CHEMICAL HERITAGE FOUNDATION

ROBERT W. ALLINGTON

Transcript of an Interview
Conducted by

Arnold Thackray and John R. Van Ness

in

Lincoln, Nebraska

on

13 November 2001

(With Subsequent Corrections and Additions)

Robert W. Allington

CHEMICAL HERITAGE FOUNDATION
Oral History Program
FINAL RELEASE FORM

This document contains my understanding and agreement with Chemical Heritage Foundation with respect to my participation in a tape-recorded interview conducted by Arnold Thackray and John Van Ness on 13 November 2001.
I have read the transcript supplied by Chemical Heritage Foundation.

1. The tapes, corrected transcript, photographs, and memorabilia (collectively called the "Work") will be maintained by Chemical Heritage Foundation and made available in accordance with general policies for research and other scholarly purposes.

2. I hereby grant, assign, and transfer to Chemical Heritage Foundation all right, title, and interest in the Work, including the literary rights and the copyright, except that I shall retain the right to copy, use, and publish the Work in part or in full until my death.

3. The manuscript may be read and the tape(s) heard by scholars approved by Chemical Heritage Foundation subject to the restrictions listed below. The scholar pledges not to quote from, cite, or reproduce by any means this material except with the written permission of Chemical Heritage Foundation.

4. I wish to place the conditions that I have checked below upon the use of this interview. I understand that Chemical Heritage Foundation will enforce my wishes until the time of my death, when any restrictions will be removed.

Please check one:

a. ✓ **No restrictions for access.**
NOTE: Users citing this interview for purposes of publication are obliged under the terms of the Chemical Heritage Foundation Oral History Program to obtain permission from Chemical Heritage Foundation, Philadelphia, PA.

b. ______ **Semi-restricted access.** (May view the Work. My permission required to quote, cite, or reproduce.)

c. ______ **Restricted access.** (My permission required to view the Work, quote, cite, or reproduce.)

This constitutes my entire and complete understanding.

(Signature) Robert W. Allington
Robert W. Allington

(Date) 4-15-03

Revised 7/8/99

Robert W. Allington, interview by Arnold Thackray and John R. Van Ness in Lincoln, Nebraska, 13 November 2001 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript # 0225).

Chemical Heritage Foundation
Oral History Program
315 Chestnut Street
Philadelphia, Pennsylvania 19106

ROBERT W. ALLINGTON

1935	Born in Madison, Wisconsin on 18 September
2006	Died in Lincoln, Nebraska on 26 March

Education

1959	B.S., electrical engineering, University of Nebraska-Lincoln
1961	M.S., electrical engineering, University of Nebraska-Lincoln

Professional Experience

1952	M & M TV Clinic
1953	Lincoln TV Center
	University of Nebraska-Lincoln
1953-1955	Electronic Development Technician, Agricultural Engineering Department
	Massachusetts Institute of Technology
1955	Intern, Lincoln Laboratory
	Instrumentation Specialties Company [Isco, Inc.]
1958	Founded Instrumentation Specialties Company
1959-present	Chairman of the Board
1959-1996	President
1961-present	Chief Executive Officer

Honors

1959	National first prize for article in engineering student periodical, Engineering College Magazine Association and McGraw-Hill Publishing Company
1959-1961	National Science Foundation Fellowship
1960	First prize for undergraduate research paper, American Institute of Electrical Engineers
1965-present	Registered Professional Engineer
1970	Accredited Professional Chemist
1972	Handicapped Nebraskan of the Year
1975	Outstanding Engineering Achievement Award, Professional Engineers of

Nebraska

1978	Distinguished Service Award, Lincoln Kiwanis Club
1978	IR-100 Award, *Research and Development Magazine*
1985	National Small Business Person of the Year, U.S. Small Business Administration
1985	Honorary D. Sc., University of Nebraska
1985	IR-100 Award, *Research and Development Magazine*
1985	Honorary D. Sc., Chemistry, University of Nebraska
1986	Lincoln Jaycees Outstanding Chief Executive Award
1986	Support of Research Award, Sigma Xi
1988	Business Leadership Award, University of Nebraska
1989	Friend of Science Award, The Nebraska Academy of Sciences, Inc.
1991	Executive of the Year, *Research and Development Magazine*
1993	Outstanding Alumnus Award, University of Nebraska-Lincoln, College of Engineering
1998	Entrepreneur of the Year, Nebraska Center for Entrepreneurship, College of Business Administration, University of Nebraska-Lincoln
1999	Alumni Achievement Award, University of Nebraska
2005	Pittcon Heritage Award, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy and the Chemical Heritage Foundation

ABSTRACT

Robert W. Allington begins the interview with a sketch of his family history. His father, a scientist for the United States Department of Agriculture, and later at the University of Nebraska-Lincoln [UNL], encouraged Allington's interest in science. During his adolescence, Allington developed his skills in electronics through building radios, among other things, and by working as a television repairman. He worked as an intern at the Massachusetts Institute of Technology Lincoln Laboratory on the SAGE air defense computer in the spring of 1955. Near the conclusion of the internship Allington was diagnosed with polio, and throughout the interview describes the effect of the disease on his life. While still in the hospital, he met his future business partner, Jacob Schafer, an undergraduate at the University of Nebraska-Lincoln. Jobs repairing scientific equipment evolved into projects to fulfill requests from his clients for novel instrumentation. This led Allington to become an entrepreneur. He completed his master's degree in electrical engineering at UNL, having taken an unusually large number of chemistry courses for an electrical engineer. Allington abandoned his original intention of a career in academic research to found Instrumentation Specialties Company [Isco]. Originally creating specialized instruments on request, the company gradually evolved into two major divisions, separation and environmental instrumentation. Robert Allington remained active in the research and innovation behind product development even as chief executive officer of his company. He concludes the interview by sharing recollections of his personal life and briefly discussing his future plans.

INTERVIEWERS

Arnold Thackray is president of the Chemical Heritage Foundation. He majored in the physical sciences before turning to the history of science, receiving a Ph.D. from Cambridge University in 1966. He has held appointments at Oxford, Cambridge, Harvard, the Institute for Advanced Study, the Center for Advanced Study in the Behavioral Sciences, and the Hebrew University of Jerusalem. In 1983 he received the Dexter Award from the American Chemical Society for outstanding contributions to the history of chemistry. He served on the faculty of the University of Pennsylvania for more than a quarter of a century. There, he was the founding chairman of the Department of History and Sociology of Science, where he is the Joseph Priestley Professor Emeritus.

John R. Van Ness is vice president for external relations of the Chemical Heritage Foundation. He received Ph.D. and M.A. degrees in anthropology from the University of Pennsylvania and holds a B.A. from Colorado College, Colorado Springs. Van Ness has held several executive positions at colleges in the Philadelphia area, most recently as associate vice president for development at Lehigh University, Bethlehem, Pennsylvania. In addition, he is a noted scholar of Hispanic history and culture in the American Southwest, a series editor at the University of New Mexico Press, and the author of four books. He has won several grants, honors, and awards for his scholarship, and has been included in *Who's Who in America*. He is also on the board of directors of the Mexican Cultural Center in Philadelphia, and is a member of the Association of Fundraising Professionals.

TABLE OF CONTENTS

INTERVIEWEE: **Robert W. Allington**

INTERVIEWERS: **Arnold Thackray and John R. Van Ness**

LOCATION: **Lincoln, Nebraska**

DATE: **13 November 2001**

THACKRAY: Dr. Allington, lets begin by discussing your family background.

ALLINGTON: All right. I will do that. My father [William B. Allington] and mother [Norma Peterson Allington] were both born in Nebraska, both in 1912. My father was born on a ranch north of Sunol, Nebraska, which had a small population of sixty people, and was about 11 miles east of the local metropolis, Sidney, Nebraska. Except for bottomland along the principal creek, the Lodgepole Creek, it was a very arid and dry grassland. My father wasn't born there but he was raised there. He was born in Lodgepole, Nebraska, in a stone house, which is still there. I've seen it.

To explain why he was living in a stone house on a creek in Lodgepole, Nebraska, I have to go back to my grandfather, who was a man I admired greatly. His name was Burt [Burton] Allington, and he was the son of John Allington. Burton was born in Brownville, Nebraska, in 1878, I believe. He and his father didn't get along very well. His father was a ne'er-do-well and made most of his living by gambling both with cards and on speculative deals. My grandfather apparently wasn't very good at it, because in 1892, when he was fourteen, they left Brownville for California in a wagon. I don't know whether it was a covered wagon or not. I suppose it was. They didn't have enough money to move themselves out there by railroad, so they just followed the U.P. [Union Pacific] Railroad in the wagon. When they got to Sidney, which is in western Nebraska, in the so-called panhandle, he [great-grandfather] jumped out of the wagon and hid in the town. The men chasing my great-grandfather gave a cursory look for him, then got back in the wagon and went on to California. [laughter]

He [John Allington] left his fourteen-year-old kid in what was probably the toughest town in Nebraska. It was a tough railroad town. It still is a tough town. There were no social services in 1892, [laughter] so I don't know how he [Burton Allington] managed as a fourteen-year-old, but he got a job as a so-called "ox-skinner." That doesn't mean he slaughtered oxen. It means that they set him up with a freight wagon, either two or four oxen, and a whip, and he'd carry merchandise from the railhead in Sidney—ammunition, guns, food, blasting powder, and so on—to the gold mines in the Black Hills.

Now at that time, the gold miners had broken an Indian treaty to be in the Black Hills, and he [grandfather] was often in the Hills by himself. He could drive sometimes with a group and sometimes by himself. Driving an ox wagon was incredibly slow—a top speed of about 2 miles an hour. There was always the danger of getting killed by the Indians but he never was, obviously, or I wouldn't be here. He would bring the merchandise to the Black Hills, and then bring gold back to the railroad. It was a wonder he didn't get robbed. He was tough. He carried personal weapons with him. He was one tough kid! [laughter]

THACKRAY: That's amazing!

ALLINGTON: Yes, then, when he finally decided there wasn't much future in driving an ox-powered freight wagon, he got a job as a miner in one of those fly-by-night mines. That was long before there was anything like mining safety. There was a foreman and two or three workers. The foreman was a drunk. They'd been working in the mine for a year or so. It was winter. The mineshaft didn't go down far—probably 50 feet or 100 feet. There was a room at the bottom of the shaft where they kept tools, lanterns, dynamite, and the like.

That mine was cold and shallow with a large shaft and a horizontal drift that wasn't very long. One day they drilled holes for dynamite charges. It was particularly cold the next day when they went to set the charges. The charges wouldn't go off because it was too cold to detonate the caps. The caps would go in and the dynamite would just fizzle instead of detonate. The foreman knew what to do. He said, "Boy, that dynamite's cold. We've got to go heat it up." There was a pot-bellied stove in the room at the base of the shaft that they could make lunch on. [laughter] He took the dynamite, several sticks of dynamite, whatever was needed to put in the holes, put them in a frying pan on the stove, and then all of them got absorbed in a card game. [laughter]

Before the card game was over, the whole mess on the stove blew up. The explosion blew pieces of cast iron all around the place. It just happened that this room was highly niched, and the niches were such that none of the direct blast hit these guys. There were low velocity pieces of cast iron plinking, some of it bounced off the dirt walls. The blast hurt their ears. It was just luck that none of them had gone out to get a drink of water, pee, or anything like that. My grandfather quit gold mining after that. [laughter]

In 1898, my grandfather opened a general store in a mining camp in the Black Hills, selling dynamite and general supplies. He married Carrie Wallace. The store wasn't a very successful operation, so they dropped it and moved outside of Lisco, Nebraska, a little town on the North Platte River, in the wilderness. Their farm was called a tree claim. It was like one of Abraham Lincoln's land claims [Homestead Act] except that it was 320 acres instead of 160 acres. In addition to building a house on it and staying there for five years, you had to plant so much of the land with trees.

This whole area was treeless, desert-like. My grandfather planted the trees, improved upon it, and sold it. In 1905, he moved to Lodgepole, Nebraska, where my father was born in 1912. He started farming and ranching near Lodgepole. He made enough money to buy ranchland north of the town of Sunol, which is between Lodgepole and Sidney. He built a very nice craftsman-style house and went into the ranching business.

In 1941, I met my grandfather for the first time. It was very dramatic. The entire family was in the kitchen. It was suppertime. Of course, everybody was waiting for him. He was a grand man. He came in and there was a bunch of banging around out there, in the dirt room where you scraped most of the dirt off. He was an incredible sight. He was wearing cowboy guns, leather riding boots, and was covered with dust. You could hear him splashing and knocking the dust off himself in the dirt room, but he was still pretty dusty. He had a red bandanna around his neck and a cowboy hat. [laughter] All this was real! [laughter]

You could see that he'd been working with a bunch of cattle that were kicking up a lot of dust, because his face, from his eyes on down, was more or less clean when he pulled the bandanna down. He had this raccoon effect around his eyes. [laughter] He came in, stomped around, spoke with a hearty voice, and everybody answered, "Yes, sir. Yes, sir." He was respected! That was something. That was the first time I had seen this. It was better than Hopalong Cassidy—much better. That was a high point for me.

In 1957, he retired and moved to Lincoln. He had to have stomach surgery due to chewing too much tobacco all his life. He didn't have stomach cancer, but his stomach was pretty much burned up from the stuff that he'd swallowed. I was with him for almost a year. He told me a lot of stories about his life and taught me how to play chess. That was quite a time. He went back to Sunol, in 1958, to take care of his wife who had terminal Parkinson's disease. He died on the ranch in 1961.

My father was born in 1912 in Lodgepole. He was a graduate of Sunol high school, a class of three, in 1929. He attended the University of Nebraska-Lincoln [UNL]. In 1929, he worked for the school. Fortunately, he started as a dishwasher in the plant pathology department. That was the first time that he had become involved in a scientific atmosphere. He was mentored by Dr. Robert [W.] Goss, the department head. My father got his bachelor's degree in 1933, and married my mother, Norma Evelyn Peterson that same year. He received his master's degree in plant path [pathology] from the University of Nebraska in 1934, and went on to graduate school at the University of Wisconsin that year. He got a Ph.D. in plant pathology in 1938 and continued in the department until 1942. In 1938, my brother [John R. Allington] was born. I was born in 1935.

In early 1942, my father took a position as leading soybean disease researcher at the USDA [United States Department of Agriculture] lab at the University of Illinois. In January 1948, he accepted an associate professorship in plant pathology at UNL. His old mentor, Dr. Goss, was still the chairman of the department at that time. My father became full professor and chairman in 1949. His job was research and administration, with very little teaching. He taught one course every other semester. At that time, he partially self-built a new house in Lincoln. My brother John and I helped with the work.

