if they had ultimate faith with God, they will live forever and if you doubted that God would heal you, then that would cancel that out. Well she called, she's on dialysis. She called up. She said, "I'm not dialyzing anymore, because you know, I don't want God to cancel out the life everafter." And she and I had, she lived down in Roseburg and we talked every day. She was in her 20s. And finally I convinced her that God probably wouldn't cancel her if she just came in for a run. So she came in for one run and I convinced her that maybe she had two runs, and he wouldn't cancel her. So finally I got her to go back on dialysis but it was a tough week.

DWM: Yeh, you're a bit of a, you're the physician, you're the inventor, you're the fundraiser, you're the religious advisor and it's quite a full plate.

RD: That's exactly what happened. And there's a Korean general in here. Oh, these are all letters to Congress when I got drafted.

DWM: Yeh, how old were you when you got drafted?

RD: Um, you know I was in my late 20s, and...

DWM: And pretty busy, probably your hands full with this kidney program here and...

RD: Well that's another interesting thing, uh, um, after I got drafted, we were still having machines and uh, there was um, uh, one of the centers called in and said the patient's blood turned green. And they didn't like that at all. And so, and it might have been fatal. I can't remember what happened, but it might have been. What was that? And, uh, we had this heat exchanger, and the heat exchanger is made of copper and when they got water purifiers, they got deionizers, the guy selling deionizers says you don't have to worry about it, just run an exhaust and don't worry about it. Well no. If it exhausts, particularly on the anion side, then it makes acid and the acid ate the copper and this was copper toxicity, which we figured out, so if you have a deionizer, you, if anything exhausts, you've got to take it off because the thing produces an acid. Now most of the machines today don't have that problem. And we took copper out entirely. But you think about this in water supplies, and if the water supply pH drops and many of them have soldering, so there is lead. Well we got, you know, we talked about all the things we got into with the patients and their uremia, but water itself is a huge problem around the world. We had a lot of sand in the machine in Saudi Arabia. Um,...

DWM: But they drafted you anyway, despite the fact that you were...

RD: Yeh, this was a congressman that wrote and uh...

DWM: But they didn't have you, did they have you working on nephrology or kidney disease when you were in the Army?

RD: They let me go out on the weekends, so I would fly out to centers, I would uh, the colonel in charge, I became chief of medicine of that ward and all the docs, we knew, really, it was a big training base for Viet Nam and I'll just take one side-line story, really the doctors, they were all really bright. One was a transplant surgeon from Houston, Texas, one was the chief of infectious disease at Hahnemann, one was another, and they all got, because we were all 1A because we never got drafted, we just kept going there training, were all pulled together at this training base and so we all obviously got to know each other really well, but one of the things we got into was meningitis at a training base, and we decided that there was a rash that appeared first, this so-called salmon rash. But, if we could find the salmon rash, draw blood cultures and shoot them with penicillin, they'd probably be well by the next day and not get into the consumption coagulopathy. And, um, so that we um, decided to photograph them and one of the doctors who was also a chief of medicine at a hospital down in Orlando, Texas, or Orlando, Florida, uh, he was a photographer, so we found some of these rashes on the wards

and we had these huge URI wards in the fall, and Christmastime, and so we took the pictures and put them up on the wall, then we had only aids in the ward, all the nurses went to Viet Nam, so when they saw these rashes and the fever they would call us, we'd draw blood cultures and shoot them with penicillin. Our incidence of meningitis and our blood cultures were 98% positive for meningococcemia, and um, so we knew if we waited another 12 hours or so, we were in big trouble.

DWM: Big trouble.

RD: And we had one guy leave the base, who obviously got it, and they waited and he got consumption coagulopathy and they lost him, but at any rate, that was just a side-line story.

DWM: So you could on the weekend slip away and do some work...

RD: Right. So on the weekends we were off doing things, uh, let's see, this is Charlie Willock. He's working on an electric powered scooter.

DWM: That's in 1976, yeh.

RD: And he, the big thing he made was parking machines, which and my dad was working, this is my dad. This is me. That's Charlie Willock. You know, I'm just a kid.

DWM: Yeh, you were very young looking. Was the community here in Portland pretty supportive of the, you know, fundraising and dialysis, and the...

RD: In a big way, yeh. And the whole state of Oregon was very supportive. Uh, and uh, it uh, it was extremely helpful.

DWM: And this looks like your newsletter...

RD: It's a newsletter at the company.

DWM: ...from February 17, 1967, so how often would that have been coming out?

RD: Probably every 3 months or so.

DWM: There's a picture of you.

RD: Yes.

DWM: And, Charlie Willock?

RD: That's right.

DWM: Right. And this looks like it is looking at your new building, your steel building going up and...

RD: That's right. And those are the steel building, too, going up.

DWM: Yeh. Amazing.

RD: All the employees, that's Charlie Willock's wife. That's a central system machine and they put this as the dialysates flow around the room and we used to stack them because I insisted on a backup...

DWM: Right.

RD: ...as I said, and then they figured out you'd make more money with it...

DWM: Yeh.

RD: ...hooking more on...

DWM: One on top of the other, yeh. And this is a portable?

RD: Yeh, that was one that we said, one of the, that machine was just another small device. We sold the 4015 more than this one. One of the things we did was early on with the machine, because we wanted the patient to be able to run it up and rinse it themselves, we took a Samsonite luggage case, a small Samsonite, and we had it wired so that it had a switch and the machine, that would go up. The conductivity meter was in the Samsonite and there was a red light related to the blood leak detector, so it was all at the bedside in a Samsonite case, for the one patient.

DWM: So it was very portable.

RD: Yes.

DWM: Yeh, amazing.

RD: Oh, this, these are the, that's what got me involved with Mr. Willock.

DWM: Ah!

RD: That's Kim.

DWM: Your daughter.

RD: And she's now in her 40s.

DWM: So she's the swimming pool girl.

RD: Yeh, she wanted to go to see Karen Willock's swimming pool, and...

DWM: Good for her.

RD: Yeh, that got us together. Um, this is a Korean general. He was a general, former prime minister of Korea. Again, he hard of my name mostly because of the machine and uh, so we had people coming from all over the world.

DWM: Yeh, and this is a picture of him with his doctor.

RD: Yeh, and that's another thing. Of course, he's not a trained nephrologist. Bill Bennett and I have talked about this several times. We had trouble training him.

DWM: The doctor, the young doctor.

RD: Yeh, and part of it was a language barrier, of course, and the general was not one who took no as an answer for anything, and eventually brought his sister over and I always worried that he didn't ask his sister if she wanted to donate a kidney. It was like, I need a kidney and you...

DWM: Here you are.

RD: Yeh.

DWM: Yeh, so this was in 1972, so this was, he came here to Portland and must have been trained along with this young doctor to, and then...

RD: That's right and then took the machine back, right.

DWM: ...took the machine back to Korea and then eventually you say he came back and was transplanted.

RD: Yeh, he was transplanted here. He was worked up for transplant while he was here.

DWM: Here.

RD: Um, and uh, Bill Bennett knows him. Bill Bennett also knows the leader of the Philippines.

DWM: Is that Marcos?

RD: Yeh, Marcos. Yeh, he went in to renal failure. Now these are all the same era, except my book is falling apart.

DWM: Well it's been around a long time.

RD: Yeh. This is one of our earlier patients. He has a cannula in there.

DWM: Yeh, I can see, um, this looks like it's in his leg here, so he has a leg cannula?

RD: Right, yeh. We had to move them around and they were really a problem, and it took a surgeon who was sort of experienced with that, just dealing with the cannulas because, um, trying to get them to work and uh...

DWM: The access problems continue to this day.

RD: Well the access problem has always been a big one.

DWM: Big issue.

RD: And then of course, wouldn't you know, we'd pick patients who have abnormal blood vessels.

DWM: Vascular disease.

RD: And so, they had serious vascular disease and um, yeh, I can put a shunt in a diabetic patient and watch their hand turn white.

DWM: Right.

RD: You know, and it uh...

DWM: Well this picture, this gentleman who's in the picture, and this is from March of 1966, with his leg cannula, I mean this is in 1966, so you've got the full setup here. I mean it really is

amazing um, how efficient, you know, you all had become at dialysis in the mid 1960s. Your bedside machine and...

RD: Right. We learned what the home patient needed and uh, I do think innovations will be headed in that direction in the future. The other thing about home dialysis machines andsoforth, they work in the center. I mean they don't have to stay at home. You can bring them in and use them in the hospital.

DWM: Yes.

RD: And that's what we did.

DWM: Yeh. How did people transport their machines back and forth? I mean these are not little.
RD: No, uh, the uh, but if they lived in a community where they had a pickup or something, they'd just throw it in the back of the pickup...

DWM: Back of their pickup truck and come on.

RD: ...and bring it on. Yeh. And of course, the 4015 machine was even smaller. It's the most popular. It's the one that's all over the world but hm, I don't, well there, it's Kolff's original...

DWM: Yes, the rotating drum.

RD: ...rotating drum. Um, yeh, it started really, I, you know I was in East Germany, East Berlin at a meeting and they had a system where they made the, used the sausage tubing and they wrapped it in little canisters and they had them in the wall, and they'd run the dialysis fluid through these little canisters in the wall, and they made them up for every run, and cold sterilize them and still use them.

DWM: Well this is fantastic. I just appreciate so much you sharing all this with me today.

RD: Well you're really welcome.

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DWM/jhl
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