In 1960, my father invented a method for controlling the Virus X disease in potatoes, which greatly stunted the size of tubers. This was his idea: he'd take the growing tips—like the leaves and the meristem tip—off potato plants growing in tissue culture. The leading area of the growth, where the growth is at the highest velocity, is the meristem tip. I don't even have a vague idea of what that is—I'm not a botanist. Up until this time, Virus X wasn't called Virus X because they thought it was a genetic defect that was closely involved with the DNA [deoxyribonucleic acid] of the plant. My father first discovered that it was a virus and then second, he wondered how the virus was propagated in the plant. Would a growing plant propagate it [Virus X] as fast as the plant would grow, if you provided optimum conditions for plant growth?

He started growing meristem tips in high potency tissue culture, so they grew exceedingly fast. Sure enough, if you snipped off the tippity-tip ends of these things, then grew them in another tissue culture, they'd be virus-free. He developed an antibody test with methods that could be used by local potato organizations that bought potatoes just for size and so forth. They had a little part-time laboratory in Scottsbluff, Nebraska, where they hired a housewife to run a simplified version of this test. He hired a superintendent for the rabbit herd in the basement of the plant industry building, and produced continuing antibodies to Virus X. They used an immunoassay to determine whether or not a plant was infected. If the plants were infected, they weren't sold as seeds. Commercially, potatoes were propagated by setting out tubers and then planting the tubers as seed. They used only virus-free tubers. The tubers were carefully washed with formaldehyde and kept in sterile conditions until they were planted, and it worked.

In 1967, he and my mother went to the Republic of Columbia—a quieter place at the time—to work on Virus X at that Republic's invitation. He led a program that brought Virus X under control in Columbia, and for a while at least, it solved their food problem.

THACKRAY: Was that a company? How was the antibody distributed?

ALLINGTON: It was a state service. In fact, propagating this knowledge outside Nebraska annoyed my father, but only at a very deep level because he cooperated. In fact, he went to other states. I remember I went along with him once on a trip to a company in Alabama to show them how to do this, and he was very cooperative with them. The idea was not to improve the world's food production at the cost of the Nebraska taxpayer; it was just to improve the world's food production, period. He knew the difference, but sometimes it bothered him because of where his funding came from. Most of it came from the Nebraska Potato Association, the state, and some of it from the federal government, the USDA. He made sure that Nebraska got first crack at it, but he also traveled frequently throughout the country explaining the immunoassay and sanitation method. I don't know whether Nebraska supplied immune serum to other states or not, but I doubt it. I think they got the other states to use the Nebraska model, where the state grew the rabbits, harvested the serum, and purified the antibodies. Then the state distributed the antibodies to the potato associations. He trained an awful lot of people how to do that at the offices of all the potato associations in Nebraska, and he trained a lot of other states on how to train local growers. It was like the Green Revolution, but it was the white revolution.

THACKRAY: Yes. That must have made him a very noted figure in the community, both in plant pathology and in the potato world.

ALLINGTON: You bet. That was a remarkable achievement.

THACKRAY: Will you follow out your father's life?

ALLINGTON: Let's see, my father resigned from the department headship to move to full-time research in 1966, and in 1967, he went to Columbia. In 1968, he resigned from UNL, which amazed me—early retirement—and became Isco, Inc.'s [Instrumentation Specialties Company, Incorporated] first application chemist. Finally, he wound up as the head of a small group here. In 1975, in May, he contracted cancer. My mother died the same year. He remarried in 1976 in March, but died in September 1976.

My mother, Norma Peterson Allington, was born in 1912 in Holdrege, which is a Swedish enclave in central Nebraska. She lived on her parents' farm outside Holdrege. She learned how to speak English when she was in first grade in 1918. She entered UNL in 1929 as an honor student in home economics. She was a member of various honor societies, and graduated in 1933. Then she taught high school for one year. She met my father in about 1931 and married him in 1933. At that time, her life converged on her husband, my father.

She was what you called in the 1950s a typical housewife/mother, and was psychologically dependent on her husband. She did have outside interests, including her old family, especially her mother [Luella H. Peterson]. My mother's family was full of old Swedes who were fun to talk to once I had learned how to understand somebody who spoke with a thick Swedish accent. In fact, we went out there [to Holdrege] often to go fishing, pheasant hunting, or the like, before I was diagnosed with polio. After I was diagnosed, we went out there for a wedding. After the wedding, my mother's uncle, Uncle Vic [Victor Harris] came up to me and said, "Bobby, how did you like the wedding?" In an accent like that—I can't do it very well. [laughter] You have to hear the real thing. I said, "It was pretty good, Uncle Vic." Then he said, "I just as soon have gone to a dogfight." [laughter]

The Swedes, they're like the Dutch. They don't fool around. [laughter] They say what they think. Anyhow, that was Uncle Vic and Aunt Selma [Selma Harris]. I have lots of memories of them. Aunt Selma lived into the middle 1980s. Mary [Lynn Taylor Allington], my wife, and I went to Holdrege and saw Aunt Selma a couple times before she died.

In addition to my mother's family, which also included her mother [Luella H. Peterson], who stayed with us quite a bit of the time when I was a kid, my mother had other relatives, UNL home economic department friends, classmates, and college societies. The shock of my father's diagnosis of terminal cancer aggravated her existing heart problem, and she died about a week later—just bang, bang, like that. It was just terrible.

I was born in September 1935 in Madison, Wisconsin. We lived in a rented 1910-style bungalow on Crandall Street. We moved in 1938 to a new home at 236 East Sunset Court, on the edge of the town. Then in 1948 we moved to 908 West Charles, a rented house in Champagne, Illinois. Then we moved again in 1948, after several months, to a purchased house at 406 South Edwin Street. I have more vivid recollections of my life before age three than most people have. My first few memories are before I could either walk or talk. One was routine and couldn't be verified, but I have good verification of the other.

My father bought a new 1936 Ford in May 1936. That would have made me about eight months old. He perched me on the fender straddling the headlight. I remember hanging onto the headlight, and hearing my father and some neighbors laugh at me, holding on. I noticed the fender was warm. I looked down and saw my white diapers contrasting to the maroon of the car. I looked up and saw my father taking my picture. In 1979, my wife and I were examining old stuff that had been saved for a long time and we found two rolls of exposed but undeveloped film. I had them processed and printed. One contained the baby pictures of me on the 1936 Ford. [laughter]

THACKRAY: How about that! [laughter]

ALLINGTON: For years people were telling me that I was crazy.

Except for a penchant for exploring storm sewers, my activities as a young child were not particularly unusual. I participated with other kids in World War II adventures. We were all Americans—nobody wanted to be the Japanese or Germans. I became more involved after age six in home workshop and taking things apart and sometimes getting them together again. For example, my father bought me a wind-up alarm clock in 1943. I took it apart without damaging it. I would have been able to put it back together except I wasn't strong enough to wind the springs, to get them reset. I gave up on that.

I had a lot of fun playing with batteries, lamps, and doorbells. My father gave me a chemistry set when I was eight, and he gave my brother and me an Erector Set when I was nine. My first encounter with electronics was at a Cub Scout meeting when I was nine. The program was on a crystal set made by a local radio repairman. I acquired plans on how to make a very simple crystal set and my father helped me build it. It worked, amazingly. It picked up two stations. We even built a crystal detector. I don't remember where we found the crystal. I do remember that it was a cubic lead sulfide crystal.

Then I went through a long dry period, in which I attempted to make more complex radios. I failed every time until I was thirteen because I had the wrong kind of tubes, bad batteries, bad homemade coils, and so forth. My father was pretty disgusted about this. He was really disappointed. He let me know! He'd say, "Can't you make a radio yet?" I remember one of the times when I blew it, because I saw the article again later.

[END OF TAPE, SIDE 1]

ALLINGTON: The 6G6 [radio tubes] were supposed to run with an anode voltage of about 100 V, but an article in a technician's magazine swore up and down that they would run on an anode voltage of 6 V, but they didn't. Years later I found another article and it said that a tube with this unusual property was the type 6C6 tube, which was one of the very few tubes that would run on an anode voltage of 6 V. Either it was a misprint or I mistook the thing when I was copying it down. It was all just stupid mistakes like that. It was just an incredible run of ineptitude and bad luck.

THACKRAY: Did your father hope you'd be a scientist?

ALLINGTON: Yes. He wanted me to be a scientist, but it was alright with him if I became an engineer. He did not want me to become a radio repairman. [laughter]

THACKRAY: What happened to the chemistry set?

ALLINGTON: I played with it and I had a lot of fun, but I didn't understand the chemistry. It was fun to produce what we called "chemical effects." [laughter] Some of it I could understand; for instance, the fountain experiment, where you absorbed a gas in a flask that has a spout in it, and it spouted liquid. That was not beyond my comprehension, but a lot of it was.

My school history is that I attended Dugeon Grade School in Madison, Wisconsin, from 1940 to 1943, South Side School in Champagne, Illinois in 1943, and Howard School, Champagne, Illinois from 1943 to 1947. At University of Illinois High School, they had seventh grade in the first semester and eighth grade the second semester, so my second year in junior high school was the ninth grade. After I completed the seventh grade there, I moved to Lincoln in 1948. From January 1948 until June 1949, I completed the last half of the eighth grade and ninth grade in Whittier Junior High School in Lincoln. From 1949 to 1952, I attended Northeast High School in Lincoln and graduated in 1952.

At the age of nine, while learning to play baseball, I made the disastrous discovery that I entirely lacked the eye to brain coordination needed to predict the path of an object moving in three dimensions, especially if it was moving towards me! [laughter] It wasn't that I would duck, you know, but I would be absolutely clueless about whether it was going to come right toward me or to the right or the left or above or below. I couldn't do it. To this day, I have a problem driving a car. It isn't as bad as it sounds—the only thing that bothers me is if I have a stop sign on a minor street going into a very busy four-lane street. As I look down the four-lane street, I have difficulty judging how long it is going to take an oncoming car to cross my position, so I always wait until I'm damned sure, and then somebody honks behind me. Another problem I have is that if the cars are far enough off, I can't see the lane lines. I can't tell whether an oncoming car is in the inside or outside lane by its motion on the opposite side of the street, which means that I wait a very long time. Lots of times I'll go out of my way to take paths that don't involve this situation, or I'll make sure that the traffic is light enough that nobody will honk behind me! [laughter]

To get back to grade school: after the experience of being picked last on scratch teams for a year, I gave up on any sport involving a moving object. I became a loner basically, especially after I was ridiculed in class by my fourth grade teacher. The result was the deepening of my interest in electronics and chemistry. I made a lot of successful gadgets before making the famous working radio. I built my first working radio was in 1948. In 1947 I made a full electric burglar alarm and a bunch of other gadgets. The burglar alarm wasn't as easy to make as it is now, because there weren't semiconductor photocells. It had a vacuum tube photocell, a gas discharge thyratron amplifier, relays, and so forth.

Whittier Junior High School was an absolute disaster. It was hard to believe that a junior high school in Lincoln, Nebraska, in the 1940s, could have been like that. There were fourteen-year-old heroin addicts—only two of them, fortunately. One of them was in a class where I was. He locked the teacher in a closet. There was a lot of banging from the other side of the door, while he passed his syringe around the class for examination. When it came to me, I actually broke it. He was furious. Fortunately, he wasn't big or strong. He was long, scrawny, and belonged to none of the gangs. He was an outcast because of his homosexuality, so there were no repercussions over this. It was serious business at Whittier Junior High.

Another thing that was hard to believe is that there was an awful lot of sexual activity among the students in the school. The place was absolutely out of control. I was beaten up twice, knifed twice—but only once seriously—and thrown down a flight of stairs once. Although I carry the evidence on various places on my body, my parents never believed this enough to make waves. On the other hand, my father was a stern, demanding disciplinarian, and from that time on, until I was in college, I didn't feel much closeness to my parents. They just left me alone to float in that hideous environment.

THACKRAY: You changed towns and schools a lot also.

ALLINGTON: Illinois wasn't like that. There were an assortment of mean kids everyplace, but in this place, more than half the kids were mean.

THACKRAY: Was that because of the catchment area?

ALLINGTON: Yes, that's right. The school was in the toughest part of town. I remember pouring lead in a mold to make castings in metal shop class. Just about all the kids smoked—you had to smoke in order to be anyone. I didn't smoke. The instructor of the metal shop always wore a plastic kitchen apron. I don't know what it was made of—it looked like vinyl, but it burned like cellulose nitrate. The students would light the strings on the back of the apron with a cigarette lighter. The fire went up the back and around the front, and caught the front of his apron on fire; by that time, the kid was long gone. This guy was a foil for them.

There were several teachers that were foils. They'd scream and shout upon aggravation and everybody would be delighted. The worst thing that happened was when some kid picked up a ladle of hot lead in one hand, and with the other, pulled the teacher's hip pocket out and poured the hot iron into his pocket. The teacher ran for the boys' restroom, pulled up the toilet seat and sat down in the water, while a bunch of yelling, laughing kids followed him. That's truly mean, truly vicious.

THACKRAY: *Lord of the Flies* (1).

ALLINGTON: Yes, a bit like that.

THACKRAY: Yes, that must have really caused you to drive in on yourself.

ALLINGTON: That's right. I wanted no part of the social life in that place, although I did want it but couldn't get it in high school, in the previous junior high, or in grade school. Starting in eighth grade, I became more interested in electronics than chemistry because I could do dramatic things to entertain myself and other friends my age. As I indicated, doing experiments was partially social and a lot of it was out of curiosity. It was probably more out of curiosity, but the social aspects would often determine what I did. I wanted to astound the kids in the neighborhood, get their admiration, and all that kind of stuff.

An example of one of the designs that I built was two generations of Tesla coils, which is a form of high voltage generation, usually over 100 kV at radio frequencies. My first attempt was a flop, so I won't count that one. The next one worked and I developed something under 100 kV. The third one used a large war surplus radio transmitter tube and a large surplus transformer to supply high voltage 60-cycle power to the tuned anode circuit. That was about 1 kV where the tube was. It worked and delivered about 300 kV at about 200 W and about 1

MHz. The output couldn't have shocked you, because of the self-inductiveness of conducting bodies, including human bodies.

The 60 Hz power transformer, however, could be deadly and I was very careful not to come anywhere close to it except when it was unplugged. When I was not driving some gadget on the high-voltage terminal, it produced an impressive discharge on its top terminal, on top of its long column. The discharge extended radially outwards 4 inches and resembled a burning bush being blown by a turbulent wind. The wind was generated by heating of the surrounding air at 200 W that was discharged through a blunt point. Once the "brush" discharge got out, it got hot, rose, and moved. The whole thing danced around so fast that you saw it clearly, so it looked like a bush blowing in the wind.

THACKRAY: Did you conduct those experiments in your home?

ALLINGTON: Yes, in the basement.

THACKRAY: What was your mother doing? [laughter]

ALLINGTON: My parents didn't like it, but they tolerated it. I didn't tell them about the danger from the 60 Hz volt transformer though. When the burning bush discharge was going on, it made an impressive noise. It sounded like something out of an old science fiction movie. "Won-won-won-won-won." It was a combination of 60 Hz modulation from the transmitter and, of course, the hissing mumble from the bush discharge. That was something. It was just absolutely "evil."

My favorite Tesla coil gadget was an adaptation of the ancient Aeropile invented by Hero of Alexandria. Instead of a steam jet reaction, it spun by reaction from the hot air produced from the discharge on the lawn sprinkler-like tips that pivoted on a needle on top of the high voltage terminal. I was the only kid in the neighborhood with nerve enough to stick his hand in the raw discharge. The trick was to wiggle your fingers and hands faster than the discharge could heat them enough to burn a hole in them, or at least leave a visible or painful welt. Even so, it left your hand smelling like a burnt pork roast. [laughter]

THACKRAY: [laughter] Did that succeed in impressing the neighborhood children?

ALLINGTON: Indeed. Another successful entertainment device was a night vision scope I designed and built in 1950, when I was fifteen. I used a surplus wavelength converter amplifier tube, surplus optics from a World War II fighter plane gun sight, a surplus 2 V storage battery, and a high voltage coil for the energy converter tube. The coil was originally intended to spark a model airplane ignition. The coil had to be converted to direct current, which I did with miscellaneous TV [television] and radio parts. I used a 6 V automobile headlight operating at 2 volts with a Wratten infrared filter for illumination. There were various ancillary functions that we had to take care of before it worked. I found that one of its [the night vision scope] best uses was playing hide-and-seek after dark. Everyone wanted to be "it" instead of the other way around. [laughter]

My next big interest, which started in 1951, was building high-fidelity [hi-fi] radios and record players. There were no notable commercial makers of hi-fi equipment except for two makers of loudspeaker elements. No cabinets were available. There was one maker of hi-fi record players and one maker of record player heads, which were vibration to voltage converters. There were no stereo program materials—everything was monophonic. It was really great to be able to blow into the class as some sort of aficionado. I made several generations of power supplies, pre-amplifiers, amplifiers, and speaker cabinets. Some of the latter were the built-in type. When stereo arrived, I probably built the first one in town. I was particularly good at making speaker cabinets. I even designed them for others, although I never built them for others. I only built them for myself.

I entered UNL in the electrical engineering curriculum in 1952, at the age of sixteen. My father rekindled my interest in chemistry and I started taking chemistry courses, as many as the obligatory engineering student could. It was difficult to get permission for the chemistry courses that weren't required to graduate in engineering. It was hard for me to get into the organic for majors course. The engineering dean did not give me credit for it. During this time, I became interested in digital computers. There were no courses in computers during the 1954 to 1955 school year. Fortunately, the mathematics department offered a course in numerical problem solving methods, so I enrolled and was pleased when Professor Camp told us, on the first day, that he had struggled with his department over whether to even offer this course, because it was intended for learning how to develop digital algorithms. At that time it was predicted that one hundred computers would saturate the U.S. market, so computer programming would never be a full-time job, let alone a profession. [laughter] I got a lot out of that course. UNL had a huge library, so I was able to do a lot of reading on electronic circuit realization of computer elements.

Aside from classes, back in high school I had discovered girls. When I started at UNL, I joined a college fraternity. I had taken a night course in TV [television] repair when I was a high school senior, and worked from June 1952 to August 1953 as a TV repairman, including throughout the school year. In 1953 through 1955, I worked as an electronic development technician in the agricultural engineering department, while attending school. Interestingly enough, the TV repair job was the more intellectually challenging of the two.

THACKRAY: Were you living on campus or at home?

ALLINGTON: I was living at home. They didn't charge the full amount for the college fraternity if you lived at home. They included noon meals, and all of the fraternity activities except for a room in the house, which was fine. It was fun, and it was something I needed. Between the fraternity and my hobbies, I was only a B- student, but I had grown socially. I was antisocial back in high school.

By the way, the TV repairman job helped a lot because I met a lot of people. I was sixteen to seventeen at that time. I had a terrible time getting a job at first. I had no experience, I was just in high school, and I was sixteen, but I looked like I was fourteen. I matured late. I finally got a job after a couple of weeks of searching. The first job was terrible. I didn't have a car, so the boss gave me a car to use. I was quite surprised to find it had no brakes, literally. [laughter] So I said, "I can't drive a car without brakes." He said, "You're sure fussy. I'll put you on an antennae crew." That was a step down but I needed the money. At that time I was extremely afraid of heights, so he fired me the second day as a good-for-nothing.

I got a new job, and did really well as a TV repairman at this other place. I did more bench work and service work. I was probably better at it than the boss was. By concentrating on what I was doing, moving fast, and planning my moves, I could turn out more TV sets than anyone else. At the same time, I learned an awful lot about people. I got to go into all sort of houses, some of them belonged to well-to-do people where the main concern was to fix the TV set without scratching any of the surrounding furniture or anything like that, and then there were other kinds of houses. I remember three in particular. In one of them, some poor guy was living with only two pieces of furniture—his TV set and a kitchen table. The TV set had some things wrong with it, and I made a lot of fixes that you normally wouldn't do. For instance, the cap was off one of the tubes, and normally you would just put a new tube in, but you can reconnect it up permanently without damaging anything, so I did that and he got it at no charge for parts.

At another place, I came in and people were eating breakfast. The TV set was near the side of the breakfast table. I looked over at them eating breakfast, and saw they had a very dirty oilcloth on the breakfast table. I soon found out why. The husband and two or three kids sat down and the wife put a bunch of pancakes in front of everybody right on the bare oilcloth, then they poured syrup on them. [laughter] The most mortifying visit was when I went to one house out in the outskirts of town, way out by itself. The woman who opened the door was wearing a disheveled housecoat and her lipstick was on crooked. She was obviously a prostitute. I got in the house and her two kids came running up to me. Each grabbed a hold of one of my legs and yelled, "Daddy! Daddy!" That was too much for a sixteen-year-old kid to take! [laughter]

I was having trouble getting into people's houses because they wouldn't let me in. They didn't want a kid fixing their television set. So I went to a place downtown that sold bargain clothing and made myself a TV repairman uniform. I bought a pair of blue work slacks, a work shirt that matched the slacks, and a black leather bowtie. I didn't have any trouble after that. [laughter] They never bothered to look at my face. They thought, "Yes, that's a TV repairman." [laughter]

Some things were great. I met several nice girls, but they dumped me. One disappointment was that being a TV repairman was no attraction. One day a girl was hanging around the living room, waiting to see who the TV repairman would be, but I was too shy to make a move. That only happened once and nothing came of it. In my dreams, you know, that should have happened every day! [laughter] I got the most trouble from pregnant women, who were for some reason or other very suspicious of strangers, and female German shepherd dogs that were not only protective of their family, but also protective of the family's possessions. If a stranger came in and acted suspiciously—went over to the TV set, played with the TV set without even being introduced, pulled the TV set around, fiddled around in the back, and took the back off—the dog would think that you were ruining the TV set. If the set had to go to the shop, you wouldn't carry the whole console back. You unscrewed the TV and pulled the chassis out, and it was hard to not get bitten when one of those creatures saw you going out the door with the secret workings of the TV set. [laughter]

THACKRAY: [laughter] Was your father encouraging you in academic directions?

ALLINGTON: Yes, he was. From the time that I was old enough to consider what I would do for a living, I wanted to go to school and get an advanced degree like my father, and go into either chemistry or engineering. The botany business didn't interest me that much. Actually, my father was more of a biochemist than a botanist, but he was a good botanist because of the progression of his education.

When I was in college, I vacillated between electrical engineering and chemistry. I started out as an electrical engineering major and that's probably why I was more of an electrical engineer than a chemist when I graduated. I'm still a fair chemist, but not because of any efforts of the University of Nebraska administration—they did give students advice, but I didn't fit in a nice little package.

In spring 1955, I very much wanted to get a scientific or engineering internship for the summer. There were two internship openings through UNL that interested me the most. One was with Cutter Laboratories, which was one of the companies that had started the production of [Jonas E.] Salk's polio vaccine in the 1950s. It was their intention—they and other companies carried it out—to vaccinate almost everyone in the United States during the early spring of 1956. I wrote them a letter of application with a resume for a job as a production technician. They turned me down because they couldn't figure out a use for what they termed an electrical engineering student. On my application, I considered myself a chemistry student. They got the wrong idea about me.

It turned out in 1956 that their product was not safe because of bad temperature control in the bioreactors. One of their batches infected a number of people with polio. I often wonder if I could have prevented that—I try not to. I was accepted as an intern at MIT's [Massachusetts Institute of Technology] Lincoln Laboratory in Lexington, Massachusetts; working on the absolutely huge SAGE [Semi-Automatic Ground Environment] air defense computer AN/FSQ-7. It was about 100 feet by 100 feet, and 4 stories tall. It was finished in about 1957, went online in 1958, and wasn't taken off-line until 1983. Twenty-five years! There were about fifteen built.

[END OF TAPE, SIDE 2]

ALLINGTON: I got the position because of my interest in computers, my experiences in electronic technology, my hobbies, and, not least, because my mother's cousin was an important person in Lincoln Lab. That always helps, especially in a big institution. [laughter] I was truly amazed when I got the job. The summer was an exciting time for my internship, because it was in the quintessential secret government laboratory, which would appeal to any kid. To get in, you left the highway on a road marked, "No Trespassing" that led you through the woods up to a gate and a chained fence with some sort of "U.S. Government Only" or "Authorized Personnel of the Government" sign on it. I don't remember the exact wording. Then you passed the security guard and parked your car. The building was huge and had many entrances, only one of which you were authorized to use. You went in the door and the guard scrutinized you and your security badge from the safety of a peephole. If you qualified to enter, an electrically operated steel door opened to the inner sanctum. There also was a lot of internal security in the building.

I was assigned—solo—to my own secret development sub-project. The purpose of the overall project was the designing and prototyping of the first powerful digital computer in the world. The computer was for nothing less than the online tactical control and coordination of the air defense of the United States and Canada. The atmosphere around the place wasn't what I expected. In spite of the secrecy, there was much more camaraderie between the professional workers than I had ever seen before, not to mention the genuine Boston deli they had in addition to the cafeteria. I had never experienced that before either. I never went to the cafeteria for lunch, because I tried out the deli first. I also enjoyed trips into the town of Boston, except for the roads and traffic.

The computer had two names. The civilian name was SAGE, standing for Semi-Automatic Ground Environment, which was a very good use of an acronym. The Air Force called it the FSQ-7. That's a strange thing to remember, but I'll never forget it—FSQ-7. The inputs were the plots of all the air defense radars in the U.S. and Canada and all the flight plans of any type filed in the U.S. and Canada. It pin-pointed radar plots of aircraft after allowing for slow speed, low altitude, and so forth. The possible threats, called "bogies," were plotted on many individual CRT [cathode ray tube] consoles equipped with light pens. Now, this was fantastic in 1955. Nobody had ever thought of a CRT console and a light pen before. A light pen was just a variation on a mouse. Instead of using the pen to move a cursor, or using a mouse to move a cursor, you used the pen itself as a cursor. The display showed little outlines of bogie airplanes, each labeled alphabetically with ID [identification] number and other notations—speed, direction, altitude, and additional things that I don't remember.

The computer and set of consoles were in a blast-proof concrete building about 100 feet square by 4 stories high. You could literally walk around inside this computer. In fact, I did. It was finished in 1957, and was up and online with fifteen replicates of itself in the U.S. in 1958. IBM [International Business Machines Corporation] was the contractor and they built the replicates fast because they were kept up to date in the prototyping phase. The computer was designed in 1955 using vacuum tubes. Considering that by 1975, eight years before the big computer was taken off-line, all computers were built using third generation solid-state circuits, says a lot for the reliability that was built into the FSQ-7.

That was another thing that I learned—to avoid marginal designs. Everything was not only tested, but all the operating margins were tested too. We simulated every conceivable combination of faults and power supplies to see how bad the situation could get and still have the computer work. It used special tubes that were designed for long life. It was amazing, especially in retrospect.

THACKRAY: Were there other college students?

ALLINGTON: Yes, there was one. I can't remember his name, but he was in the next lab or set of offices from mine. He was from Oberlin College.

THACKRAY: Were there any formal activities for you as a student, or were you just plugged in, as it were?

ALLINGTON: No, it was formal. I was given a designated project, told to work on it, and then make reports. I was treated like a real engineer except for my salary. I can tell you exactly what I was working on. The computer was so huge that the propagation time for signals going from one part of the computer to another—from the processor floor to the memory floor for example—was so long that they used coaxial cable to connect them up. I designed the driver that was used for every one of these coaxial cables. It went from a logic level to a level that would drive a coaxial cable 15 V through a 93 Ω cable, which is a lot of capacity discharged through the cables.

THACKRAY: Was this your first extended time away from home?

ALLINGTON: That's right. I had spent maybe a month working at the ranch once, but that was with the relatives. I was on my own, which was something. I met girls without parental supervision, which was—well, what can I say about that? [laughter] That was another big positive of being on my own.

The manager of the place was Jay Forrester. He went from modeling air defense environments to modeling large corporations to modeling economies in general. At Lincoln Lab he was spoken of with reverence. He was the only one in management there that later visited me in the hospital. I've met him three or four times since. I even accepted an award for him once. That was a real privilege.

THACKRAY: When and where was that?

ALLINGTON: I didn't even have to go far for it. Amazingly enough, the award ceremony was being held at the local university. It was late 1980s or early 1990s.

On 11 August 1955, I woke with a stiff neck, but I went to work and didn't think much of it. I swam a lot when I was working there, in a suburban lake. It had a lot of houses around it, but was designated as a public swimming place, at least for residents in that county. You could swim underwater for considerable distances, which was fun, because the water was clear. I went swimming that day, and felt better from the exercise, but I had a headache and sore back the next day, Friday. After work, I swam again and felt better. The next day was Saturday, and I didn't feel any better after swimming. On Sunday I stayed in bed.

On Monday I got up and just managed to drive the 20 miles to work. My superior saw me when I got to my office and sent me to the dispensary, which had a full-time medical doctor and nurse. The tentative diagnosis was poliomyelitis [polio]. He drove me to a medical laboratory. "Don't drive in this condition," he said, before a definitive and unfortunately positive test. Then he drove me to the emergency entrance of Massachusetts General Hospital, which is composed of several different buildings with names like [George Robert] White or [Charles] Bullfinch—the famous architect from Boston. He designed a lot of the early buildings in Boston.

When the dispensary doctor dropped me at the emergency entrance, he told me I should call home and say good-bye. There was big crowd around the entrance, people with broken arms, bleeding cuts, and so forth. A guy with a bad knife cut on his face walked up to me and said, "You don't look so bad. What are you doing here?" When I told him, he jumped back, the crowd melted before me, and I had access to the payphones. Polio was better than leprosy! [laughter]

I called my parents, but for some reason I didn't expect them to come, probably because I was confused. A man in a white uniform and a clipboard was going around listing ailments for triage. I talked to him and he told me to come inside right away. That was the last time I walked. Two orderlies with facemasks tossed me onto a gurney and wheeled me into an isolation room on the eighth floor of the White Building. Severe paralysis developed in a few days, and my parents came to visit in about a day and a half after I'd phoned them. They had dropped everything. Some friends from work visited, as well as my mother's cousin.

I became sick enough to be moved to the tenth floor of the White Building, which was reserved entirely for critical polio patients. My condition was soon downgraded to danger. Since everybody with the same condition was segregated together, I had the experience of seeing patients like me die around me. That was scary. I spent three days in an iron lung and had a lot of weird, vivid, detailed, storytelling hallucinations, all of which I remember quite clearly. I got better, progressing up to critical and then to fair.

At this time I met a wonderful nurse and we were very attracted to each other. In fact, we were in love. After I was evacuated on a National Guard medevac [medical evacuation] plane back to Lincoln on 25 October, the affair didn't survive long. She moved closer to Lincoln—that was a half step—but she was still a long way from Lincoln.

In addition to paralysis, my legs couldn't be moved because of muscle contractions. The treatment for this was radical leg-stretching by a physical therapist. The leg stretching was carried out to such an extreme every weekday morning that I lost consciousness from the pain and would wake up in a chill in some other room. This went on for one-and-a-half years. The only way I remained sane was by withdrawing mentally from my physical condition. This worked, but it de-socialized me again. I was discharged from the hospital in June 1958. While still in the hospital, I restarted part-time at UNL.

The University of Nebraska, at that time, was not at all accessible, but I'd found enough friends to push and carry my wheelchair about. I also had help from the State Department of Welfare and the State Department of Rehabilitation. Probably due to brain damage from polio, most polio survivors convert to a Class A, or Type A, personality, myself included—a pretty exaggerated Type A. I studied all day from the time I woke up until 11:00 pm. My grades changed to A+ every semester, but one, and that was an A, for the following six semesters that I was in school.

In September 1958, I had a full-time course load in chemistry and electrical engineering. My most influential teachers were Dr. Donald Nelson in electrical engineering and Professor Cecil Vanderzee in physical chemistry. Dr. Vanderzee opened up a whole new world for me. I learned more in his physical chemistry course about what happens and why things happen than in any other course I ever took. It was a wonderful course. I graduated with a bachelor of science in electrical engineering in 1959. I'll have to go back to 1957 to explain why I didn't go on for the Ph.D.

THACKRAY: Were you living at home at this time?

ALLINGTON: Yes. I started a part-time business, in late 1957, to repair and make scientific instruments. That was before I started back in school, so I was in a hospital from August 1955 to May 1958. This was at the suggestion of Dr. Robert Feeney, who was then chairman of the UNL biochem [biochemistry] department. While I was a student and still recovering from polio, he introduced me to my future business partner, Jacob [Jake] Schafer. Jake was a toolmaker at the Elgin Watch Company in Lincoln. I was anxious to work while in school, because as I mentioned before, I was receiving welfare, but I wanted to be independent. Additionally, I was used to working. Jake started repairing microscopes, and I was repairing almost everything else on weekends when I was furloughed from the hospital.

Jake worked in his basement and I worked in my father's garage. After a few months of repair work, we started getting requests for making custom, one-of-a-kind pieces of scientific apparatus. We started getting jobs that required machine work, but by then we had enough money in the kitty to buy our first machine tool: a little 9 inch South Bend engine lathe for Jake's basement. By the way, Isco had this lathe until 1999 and used it in the engineering model shop until 1997.

John R. Allington was born in 1938. He had the little brother problems with the big brother, and I had the big brother problems with the little brother. He also had scientific interests, but he was more interested in a home shop than I was. By the time he was in junior high he was an accomplished woodworker and, considering the tools he had, a fair machinist. He didn't have many tools at home for machinery. I remember once in grade school, he built a Bunsen spectrometer, a spectroscope, from scratch. He bought a 90 degree glass prism and he made the arms, the slits, and the table for the prism, light source, condenser, eyepiece, and everything. He took it to the science fair and didn't win an award for it because nobody believed that he had made it himself. It was so well done they thought it was purchased. [laughter] He was very bummed about that.

He and I have always both been interested in guns. The interest for me was to look back before the twentieth century to see how most cultures' developments in metallurgy, machinery, kinematics, and so forth, were reflected in the quality and maturity of the designs of their guns. The quality of design and construction of a handgun or rifle built before 1900 determined, even from a gross standpoint, about how good and safe the weapon was. Small arms were always on the leading edge of technology for the five hundred years before 1900.

John looked at it a little differently; he was more of a hunter and shooter than I was. He was also interested in guns because they were devices that he could build, and make a quality product. He made guns and he restored antique guns in horrible condition that became good shooters. He's got a collection he started in the late 1950s and early 1960s that's worth many times what he put into it—guns have appreciated tremendously. I've got a much smaller collection. I didn't buy guns with the idea of an investment. I bought a gun because of its historical value. In the 1970s, I sold a lot of my historical units because I was afraid they'd be confiscated. That was a mistake.

John went to the UNL, but he didn't want to take engineering because he didn't want to have any professors that had taught me. [laughter] He had had trouble with living in my shadow before, so he took geology. He got a master's in geology and worked as a geophysicist for Pan-American Oil Company. He was stationed in Casper, Wyoming. I went to visit him once, when he was living in a nasty apartment. A bug dropped off the ceiling onto the back of my hand, bit me, jumped off the table, and disappeared into a crack in the floor. My hand swelled up. Nice place. [laughter] Casper was a tough town. He was dating an Indian girl who he'd met in the emergency room when he'd hurt himself. She was a nurse.

He was transferred to Louisiana and was working on what they called a Seis [seismographic] boat. There was a flotilla of boats paddling slowly across the Gulf [of Mexico] being navigated along a pattern. The boat in the middle was called the powder-boat. When it let off an underwater bomb, everything jiggled and shook. The Seis boats recorded all the echoes on seismographs and brought the data back for processing. It was a very secret process for determining underground locations and species of underground strata. It didn't happen on this particular flotilla, but on another flotilla the powder-boat blew up. All everybody saw was a tremendous orange blast. The Seis boats rocked back and forth. They never found a trace of the powder-boat. John said that he would quit if they put him on a powder-boat. While he was there, he was going with a Cajun girl. He knew many of the local customs, and was the kind of guy who absorbed atmospheres.

When he got back, in 1964, I think, I offered him a job in charge of sales, because up to that time I was in charge of management, design engineering, sales, and accounting, the latter of which meant putting the stuff in a box and sending it off. All of that was getting too much for me to handle, so he came here to take on some of the work. He took early retirement a few years ago, and he's got tremendous hobbies. He's got a complete machine shop in his basement—he's had that for a number of years—including a lathe and a milling machine. You can build almost anything out of metal with a lathe and a milling machine. He's got all the ancillary stuff like a drill press and so on. I remember once he was repairing the lathe and it tipped over and fell on him. It didn't hurt him, but he was trapped. His wife [Margaret Allington] wasn't home. In fact, nobody was home. It was quite a while before he got out from under that thing. I imagine that that was a pretty scary situation. He spends most of his time making things and playing with machinery. Most who got a start like his with Isco, would be in a position to do that.

[END OF TAPE, SIDE 3]

ALLINGTON: They built two houses in Lincoln. The second one, the more glorious one, they live in now.

THACKRAY: Going back to your parents, were they religious?

ALLINGTON: My father was an agnostic. My mother was religious. I went to Sunday school. I was not really an agnostic. I was more like a Unitarian.

THACKRAY: Joseph Priestley?

ALLINGTON: Yes. [laughter] I prayed, when I thought I needed to, but I didn't feel like I had any connection with God. That changed after I got married. The family I married into was more religious, and I became a believer in 1982. At first I was interested in the Catholic Church. My new family was Episcopal. The beliefs and liturgy are about the same in the Catholic and Episcopal Church, except for these big bumps like married priests, the involvement of the church in reproduction, women's place in the world, and stuff like that, but the rest of it is basically the same considering how the churches developed.

The Episcopal Church is not a Protestant church. It is a national church. [King] Henry VIII started it because he wanted his own personal church because of his personal problems. He proclaimed that he was the head of the church as far as England was concerned. There was really no difference in belief [between the Catholic and Episcopal or (Anglican) Churches] except for who ran the show, plus tolerance of divorce. That's why the churches are still that similar. When John Paul II became Pope, although I liked his stand on communism, I didn't like his ideas on the status of women. He meddled in the reproductive and sexual affairs of people. I felt that they [Catholics] were working toward the decrease instead of increase of the status of women in society.

In 1983 I went to the baptism of two of my grandchildren with my wife. The priest, Father Max Kors, who was a friend of my wife's, was an Episcopal priest in Falls City, Nebraska. I witnessed the baptism, and felt something I'd never experienced before. There was a warm glow of religious certainty that enfolded me and I asked the priest to baptize me too. The priests don't take anything that lightly, so I had to talk to him for about an hour explaining my commitment, and he explained what it means, and then he baptized me. I was baptized at the tender age of forty-seven or so. I started attending church in Lincoln and was confirmed in 1985, which was a big year for me—I'll talk more about it later.

THACKRAY: That sounds like a John Wesley experience. I would also say, as an Episcopalian, you can be anything from a Unitarian to a Roman Catholic inside the Episcopal Church. [laughter]

ALLINGTON: You can, they're pretty good at that. I don't feel myself trying to pull it or myself in any other direction. We have a mainstream priest. He has a military air about him because he was a chaplain in Vietnam. His hair is cut short and he's extremely punctual. He doesn't bark at you for his sermon. He's got positive aspects of the military character that are still there. [laughter]

THACKRAY: Do you want to get back to 1957? You were talking about repairing things in your father's garage and buying the engine lathe.

ALLINGTON: Yes, we had that engine lathe up until a few years ago when Isco cleaned house in 1997. We decided the garage had too much stuff and too little space. A lot of it was never used, so we had a big house cleaning. When we consolidated operations, we got running on much less square footage per person. In fact, much less square footage, period, without any problems, and now we're comfortable. Nobody has to step over things and say, "What the heck is that?" "I don't know. It's been here since I've been here." [laughter]

It was at this time [1957] that we got a request for a scientific instrument that wasn't one shot. It was a fraction collector for liquid chromatography. The apparatus collected sequentially separated chemicals into test tubes from a chemical separator called a chromatographic column. The fraction collector served a market niche—biochemical laboratory instruments—that I knew something about, because of my father's influence.

My father was a plant virus researcher, as I mentioned earlier. In his position, he dealt a lot with biochemistry, so I knew something about biochemical and plant research methodologies. Incidentally, Isco still makes fraction collectors. It's over a four million-dollar segment of our business. Every five years or so, we bring out another one.

My father gave me a copy of the USDA's Agricultural Research Service Professional Staff Roster. Presto! I now had the makings of a mailing list for marketing fraction collectors by direct mail. It was easy to check out the job titles to see whether it sounded like they had something to do with biochemical research. A Lincoln printer of church bulletins printed some not very good, but entirely adequate brochures for the product, and suddenly we had a shoestring manufacturing business. The electronics and the mechanicals in the product were crude; there were government surplus tubes and generic metal box cases. New test tube reels were punched out of sheet aluminum and were punch-activated by a three-pound sledgehammer. The important point in this particular niche was the separation applications for biochemical research. Other companies produced products of no better caliber than ours. Looking at it this way, our little shoestring garage and basement operation could compete, because our competitors knew as much about the work as we did. At about this time our first big trial hit. Elgin Watch Company closed down and Jake had to decide whether to take a gamble on Isco being a full-time business for him or get a job, which involved moving out of town.

THACKRAY: When was that?

ALLINGTON: That was before we set up a permanent business—probably 1959.

THACKRAY: What was the legal nature of the business at that time?

ALLINGTON: We were a corporation, incorporated under the laws of the State of Nebraska. Then, the company was called Instrumentation Specialties Company, which reflected the idea of taking on about anything in the instrument area. Later, we changed the name to the initials, Isco, because the original name was cumbersome. The company was incorporated at the start of 1958, and was re-incorporated in the early 1960s because of some stock offering that we had.

THACKRAY: Was it initially just a straight partnership of the two of you?

ALLINGTON: Yes, the fact that we were a partnership meant that Jake and I each had 49 percent of the stock. My father had 2 percent, which only gave me quasi-control, because my father wouldn't necessarily side with me. For all practical purposes, it was a partnership. I don't think his [my father's] two-percent vote was ever invoked.

THACKRAY: So it was literally just the direct mail and the response for the fraction collector that shifted it?

ALLINGTON: Yes, that moved us into business. We started making fraction collectors for the universities here and in Omaha [Nebraska], and then we got into the mail order. The rotary-type was a lot cheaper, and weren't as hard to sell as the other type was. We could make them more cheaply because we had almost no overhead. In 1959, when the Elgin Watch Company closed down, we were starting to receive those orders by mail. Since Timex [Corporation] was the only successful U.S. watch company at the time, Jake decided to stay here at Isco, in Lincoln. I started looking for other products we could sell to the same market.

The first new product was the most obvious, an even cheaper version of our fraction collector. The next was an instrument for fractionating centrifuge density grading tubes, a technique which is used for sedimentation rate separation of macromolecules in an ultra centrifuge. That was followed by development work on UV [ultraviolet] line absorbency detectors that made separation either by liquid chromatography or by centrifuge density gradients. Incidentally, even up to the current date, the detector uses a lot of phosphorescent devices cascaded together in a patented wafer with higher throughput and narrower bandwidth light filters than were in our competitors' filters (2). The exact components were a secret.

Those projects involved some chemistry. Some of it made me nervous, like making fluoride phosphor. Manipulation was one thing I always had trouble with in chemistry. I remember the hardest thing I ever had to do in a chemistry laboratory was measure stuff out on a two-pan analytical balance with partially paralyzed arms. In order to measure with it, I got close to it, which meant using forceps and the little weights. Then I moved the milligram rider on the top. The milligram rider was controlled by a handle, but it was out of my reach. I took one hand, propped the other hand up there, laid my elbow on a pile of books, fiddled around, knocked the milligram rider off the top, and called for help to get the rider pushed back on top of there. [laughter] That was bad.

I was very conscious of lab safety and my own limitations. I remember once I had a hydrogen [H] explosion and blew sulfuric acid [H_2SO_4] all over my face. We didn't have a lab shower, but we had a sink with a high shower on it. I ducked my head under that and turned it on. I didn't suffer any damage, but when my coat came back from the cleaner, it came in a plastic bag and was in little shreds. [laughter]

The creation of phosphorus [P] for UV detectors involved co-precipitating soluble rare earth salts with hydrofluoric acid [HF], which was not my idea of any fun, and then heat-treating the precipitate. Heat-treating is hot by nature, but I wasn't worried about that. I did it with a long forceps and a crucible furnace. I hated the precipitation process. I'd pick up a bottle of that crap and pour it—my hand would shake. I was glad when I had other people to do the actual physical manipulations of chemistry, and I could just tell them what to do.

THACKRAY: Was everything made through batch processing or for individual orders?

ALLINGTON: No, I made up quite enough phosphorus for almost one thousand UV detectors, which we eventually used up. I wasn't the one that personally made it the next time, I can tell you that.

THACKRAY: When did you first hire an employee to help the two of you?

ALLINGTON: I had two machinists. As well as being the designer, I was also the electronic assembler. That was another waste of my time, so the next person I hired was an electronic technician, who could assemble and QC [quality control] test instruments.

To go more slowly through the chronology: when we started out, Jake worked in his basement and I worked in the garage. Jake did the machine work and I did everything else. Jake also repaired microscopes.

THACKRAY: How were the first twenty orders obtained?

ALLINGTON: The very first orders were from people that we had repaired things for.

THACKRAY: How did they know that you existed?

ALLINGTON: Jake passed out business cards around UNL.

THACKRAY: So these were individual professors asking, "Can you fix this?"

ALLINGTON: Yes. Then we'd get a purchase order after the repair. The professors would take care of getting the purchase order, on trust. We were naïve about purchase orders—I'll get into that later. Before we moved into a purpose-built building, I hired a machinist to assist Jake.

THACKRAY: How long after starting out did you realize that there was more work that you could do?

ALLINGTON: It wasn't until we'd moved into the purpose-built building and had been there for six months or something like that. It was probably the summer of 1961. I hired a fourth employee, counting Jake and myself as employees, to do assembly work. I just kept hiring people to reduce my workload. I hired a full-time bookkeeper finally in 1964, so I didn't have to interface with an external bookkeeper. By 1964, we had about forty employees.

THACKRAY: When did the fraction collector come in?

ALLINGTON: About 1958, six months after we started repairing things.

THACKRAY: What else was going on in your life, as far as the impact of the polio was concerned?

ALLINGTON: I was back in school by that time. I've got all this down here—that part and what it meant to me. I talked about school earlier, and the start of Isco was current with my on-going schoolwork. Isco had some competitors, who also realized that biochemical instrumentation was an underserved market area. At the same time, I was having fun with my master's research on the electro-optical properties of bentonite sols (3). By chance, I also learned how to make electrically tunable light filters, which unfortunately were not useful in spectrophotometers because of the way the color change went, but were still kind of an interesting thing. I learned a lot about electro-optical effects due to asymmetrical particles in suspension. I discovered some things that I never was able to explain in the time I had available, so I just recorded them. [laughter]

I'll tell you one thing that was strange, to give you a better insight into the bentonite sols. I started with a sack full of bentonite, which is driller's mud. I would get the mud to fractionate into a bunch of various sized particles through a particle sizer (continuous flow centrifugation in water suspension). The electro-optical properties were slow (seconds to tens of milliseconds) due to the viscous coupling to the suspending liquid. I experimented with electrodialysis, which is trying to remove charge. I tried other ions to try and add charge. In order to get a better feeling for a simpler system, I worked with nitrobenzene [$C_6H_5NO_2$], which has a high electro-optical constant, which involved a lot higher voltage. The odd thing about it was that I'd get different patterns depending on the type of electrodes I would use, which metal they were made of.

For instance, with chromium [Cr] surfaced ones I'd get an almost rainbow-appearing effect. The field between two parallel plates was not uniform, even though there was a uniform clear solution. It made some really beautiful rainbow-like patterns where you went through transmission zeroes at various wavelengths; and as you increased the voltage, you got a bloom of color on one electrode. As baffling as I'm sure it was, a hundred years ago, people probably thought it was an ion discharge. I researched that. I was convinced that it was some chemical effect: ionic reaction or recombination. I developed a bunch of hypothetical solutions that were in the form of differential equations that couldn't be solved manually. I obviously didn't have access to a digital computer at the time, which was kind of ironic. [laughter]

THACKRAY: That would have been a good Ph.D. subject.

ALLINGTON: Yes, it would have been a good Ph.D. subject, and more interesting than the bentonite sols.

Another product line that started in the garage shop era was the plant growth chamber. Professors in UNL's agronomy department approached us. They asked us to make a small plant growth chamber, not much bigger than a large kitchen refrigerator, with precise humidity control, as well as the usual temperature control and solar simulation. Up until then, plant growth chambers did not have positive humidity controls. We built him one, and thus added another item to our product line. Later, we developed a larger plant growth chamber, about as large as could be shipped without knocking it down. Both plant growth chambers were considerably more sophisticated than any other units available. We were aiming for the high end of the market in trying to build an incorporated instrument expertise, which other makers didn't have. We were successful, but success was a mixed blessing. As a result, I did not consider Isco to be limited to the separation science business. That lack of focus prevented us from fully capitalizing on the so-called "liquid chromatography revolution" ten years later.

In that period, we used metal-halide arc lights, instead of mercury arc lights or fluorescent lights for plant growth. We were the first to use metal-halide arc lamps for plant growth. I designed and built the world's first portable spectroradiometers to study this, and they also became a product. If you ask any over-age hippie right now, they'd tell you that what they smoke is grown under metal arc lights. [laughter] At least that's what I understand from reading the newspaper. [laughter] Metal arc lights give a very white sun-like light. I would have never considered growing any of that stuff [marijuana]. I don't think any of us even knew what it was, but we were the first to grow plants in artificial environments under metal arc lights.

In 1959, we were approached for a big one-of-a-kind job by a professor in the Department of Veterinary Science.

[END OF TAPE, SIDE 4]

ALLINGTON: The ruminant process in sheep or cattle can produce copious quantities of gas. That gas can cause liquid stomach contents to foam, so that it can't be burped out. The animal becomes bloated and will probably die if not treated. A notorious example of this would come from cattle that had eaten something like alfalfa. The purpose of our apparatus was to research the problem. I was very naïve about business at that time, so we just had a handshake contract on it. The product was technically difficult because the transmitter had to be small enough to be shoved down the animal's throat. It had to be rod-shaped and float with its pressure-sensitive end above all the stomach contents, so it wouldn't read a falsely high pressure and so forth. Creating a special radio receiver and recorder were not that easy, given the 1959 resources.

At any rate, the job took almost a year, throughout which I made frequent progress reports to the professor/customer. When it was done, we presented the apparatus and a bill for three thousand five hundred dollars, and then learned that the customer had neglected to get the funding to buy the apparatus. After some groaning and haggling, I was invited to the UNL business office where the chief person offered me ten cents on the dollar, three hundred fifty bucks, take it or leave it. I figured my pride was worth more than three hundred fifty dollars, so I flounced out, or at least flounced as well as somebody in a wheelchair can flounce! [laughter]

By the time I got home, I wasn't feeling at all flouncy. In fact, I felt terrible. When I got home, my mother told me that I had a telephone call from somebody at a company called the Feed Service Corporation in Crete, Nebraska. I returned this call to Phil [Philip] Anderson and he asked me if I'd consider building another one of these systems, which he needed in a big hurry.

It seemed I could sell my ruminant pressure apparatus for mechanical oxidation reduction potential for studies in ruminant animals. [laughter] They formulated and sold a urea-ethanol-phosphate based feed supplement, in which oxidation reduction potential in the rumen was metabolically important to prevent alkalosis. I managed to catch my breath and I told him, "Why yes, indeedy. We can probably supply you with one of those systems in just a couple of months, and how much is it worth to you?" We settled on the amount of ten thousand dollars, and he mailed me a purchase contract. [laughter] My mother said it was a miracle, and I agreed.

THACKRAY: What were your total sales in other directions at that moment?

ALLINGTON: Frankly, I don't know, but ten thousand dollars was a large figure. It was crucial to starting the business on a full-time basis—that ten thousand dollars was not only a lot better than thirty-five hundred dollars, it actually made a difference. At the time, I had an NSF [National Science Foundation] Fellowship that precluded me from outside work except during school vacations. This whole business had happened about a week before Thanksgiving, so over Thanksgiving break, I poked at the design for the new transmitter including the circuitry, electrodes, mechanical parts, and the automatic zero adjuster. Between Thanksgiving and Christmas, Jake Schafer built up all the mechanical parts and assembled them. Over Christmas vacation, I wired and tested it, and we delivered it to them just after New Year's Day. We got the ten thousand-dollar check, and I was very impressed by the fact that there'd been no attempt to take advantage of me.

Up until this time, I had intended to have an academic career like my father's, and to have only a temporary or part-time involvement with Isco. I thought about the reliability of verbal statements I had from UNL. People at UNL had offered me an academic position after I'd earned a doctorate. I also thought of correspondence with other universities who had written me about my potential there as an NSF Fellow, not to mention industries who were interested in hiring a former NSF Fellow who had just received his master's. After I wrote back expressing interest and mentioned my use of a wheelchair, not one of them replied. I could see there was going to be a tremendous growth in medical and agricultural research during the 1960s in instrument markets that were poorly served by current manufacturers. A company starting out then could just ride the wave up, even if it made a lot of mistakes.

By the spring of 1960, I had decided to devote myself to Isco instead of to an academic career. I dropped out of school at the master's level, upon receiving the degree in 1961. My intent was to support myself—I had no business plan beyond that. I mentioned hiring the first real employee, Norman Ertl, who was a former Elgin toolmaker and a friend of Jacob Schafer. We only had about twelve thousand dollars in retained earnings, most of which were from the Feed Service Corporation project. My father took out a mortgage on his house and loaned us another ten thousand dollars. Such was the state of the company as we embarked upon making it a full-time operation with a real honest-to-goodness place of business in 1961.

THACKRAY: What was the age of Jake at this time?

ALLINGTON: He was about fifteen years older than me.

THACKRAY: He was a practical machinist?

ALLINGTON: Yes. I'll say one thing about engineering at the University of Nebraska. They might not have been foremost in electrical engineering, but they wanted you to be able to practice engineering in many areas. For instance, I had four semesters in drafting, two semesters of statics and kinetics of structures, a semester of mechanics of materials, and a laboratory where you tested materials and objects for destruction, not to mention courses on surveying. Even now I could design a bridge truss.

THACKRAY: It's not every CEO [chief executive officer] who can say that! [laughter]

ALLINGTON: I never had any courses in machining. I'd fiddled around with a metal lathe at home and had a terrible toolbox. [laughter] I had to use the lathe to make things. The parts would work but they weren't pretty. I made a high pressure capacity voltage divider using my lathe parts, as an agricultural engineering technician. It wasn't anything you'd want to sell, except perhaps to somebody who didn't know tool parts. [laughter]

So with twelve thousand dollars in the kitty and the ten thousand-dollar loan from my father, we built a forty-foot by forty-six-foot steel building in an industrial area in Lincoln and equipped it with a better milling machine and some sheet metal equipment. We finally got some real laboratory equipment to supplement our makeshifts.

After several expansions of this building, we grew out of it, and eventually it was sold to become the local Junior Achievement building in Lincoln. The first year, in 1961, we only had sales of about one hundred thousand dollars, although that would be a lot more in today's money.

THACKRAY: That's a large amount of money.

ALLINGTON: We had only been in full-time business for one year. That would be about four hundred and fifty thousand dollars or something like that now, I think, in our first year. We experienced a positive cash flow, but we lost money due to depreciation. Believe me, this was a better position to be in after your first year of business than having profit with a negative cash flow, because with a negative cash flow you aren't able to pay your bills. Fortunately, Isco became profitable the next year. I hired a few more people, paid back my father in 1963, and expanded the building to double its original size. By this time we had quite a number of research instruments in our product line, and we were finding that we were able to market the biochemical ones to chemists and biochemists outside of agriculture. That proved to be very important later on.

In 1964, my partner, Jake Schafer, wanted to leave the company and forced me to buy him out. The book value of the company at that time was about sixty thousand dollars and Jake wanted half of it. We had no cash and for a while it looked like the company might have to be liquidated. However, I was able to have a private sale of stock to some of my friends and relatives and raised about forty thousand dollars for which they got about 35 percent of the stock. After paying off Jake, Isco had ten thousand dollars more long-term capital and 10 percent of the remaining stock residing in the corporate treasury.

That proved to be useful for stock options in attracting key employees. Two key employees, Frank L. Lederer, the eventual executive vice-president of Isco and a former classmate of mine, and my brother John Allington, who eventually became marketing vice-president for the separation instrument division, joined the company at that time.

By 1966, the company employed about fifty people and had discontinued manufacturing specialized one-of-a-kind instruments because of their low profit potential and because they were too disruptive to monkey around with. We still made things that were marginal and things that were strange. One of the things that we sold in the mid-1960s was a chiller for high speed "super" centrifuges. Even though the chillers had a nice smooth rotor, atmospheric air pressure was still enough to get them hot so that they were uncomfortable to touch. There were a lot of things you couldn't use them with because of their thermal problems. I had studied refrigeration on my own with the design of refrigeration systems for the plant growth chambers.

I made one compact unit for them, using only a half-horse compressor, by buying a compressor that was intended for lower operating temperatures, which meant they had a higher displacement. If you used one of these things to cool down from room temperature, it would over-heat and cut off. I designed a cycle on it so that you put your rotor on the centrifuge, pushed the lid down—you couldn't turn it on until you got the lid down—turned it on, and then it started up. It had a slow start-up feature to protect the centrifuge more. As it started cooling the centrifuge down, the first thing that happened was that the compressor became overloaded with the struggle to get the pressure down, but before anything got dangerously hot, the thing was at its proper operating pressure. It was designed so you couldn't set it below 20 degrees, so it didn't take very long for a half-horse compressor to get this big a volume down. The whole mess chugged along at whatever temperature you wanted it at, and when it shut off, it opened the lid and automatically defrosted the coil, which had frosted up during all that work. It made a pretty economical design, but it was moderately silly! [laughter]

We made a thing that was really silly, again in agronomy. One of the machines for experimentally treating row crops was a simulated tractor running some increment over the row crops. We built a huge stainless steel box. One of the things that it had to do was so-called spray flaming, which ran a hot propane flame over the crop and burned whatever was bad (weeds) off. There was something to display the strength and the speed of the flame. The box also had a track mounted longitudinally above it, a very lightweight simulated tractor on rails, an adjustable gearbox, a winch, and clutches that started and stopped it. You ran it on regular tractor speed, at about 3 miles an hour. That doesn't sound like much, but when you got all the parts in the box, it would go bang-bang, as the whole apparatus slammed across the machine.

It was really spectacular when you did the spray flaming. You pushed the button, the flames came on, and it paused for it [the machine] to stabilize. It was in an area where there were no windows, because the windows would have broken from the heat. There was also a fan that cooled the machine off. It had an ingenious set of burners modeled after tractor-pulled burners made out of heavy-rolled steel and cast iron. I designed a lightweight copy of them out of thin heat-resist alloy and aluminum.

We had a new guy that was working for us as an apprentice, who was a wounded Korean War veteran. Jake gave him the responsibility of building the burner. We had an original part and a scaled sketch of it, with the dimensions and so forth. He made it, and it was a little lumpy, but it looked like it would work. However, when he turned it on, the flames came out of that thing in every direction except the hole that they were supposed to come out of, and Jake said, "Maybe I'd better make those myself!" [laughter] Those kinds of disruptions could've cost us. It was fun making and planning it, but playing with it was expensive as far as corporate time and money were concerned.

THACKRAY: Were those Lincoln orders?

ALLINGTON: Yes. We weren't willing to make anything big for anybody outside of Lincoln, because it was too much trouble. We wanted the buyer to come to Lincoln, observe the machinery operating, and give it an acceptance test. We didn't want to do an acceptance test out in Ithaca, New York.

THACKRAY: You said there were about fifty employees by 1966. That's very rapid growth.

ALLINGTON: It was very rapid growth. We doubled every year for a number of years. Actually it wasn't just us—the market was doubling. When we started out, the most complicated things in anybody's laboratory were two things: one was a Beckman [Instruments, Inc.] DU spectrophotometer and the other was either a Coleman [Instruments] or Beckman hand-operated potentiometer. Chromatography only consisted of a column and a guy with a beaker who would pour the methylene dichloride or whatever solvent into the column, hold a test tube under here like he was washing it, then change test tubes like this, then he'd take them all in his Beckman DU for assay.

One of the first things that we made was, as I mentioned with the phosphor, the UV detector. It was the first one that measured absorbance instead of transmittance. It was also the first detector that had a slope-operating chromatography peak detector, so that you could isolate peaks in a fraction collector (4). This was the first use of slope logic peak detection, now used in all chromatographic software. I also invented the first practical two-pump chromatographic gradient former. All those innovations were patented, so they gave us an advantage in the market, which was just exploding.

THACKRAY: Yes. Did you have a "cash cow," as it were? Was the fraction collector the "cash cow?"

ALLINGTON: The fraction collector and the UV detector were the cash cows. We still make both of those, but the current designs are completely different from the originals.

THACKRAY: I was thinking about your fifty employees. What sorts of jobs were being done by those fifty employees?

ALLINGTON: By the time I had fifty employees, I had a manager for manufacturing, a manager for engineering, a two-man engineering crew outside of myself, a draftsman under the supervision of another guy, an accountant, and a bookkeeper. The accountant was responsible, with the bookkeeper helping him. I kept bringing in the work, slowly, from what you would expect from a two-man operation to what you expect from a fifty-man operation.

THACKRAY: Yes. When did you hire somebody at the Ph.D. level, or somebody else, to do research and product innovation?

ALLINGTON: I'll get to that in a minute. We discontinued specialized one-of-a-kind instruments, as I said, because they were too disruptive to monkey around with. More importantly, one-of-a-kinds diluted our effort to build up a product line that would exploit our biochemistry research market. Even so, our product line wasn't coherent. In addition to separation science, the product line included light measurements, the portable spectroradiometer, apparatus to calibrate it to NBS [National Bureau of Standards], the apparatus for applying insecticides topically to insects, and, of course, plant growth chambers.

It was becoming apparent that every expenditure on agricultural research products such as growth chambers diluted our efforts in the biochemical separation market, the area in which we were a more efficient producer. In addition, Isco had extended to the fullest possible extent of our original two hundred-foot by one hundred and fifty-foot lot, and there was no possibility for contiguous land purchase.

We leased some plant space across town and split up the operation with the administration, sales, engineering, and R&D [research and development] in the original location, and all manufacturing processes in the leased location, on the west side of the Lincoln municipal airport in an old [U.S.] Air Force building. This did not prove to be efficient. We needed to buy a large lot and put up a new building, and we needed to do it badly. Furthermore, since neither the manufacturing process nor the marketing of plant growth environmental chambers fitted in with the marketing and making of biochemical laboratory instruments, Frank Lederer wanted to split the company into two divisions with one division concentrating on each product line. Another reason to split the company that way, which was probably more influential but remained unspoken, was that Frank Lederer and John Allington didn't get along!

We created an environmental chamber division to utilize the leased airport building. In 1967, I tried to get the long-term financing necessary to realize the goal of getting enough land and putting up a new building with expansion capability. I tried various sources expecting success. "Why not?" I thought. After all, Isco had an excellent financial and growth record. We'd been profitable and we'd been growing rapidly for five years. Unfortunately, we were in an esoteric line of business as far as Lincoln, Nebraska, was concerned. I tried the banks—silly me! There was no way they would give a loan to Isco. They wanted sure things like financing the fourth gas station in a three-station street intersection. [laughter] That was before the oil crunch of the 1970s, which caused most of the proliferated 1960s gas stations to go out of business.

A Small Business Administration loan didn't look possible for us. I had only one positive end result of inquiries about venture capital. That venture capitalist wanted to sell Isco some land and a building at greater than the prevailing price, finance it at a greater than the prevailing interest rate, and get 50 percent in the ownership of Isco. That proposal drove us away immediately because it was so outrageous.

I got a much better offer in Denver, Colorado. The price for completed land and building package was reasonable and the guy didn't want any of Isco. He just wanted us to make the payments. After all the payments were made, the land and the building would be ours. I was about to move Isco to Denver, when an investment banker from Omaha showed us how we could issue Industrial Development Act [IDA] bonds, which were type of tax-free bond that the federal government abolished later.

In 1968, Isco issued four hundred and eighty-five thousand dollars worth of IDA bonds. The bonds were used to pay for the land and build the initial part of the present building at 48th and Superior Streets on the original twenty-acre lot. The building was built and we moved in very early in 1969. Frank Lederer, who had been Isco's manufacturing manager, was set up as the head of the newly formed environmental chamber division in the leased airport building. It was a very small operation with only three employees. The rest of Isco was designated the separation instruments division. I became manager of this division and CEO of both divisions.

At the same time, something unexpected happened: the end of our various and generous environmental chamber funding. Federal funding in agricultural research suddenly dried up—I suppose it was one of the early economic victims of the Vietnam War. By early 1970, the agricultural research apparatus market was absolutely terrible, especially when you remember that the agricultural research mechanism of the 1960s had produced the Green Revolution, which abolished hunger in most of the world except sub-Saharan Africa.

The loss of the agricultural research market was not a big blow to the separation instrument division, since that division's product and marketing efforts had gravitated toward the chemical and biochemical separations market. At that time, biochemically-oriented medical research was starting the rapid growth that it enjoyed during the 1970s, so the separation instrument division continued on schedule with only a little bump in its growth, by just a partial redirection of its marketing effort. However, that was not the case with the environmental chamber division. They had a product that was absolutely useless for any purpose other than agricultural research. Not only that, our segment of the environmental chamber market was in the fancy, highly instrumented, and high-priced end—just the thing researchers would not buy if they were short on funds.

One obvious possibility would be to lay off Frank Lederer and the three people working for him. However, during the year that the environmental chamber division had been in operation, I could see that Frank Lederer was an excellent manager and an entrepreneur in his own right. My previous experience with him told me that he was also an excellent design engineer. Furthermore, the separation instrument division had already developed a primitive, first generation sampler for monitoring the pollution of water. I felt that the time was right for a water pollution monitoring line because it was apparent that the U.S. was going to finally clean up its water pollution problems instead of just talking about it in Congress. At that time, large parts of Lake Erie were dead, and the Cayuga River through Cleveland was so badly polluted that it caught on fire at least once each summer. Pollution control instruments interfered with the separation division's marketing. I turned the product over to Frank's operation and changed their name from the environmental chamber division to the environmental instrument division. He started manufacturing the pollution sampler while at the same time developing a greatly improved version.

The next year he completed the improved version, which was the industry's first good automatic sampler for sewage and polluted water. The environmental instrument division sales improved rapidly as the sampler gained rapid customer acceptance. The following year, a pioneering flow meter was introduced for measuring flow in sewers, which was then replaced by a better flow meter in 1975. Over the years, the environmental division's product line improved and expanded to the point where it was the dominant force in its part of the wastewater monitoring market.

To go back to 1967, in the separation instrument division: on account of the distraction of unrelated products, spectroradiometers and so forth—it was something that could be described as my bad luck or my bad judgment—Isco got off to a poor start in the liquid chromatography revolution—high performance liquid chromatography or HPLC. Our first HPLC pump was a high pressure, low noise syringe pump designed for a relatively low flow rate of less than 0.5 to 1 ml a minute required by the 1 mm diameter pellicular (25 micrometer spherical particles coated with a thin, porous, active layer) packing. We were developing a syringe pump for it because we were co-developing a heat of adsorption type HPLC detector that required much less flow noise variation than even the best reciprocating pumps.

[END OF TAPE, SIDE 5]

ALLINGTON: The detection thermistor was in a downstream bed and was surrounded by whatever packing was in the column, so you measured a heat of adsorption corresponding to the heat of the absorption separation in the column. You could get the same thing out of one of the detectors. Anything that could be separated in the column could be detected in the detector. It had a unique method of canceling both thermal and flow noise. Its best comparative advantage was better signal to noise ratio—absolutely intractable with conventional pumps and even with a syringe pump. Unfortunately it had an odd peak shape that was not quite equal to the derivative of the standard concentration peak. That solution to the sensitivity to noise problem, the use of a quiet-flow [e.g. class 9 bearings] syringe pump, and the unique heat flux balancing method were adopted to fix the noise and drift problems within the builder's fashion. We got a nice patent on that (5). We eliminated the temperature sensitivity by building the detector head and two heat exchangers inside a vacuum insulated container. We couldn't do much about the odd peak shape. Unfortunately the popularity of heat adsorption detectors fell drastically by the time the design was completed and we were ready to go into production, so I had to scrap the detector project before we spent any more money on it.

At the same time, 1 mm ID [internal diameter] columns holding coated solid beads were replaced by 4.5 mm ID columns holding porous 5 micrometer particles with 2 ml per minute flow rates, which emptied a 375 ml syringe pump in about three operating hours. The syringe pump turned out to be very saleable for industrial chemical operations, but we were left on the sidelines in the HPLC business with only our fraction collectors, sample changers, UV detectors, and digital integrators to offer to the mainstream HPLC market. The rest of our separation line was in electrophoresis and density gradient fractionators. We still make fraction collectors, which are useful for prep-HPLC as well as low pressure liquid chromatography.

During that period of time, our competitors developed strong patent positions in HPLC pumps. We made another abortive effort to enter in the HPLC market in 1977 and 1978, but during the 1970s we were designing mostly classical low pressure liquid chromatography equipment. In 1980, a small market for micro LC had become apparent, and we developed a special syringe pump and an ultra-micro volume variable UV absorbance detector for it.

In 1984, we again tried developing a mainstream HPLC instrument system and this time we were more successful. It was not a big part of our business but it was large enough to be interesting.

On the financial side, from 1970 to 1977 short-term bank loans were used extensively for working capital to finance inventory. In manufacturing, we found that our inventory had to be controlled very carefully. That was a particular problem for Isco, since we made a wide variety of complex products in relatively small quantities. At that time, there were more than seventy thousand different parts in inventory in the separation instruments division and one-third as many in the environmental instrument division, and there was no way of correlating the two of them together, either.

We found that such an inventory consumed cash at an unbelievable rate if it was not controlled well. In 1977 and 1978, we installed a computerized MRP, a manufacturing and resources planning system, which integrated manufacturing process scheduling, inventory control, purchasing, unit specifications, what goes into our products, how the products are made, and the incoming orders from customers. We developed that system largely by ourselves. It was the first one for a small, diversified, manufacturing business.

Before this system, we lived from production crisis to production crisis and had plenty of angry customers because we couldn't make delivery dates; even on established products. With the use of that system, we immediately got inventory more under control, paid off more than six hundred thousand dollars in short-term bank loans, and still had cash left over to put in short-term investments. We did that by squeezing over eight hundred thousand dollars worth of inventory the first year. In the second year of operation with that system, we saved another nine hundred thousand dollars in inventory.

Before we had that system, we had expediters in every production department, who were more or less futilely trying to keep things moving smoothly by hand methods such as red tags, book slips, and other means. After we installed that system, we transferred all the expediters to more productive jobs and didn't lay anyone off. At the same time, we greatly improved our on-time deliveries to our customers.

In 1980 and 1981, Isco issued a total of a little over four million dollars in IDA bonds. That was in addition to what was mentioned previously. The proceeds were used to expand the 48th and Superior Streets building from 40,000 square feet to 100,000 square feet, and to remodel a larger facility at West Gate Industrial Park for the environmental instrument division. The industrial park building was basically a shell when we bought it—a high-ceilinged warehouse. We spent 1.2 million dollars remodeling an indoor plant for the environmental instrument division. Since the ceiling was so high, we divided it vertically into two floors, making a total of 80,000 square feet. After that, we increased the environmental division to 130,000 square feet and paid off all the bonds.

In 1985, Isco issued stock to the general public for the first time. The purpose of that stock option was not just to raise money for the company or to allow management people to cash in. It was to keep the faith with our 1964 stockholders, who had kept the company from going into oblivion when Jacob Schafer left, and had sat on their illiquid stock for twenty-one years. Most of the proceeds went to the stockholders, but the remaining proceeds to the company were about 1.6 million dollars for long time capital. The original stockholders wound up with an almost one million-dollar profit each.

Nineteen eighty-five was a very important year for me. Based on my work, the faculty of the Department of Chemistry of the University of Nebraska recommended me to the Board of Regents for the degree of Doctor of Science (Honorary). I am proud of it.

THACKRAY: That was an earned doctorate.

ALLINGTON: Yes, I feel it was more earned than many. [laughter]

During the 1990s, the environmental instrument division broadened its product line beyond water samplers and open flow meters. Small meters for water quality parameters such as pH were added to the list. An online process control total organic carbon analyzer was introduced, which has a good market in Europe. We introduced that instrument for factories to monitor their compliance on the regulation discharge of organic compounds in the sewers or waterways. The environmental instrument division has also introduced a closed pipeline measuring flow meter, which has a number of technical advantages that have enabled it to make a good entry into this competitive market.

Just very recently we introduced a second process instrument, a hydrogen sulfide [H_2S] process analyzer. That instrument is used largely for monitoring hydrogen sulfide content in outflow water. Customers add something to the water that sequesters hydrogen sulfide, like ferric chloride [$FeC1_3$], but they don't want to add any more of that than is necessary. What they needed wasn't necessarily an amount that removed any particular amount of hydrogen sulfide without leaving a particular remainder, but rather something that provided a control signal dependent on how much the vapor pressure of H_2S was, observed by sparging, with measurement in the gas phase. The product controls stink rather than concentration of H_2S. The output controls a ferric chloride feeder: less $FeC1_3$ is needed to control stink than concentration.

This hydrogen sulfide process analyzer takes a continuous water sample, corrects the temperature, and sparges it with air. Then the air goes into a H_2S gas detector, which does more massaging of it. The result may be used to set the mass flow of ferric chloride necessary to bring the stink down as opposed to bringing the hydrogen sulfide concentration down. It was the stink that people were excited about. [laughter] The product was not intended to control the hydrogen sulfide in large flooded sewers where the hydrogen sulfide may corrode metal parts, but rather for open watercourses where the problem was that nobody could stand to live near them. We just introduced that at the water show and we'll have to see how that comes out. That was a pretty clever thing, and it took a while to figure out how to do it. Not that it was necessary, but I spent a lot of library work to try and find what Henry's law was for a hydrogen sulfide water system over the temperature range of interest. You wouldn't believe the many differences of opinion.

THACKRAY: Were they in the literature? [laughter]

ALLINGTON: Yes. One of my "old friends," the *CRC* [*Chemical Rubber Company*] *Handbook of Chemistry and Physics*, wasn't even close (6). Besides, not enough temperature points were given to be of help. I found one good reference in a recent scholarly work that critiqued previous work, and it was easy to make a computer-generated table from that.

The separation instrument division had introduced several products for supercritical fluid extraction in 1990. Extraction is the process of removing contaminants or minor constituents from solid material. The classical way of doing that was with organic solvents in a soxhlet. With the EPA's [Environmental Protection Agency] increased control of the use of conventional organic solvents, a more environmentally friendly solvent was desirable. Supercritical fluid extraction [SFE] typically used carbon dioxide at high pressure and temperature as a solvent. At temperatures above 38 degrees Celsius and pressures above 1050 psi, carbon dioxide behaved neither as a gas nor a liquid, but as a supercritical fluid. Supercritical fluids have extremely low viscosity and therefore a rapid diffusion coefficient, which rapidly removes the analyte once detached from the substrate. In spite of this low viscosity, supercritical fluids still retained some of the good solvating properties of liquids, which resulted in the rapid removal of the analyte.

Commercial carbon dioxide was and is produced by the removal and purification of flue stack gases in fossil fuel power plants. Therefore venting carbon dioxide from the supercritical extractor to the atmosphere does not increase the carbon dioxide load to the atmosphere as there is a correspondingly smaller amount of carbon dioxide being vented by power plants. That resulted in a rapid and environmentally friendly extraction process. That equipment has been a significant proportion of our entire business; especially in the analysis of fats in foods—the amount of fat in foodstuffs is a big deal. You'd be surprised how much fat there is in a Fritos, for example. It's 40 percent. The fat tastes good, but you can't have it more than 40 percent because people don't want to eat too much fat, so it has to be right at 40 percent. Furthermore, I understand Frito-Lay's [Inc.] taste tests indicate 40 percent fat provides the best taste. Unfortunately the market for SFE dropped seriously.

I was deeply involved in the development of that product. Most of my time was taken up with product R&D, until 1996. A lot of it still is R&D—more than most CEOs. In September 1996, Douglas M. Grant, former head of the environmental instrument division, was elected corporate president, and I became chairman and CEO. Actually, those were two of my existing titles, and I just gave up being president, which means Doug has taken on more of the hard work and responsibility.

In April 1996, it became apparent that maintaining two separate operating divisions that independently designed, manufactured, and sold two product lines with considerable functional similarity was not efficient arrangement. Management functions were duplicated, and economy and scale of purchasing was not being realized. Due to fluctuations in supply and demand, time in the respective engineering, sales, and manufacturing departments was not as yet efficiently realized as it should have been. Operating from two separate buildings 5 miles apart with four road connections between them was just not efficient. There were many more reasons why this setup wasn't efficient—there were human reasons, for one thing. Someone over there in the other division would almost be viewed as a competitor; a disembodied voice on a phone, instead of a colleague. So the decision was made to consolidate the two divisions into one operating company.

It was decided to expand the plant at 48th and Superior Streets, the old separation instrument division plant, and locate headquarters and operations there. The decision was made because the Superior Street location had several times as much land and better road connections to Lincoln and the outside world. The two divisional operations were consolidated from an operational standpoint in June 1996. In September 1999, both divisions were physically consolidated in an enlarged Superior Street building. The building process stretched on for too long and the company continued to suffer until fiscal year 2000. We now have four hundred and eighty employees and annual sales of something like fifty-seven million dollars in this last fiscal year. It looks like it will be more than that this year—we're profitable. In addition, we have about one hundred and sixty U.S. patents assigned to Isco, with me as patentee on about one hundred of them.

To get back to my personal life: I didn't have much of one from the time I got back to Lincoln in 1955 until about 1972, when I had slowly and partially recovered. The first reason was that it was difficult for me to get over having polio and being in a wheelchair, and the second reason sealed why it took so long. My father didn't want me to drive a car. He was adamant about it, and convinced me that I shouldn't drive a car. In that respect, it spoiled my life for many years. In our society, trying to talk to women, girlfriends, and prospective spouses without driving a car is almost impossible. At that time, I was still living with my parents upon whom I was psychologically dependent.

Suddenly my father announced to me that he and my mother were moving out. That left me pretty much living alone except for the company of a very intelligent dog, which doted upon me. Steinmetz, a golden retriever nicknamed Metz, was in fact named after Charles Proteus Steinmetz, the famous engineer and physicist. Metz had a vocabulary of about two hundred words and could parse and obey phrases like "Go downstairs to the basement and get me a book." The way you'd do that was to accent the important words. You'd say, "Go <u>downstairs</u> to the <u>basement</u> and <u>get me</u> a <u>book</u>." I made up different instructions and he could do them. He spent a lot of his time getting me things. When I didn't ask for anything, he tried to figure out something I might want. For example, if I looked uncomfortable, he brought me a pillow. [laughter] He was an amazing dog. We took care of each other. He took care of me and I took care of him.

VAN NESS: You're not going to tell us he read the books, though!

ALLINGTON: No, he didn't. He couldn't read and that was a disadvantage. If there were several books it didn't work. He took the one on the top. I had to remember if I wanted the book on the top. He could not read the titles. [laughter] It was the same with magazines—if I wanted the magazine on the top of the magazine stand, I'd say, "Go get me a magazine." If it was the second one, I'd say, "Oh, good dog!" Pat, pat, pat, pat. "Now, go get me a magazine," and then he got me the second one. [laughter]

I usually made myself a martini when I came home from work, and he would watch me drink it. After several weeks, he wanted one too and indicated this to me. I understood him as well as he understood me. The next night, I made one for him too and poured it into a large ashtray. He chased the olive around and around with his nose, caught it, then lapped up the drink. He lapped up half of it. This became a routine. He always said he wanted one half of a drink. Once I tried to make him drink one as big as mine, he looked me right in the eye, and growled at me. [laughter]

As a pup he was treated for a bad infection against which normal antibiotics didn't seem to be working. He was dying and the vet gave him a plaque test, which is unusual in work with animals. The vet found that neomycin, which is an aminoglycoside, was the only thing that they had that would work. Unfortunately neomycin was toxic to him. He was never too healthy after that, and at age seven, he contracted liver cancer. By this time, he was accompanying me to work. Twenty minutes after the first time I brought him to work, he knew which rooms he was allowed into when he wasn't on a leash. When I had him on a leash, I took him anywhere where it wasn't dangerous. I never took him over to the factory.

I took him around the offices off the leash, in my office, and into the company library, which at that time was adjacent to my office. It was interesting to watch him go from one room to the other; he had to go through a forbidden space to get to one of the other rooms, so he moved really fast through the two doorways. It was a sort of tunneling effect! [laughter] He died at age seven, in 1975, and I was desolated. Two months later, my father's cancer was diagnosed and my mother died. A woman who had been heretofore the greatest love of my life broke up with me. Isco had serious management problems. My life experienced very violent ups and downs—mostly downs—by the end of 1975.

In April 1976, I got to know my future wife, Mary Kaylor. We had met a couple of times before. She was a widow who had four daughters and two sons by a previous marriage. I fell in love quickly and proposed marriage on 11 August 1976. Two days later my father called me to say that his cancer, which was formerly in remission, had metastasized, and he only had a month to live. It had moved to the brain and the doctors couldn't treat it because of the blood-brain barrier. We moved our wedding date up to 4 September 1976. He came to our wedding, which was the last time he was out socially. We really had a grand wedding—we had a good time. We got married in a big church. There must have been close to one thousand people at the wedding and a thousand people at the reception at one of the private downtown clubs. It had all the grand traditional luxuries like champagne, smoked salmon, and all those kind of things.

My father died on 15 September 1976. Mary and I were with him in the hospital room in Houston [Texas] where he went to Monroe Dunaway [MD] Anderson Hospital because he thought that was probably the best cancer hospital. They couldn't do anything for him.

Another thing that made the wedding a great affair was that Mary's family was much more dynamic, caring, and loving than I had ever experienced. I got along very well with her kids, but they were too old for me to adopt. One of them was statutorily young enough to be adopted, but she didn't feel like she wanted to be adopted, which made me feel bad. Mary and I had a two-month honeymoon at out-of-the-way places I had found in Europe during earlier business trips. Most of our time was spent in Slovenia, in the former Yugoslavia. It was an absolutely charming place.

Another big event after marriage was buying, in 1979, and restoring an old National Register house that was built in the Shingle and Richardson Romanesque style, probably the best example of it in the state. It has a heavy Colorado red-stone, castle-like base and upper-story shingles that are curved in kind of a sensual and surreal sort of a turreted way, about and above it. The effect is more Art Nouveau than Romanesque Revival.

During that time (1968 to 1984), I was very immersed in community service. The high point was being the chairman of the city county planning commission [Lincoln City-Lancaster County Planning Commission].

[END OF TAPE, SIDE 6]

ALLINGTON: A couple of things just seemed to always go like clockwork. Somebody would apply for some sort of commercial, higher density use permits on an older house, and the neighbors would come in and weep about, "They're going to destroy our neighborhood with traffic and noise and wreck our property values." The commissioner and the council would just ignore them as a rule. Then the neighborhood home owners came in 1969, and I expected that line of complaint to come out. That time an adjacent nursing home wanted to buy an old house. The neighborhood people came in and they said, "Please, don't let them take away and destroy our castle!" [the National Register house Allington bought in 1979]

At the time, I had two Mercedes cars. I had a huge Mercedes—it was a model 600 and it had the biggest engine. I bought it in 1969, just before they stopped making them. In the 1970s they were worth well over one hundred thousand dollars. I paid eighteen thousand dollars on a special deal at the factory, and I was treated like royalty. They only made something like fifty per year of these cars. You still see them in movies—big chrome radiator, long fenders, a sleek looking machine. One of the reasons that I got it was that it had 50 miles on it because it had been used in a James Bond movie, *On Her Majesty's Secret Service* (7). Did you ever see those Bond movies? This was the one where Telly Savalas survived a broken neck and he had this wicked woman. He zoomed up and she shot Diana Rigg and James Bond at their wedding—he floored the car.

It was a big silver Mercedes that weighed 6000 pounds, had a 450 hp V8 engine, and was fuel-injected mechanically. The engine looked like it was a diesel except it had spark plugs. It was a magnificently polished aluminum engine. They were sold mostly to people in Saudi Arabia, Afghanistan, and places like that where they were really rich and they needed a car to get away really fast on unpleasant occasions. [laughter] The car had two horns, one of which sounded like a fire engine or locomotive, and one which was standard. That was a useful feature in a vehicle that cruises at over 140 mph. It had a four-speed automatic transmission, but the fourth speed was not overdrive; instead the first speed was an under-drive lower than the normal first speed. You stepped on the gas hard and this speed kicked in, and all 6000 pounds of this car went yip-yip-yip-yip-yip! [laughter] Zoom! It was like the roadrunner taking off, or very similar. It was incredible to see this car doing that. [laughter] Another thing was that it had a bunch of extra stalks on the steering control that independently varied the ground clearance and the suspension stiffness.

VAN NESS: Do you still have it?

ALLINGTON: No, I sold it in 1986.

You moved one of them [the stalks] and the car lifted up 3 inches! You moved another one and it increased the stiffness of the shocks. If you were going over a really bumpy, rough road you lifted it up 6 inches, and if that wasn't enough, you increased the stiffness of the shocks. If you wanted to go above 130 mph, you let it down and then ran the shocks tighter. The car went 155 mph but I drove it at 145 mph. It didn't feel bad at that speed. It didn't tend to kind of float down the road like a sports car would at 140 mph. Instead, it felt completely solid. It felt like you were never even going to move it from its course! [laughter]

Anyway, in 1970 a friend drove me in this car to this place—the "castle" that the neighbors didn't want destroyed. The reason that we bought the car in the first place was because when we were visiting our European dealers; Phil [Philip M. Wittig], the chief financial officer, my brother and I, found out that it would cost us close to about six thousand dollars to rent a car for two months—just an ordinary car. Car rentals were very pricey in Europe. Looking at this car, we knew right there that it (the Mercedes 600) would be maybe near eight thousand dollars. When you included the investment credit and the fact that there was no duty on it, because it came back as a used car—we put a lot of miles on the car—we had only eight or nine thousand dollars on it. A few years later they were selling them in the United States for one hundred and twenty thousand dollars.

Another reason we bought this car was that we wanted to impress and intimidate our dealers and potential dealers. They were very class conscious and somebody who was not of the highest class would be afraid to own one of these things, let alone be able to afford it. It worked very well for that purpose! [laughter] Our Dutch dealer, Joop Klinkenberg, still talks about it. I remember I was with him in the front of the building in Amsterdam, and Phil went to get the car, which was parked around the corner. We were waiting on the old cobblestone sidewalk, and Joop looked to see what brand of car would come around the corner. He looked and he looked, and finally saw Phil driving the Mercedes. Then he spoke in Dutch, but it was perfectly obvious that he said, "My God, it's a 600!" [laughter] I have talked to him a lot since, and he admitted that he was very surprised. It probably won us a good dealership.

Anyway, the National Register house in 1969 was in a jungle. It could only be seen in the winter, and we drove out there in the summer, when long-tipped bushes and trees were all around it. When you got up close to it, where there was a break in the trees, suddenly you could see the house, and you saw at last gables and how they curved, and the stained glass windows. You also saw that the shingles were blanched and falling out, the foundation was cracked, and so on. I just looked at it, and I felt my eyes start to hurt. I wanted to cry. It just looked so sad and forlorn, like a beautiful woman that has fallen on hard times. It took a long time to get that thought out of my head. I still think of it. My father told me, "Don't you dare get a house like that. It would be terrible."

So in 1969, after my presentation to the rest of the planning commission, the city planning commission reversed their usual position and voted to deny the conversion. They didn't want this beautiful house torn up to expand the nursing home. Three years later the nursing home people were back again, asking for the same thing only with a slicker presentation. They brought in charts and all of that. Nonetheless, they were just about thrown out of the planning commission hearing, and some preservation lobbyists helped persuade the city council against them.

The house went through a succession of people who tried to restore it. The first one was Lyle Hansen who owned a trucking company. I think his business went bad for some reason or another and he had to sell it. Then it was bought by Robert Potter, a restaurateur in Lincoln. Potter had a really good reputation from building theme restaurants around town, which he sold for a vast profit. He had the idea that he was an expert on building theme restaurants—his history convinced him that he didn't make mistakes. [laughter] However, he had just blown one new restaurant, and then he blew the next one, too. He was short of luck, all of a sudden. He came to the planning commission in 1979 and wanted to convert this house into a theme restaurant. I thought, "That is really great!" One clause that was put in the 1978 Lincoln Planning Code was a provision for special use permits for National Register properties, which would allow them to have commercial uses in residential areas provided such commercial uses would tend to preserve the property more than existing or other residential uses would.

I was chairman at that time, so I was excited about this opportunity—here was the salvation of this house that I had looked at. There were two meetings: one a public hearing and one an executive meeting. He seemed to do really well in the public hearing. The neighbors thought the restaurant would enhance their property values, as well as preserve their castle.

During the planning commission's executive session, Mary and I left for Michigan. Her second-oldest daughter was getting married, so I missed the executive meeting. It was between Christmas and New Year's, and on the night of the marriage, a blizzard hit. There was 2 feet of snow and nothing was moving. The snow just kept on coming. We went in a utility vehicle, a Jeep Cherokee, to the airport, but when the airport doors opened, you could see people sleeping on the floor. A bad sign! We stayed around until we could get out of there, on about 15 January.

THACKRAY: What year was that?

ALLINGTON: It was 1979. In February, somebody on the commission said, "It looks like Mr. Potter isn't going to be able to get his restaurant after all." I thought, "That's too bad." I figured that he probably couldn't get the financing he had in mind, and I got the idea he was looking to sell it, but I couldn't buy it because my house had to have a swimming pool in it. I had to swim daily or I would die. I hated it, but it was something I had to do. I used to like to swim before I got polio. Another reason I didn't like the pool was that the dog that I bought to replace Metz drowned in it. He wasn't as smart as Metz was and I was negligent and forgot to close the pool room door.

In late February, I went with my younger son, Keith, on a plane to the Mayo Clinic in Rochester, Minnesota. I was gone two weeks, and my wife was with me the second week. After all this "Mickey Mouse" that they did with me—examined me and treated me in various ways—my wife and I were talking to the doctor that was supposed to tell us what to do so that I could survive longer. I said, "One thing I've got is a swimming pool in the house. Maybe I should use it more." I had to admit I'd been slacking off. However, the doctor looked at me and said, "Actually, you don't want to use it much."

It was absolutely of every interest to me that they had just discovered the post-polio syndrome, which was brought on in post-polio patients—polio survivors—by over-exercise. Up until that time, the medical opinion was you that had to exercise until you dropped. I didn't believe that because, when I exercised until I got tired, I didn't get this good warm feeling that you would normally get. I felt sick, pukey, and that something was wrong. They said, "Don't worry about that! No pain, no gain," and so on. I still didn't believe it, and I didn't exercise as much as I was supposed to. That's why I'm alive today; otherwise I would have been dead before 1990.

When the doctor said that, Mary and I looked at each other and she said, "Now we can get rid of our god-damned house!" [laughter] My mother died in that (then present) place. With Mary being Irish, I think she believed that my mother's spirit haunted it. I hated it for all the bad memories. I went and talked to Robert Potter, the owner, on the phone about buying the house. "Are you the bum at the head of the planning commission?" he asked. I said, "Yes," and he came out with terrible, really loud, profane language. I finally broke in and said, "What's the matter?" He said, "Don't you know that those bastards voted me down, so I couldn't build a restaurant inside of it. It was all a plot. Now you're trying to buy the house." I convinced him that wasn't the case, because I hadn't even been at the vote for restaurant permissions. I had thought he was going to win, and I thought the only reason he couldn't make it work properly was because he lost his financing. He said, "Well, financing is a little problem. If you want the house, come on over. I'll talk to you." I talked to him. I was on my best behavior and convinced him that what I said was true.

The interior of the house was a disaster. There was one place where the ceiling was gone, under that, water ran in, and the floor was gone. He had arranged his furniture around the hole in the floor. [laughter] It was in terrible condition, but I was still crazy about this house. I found out that he actually was having financial problems. I had gotten there too late; he already had a sales contract with the Near South Neighborhood Association for one hundred and fifty thousand dollars. They wanted to use it as a neighborhood meeting house. They were financed by government grants, and Lincoln Foundation Grants. At that time you could get a grant to build a fishpond in your backyard—grant money was just all over the place in the 1970s, and it didn't dry up until the 1980s. During that time my wife, Mary, was a great source of encouragement to me. She also came up with a great negotiating policy that started with letters to the Association wishing them well with the house, and if they didn't go through with it, I would buy it and restore it to substantially original condition.

Mr. Potter had a current, two hundred and fifty-five thousand-dollar debt on this one hundred and fifty thousand-dollar house. Even though the Association was good for one hundred and fifty thousand dollars, they couldn't close. It was government money, so since they couldn't close, the agencies took the money back immediately. The neighborhood association still had the upper hand with the contract, but I was on good terms with those people because I was the preservation member of the city planning commission, and I knew most of them. I had helped them when they were first organized in the 1960s. I knew their lawyer so I went over to the lawyer's office and talked about it.

One of the problems with this house was that the lot was too large to take care of and the extension of the lot went to a place where the school children walked from a nearby school. Their negotiator said, "You've got more lot here than you need. How about deeding off 100 feet of the west side of your lot to us and we'll give it to the city for a city park, which we'll name after your house." The house was named Maple Lodge. "We'll name it Maple Lodge Park. You have to also promise to make your best effort to restore the house." I didn't want to lose 100 feet, so I looked at the original lot plan, which showed the elaborate concrete pathways for turning in and out of the double garage. The house had the first attached double garage in Lincoln. I said, "We can have a good happy-ending story if you like." I got them down to 75 feet, which was just exactly what I wanted. I was required to make a twenty thousand-dollar investment in Mr. Potter's dying restaurant, and I bought about fifty thousand dollars' worth of very elegant and expensive furniture from him for about ten thousand dollars, which was separate from the land sale, and thus isolated from his creditors. I made a deal with his creditors for them to accept one hundred and fifty thousand dollars for two hundred and fifty-five thousand-dollar liens. Everybody went away happy.

We then faced the problem of fixing it up. I had probably a dozen men working on that place for a year before it was good enough for us to be able to move in. Every trade you can imagine—an electrician, plumber, HVAC [heating, ventilating, and air-conditioning] installer, elevator installer, stonemasons, fine carpenters, roofers, painters, and on and on. I ran out of money. My wife wanted me to board the place up and save some more money, but I was afraid of what would happen to it since some thieves had already broken in once and stolen some stained glass windows. Fortunately we did get them back. An uninhabited mansion in its poor neighborhood stuck out too much. I worked out a deal with these various people [the contractors] where they only did just so much to make it barely comfortable and then stopped. It was just enough so that we were able to live in the house, even though they had not fixed it up entirely.

We got the leaks fixed, the floors fixed, and everything worked, but things were still loose and dangerous. I had carpenters—one-and-a-half full-time equivalents—working on it for two years while we lived there. It was just fantastically expensive. I used up all the money that I had and Isco's stock wasn't liquid at that time. I couldn't borrow money from my bank because of the 1980 bank liquidity problems. My banker, who was executive vice president of the bank and also a director of Isco, had told me, "You can borrow the money when you need it." I needed another extra one hundred thousand dollars, but there was a bank crisis where there just wasn't enough money floating around to give loans, so the bastards backed out of their loan. I finally changed banks. [laughter]

I had to do something that I didn't want to do, which was to sell our old house before we had the new one done. The real estate salesman said, "You won't get anything extra for the swimming pool. You'll be very lucky if you get one hundred thousand dollars for a house like this, pool or no pool." We had a swimming pool that I thought was probably worth thirty thousand dollars, but she planned to list the house at one hundred thousand dollars. Before it was actually listed, some guy snapped it up, because he was desperate to have a swimming pool. Boy, was I fried! [laughter] He called me up and he said, "What will you take for the house?" I said, "One hundred thousand dollars." He said, "Don't be silly. Everybody comes down some." I said, "Not me. That real estate sales woman snookered me. It'll be one hundred thousand dollars until the real estate sales contract expires, and then I'm going to have it listed for one hundred and forty thousand dollars." [laughter] His voice faltered and he said, "I'll take it!" I lost some money there, but at least I got that much.

Up until then, we had had a lot of half-jobs done, but we finally decided to spend the money and have the aggravation of listening to the carpenter's noise. It's done now—as much as any house is done. It's absolutely a gorgeous house, with fountains and everything. It has two turrets: one a broad turret on the front porch and a tall castle-like turret with a lion climbing a spire on top of it.

VAN NESS: It sounds wonderful. Is it on the National Register of Historic Places?

ALLINGTON: Yes it is, and it's a great place to live.

I was going to say several more personal things. Disaster struck on 2 October 1982, when my son Keith died in an accident at work. He was a surveyor and was electrocuted because he put a pole through some trees and hit an unmapped power line. I remember Mary's and my high speed run to the Omaha hospital, but it was too late. We were devastated, and I don't use that word lightly. Things haven't been the same since. He was such a fine son. We still grieve for him, especially Mary.

The Small Business Administration selected me as the National Small Business Person of the year in 1985. Later that year was Isco's IPO [initial public offering]. My only investment was equity in Isco, 50 percent, so I took one million of that and put it in debt securities. With a really good manager, it was one million dollars in 1986 and it's up to three million dollars now. I've taken some of it out, but I get almost 5 percent a year and it is tax-free. I wouldn't be in bonds if I weren't already so top heavy on Isco stock. It's too risky now to have all that equity, especially if it's all in one company.

THACKRAY: I asked you a little earlier about research and innovation. You've been a great driver of that, and from the sound of it, you're still quite actively involved.

ALLINGTON: From 1990 to 2001 I had been more of a kibitzer and mentor at the unfortunate advice of a consultant. Now I have projects again on my own. I used to have a floating staff of researchers who I'd give ideas to, and they scurried around trying to make a new type of this or that. I do my part of the scurrying. One of the most fun things I ever did was succeed in making an antimony-ion discharge lamp by using a microwave discharge. The whole thing had to be small enough so it could fit inside a chromatographic detector. I was afraid it wouldn't be fiddle-free. Our competitor, LKB, a Swedish company, sold to Pharmacia who then sold the instrument business to Amersham, had one that was a neutral iodine discharger. It was 206 ml, and it was rough. You had to take the lamp out and rub it on your sleeve like this—like it was a lightening rod or something—and then put the lamp back in, and then maybe it still wouldn't light. The next day it would be different and it would light straight-away. That [Isco's version] wasn't that bad; in fact, I had it running for two thousand hours without touching it. One of the problems to overcome was building a miniature low-powered microwave unit.

[END OF TAPE, SIDE 7]

ALLINGTON: We used a power transistor intended for ground mobile stations that ran about 1 GHz. The resonator had two bars, about an inch long, one under the other. They tapered out and had cup-like things that we put the lamp between. The first thing that I learned was that if you put antimony trichloride [$SbCl_3$], which has a high vapor pressure, in an AC [alternating current] or RF [radio frequency] electrical field, the light throws off a very interesting spectrum. Amazingly enough, those lights just resonated through the spectroscopic UV like 200 to 400. There were some nicely visible lines, which weren't hard to filter. It ran for a few seconds and then it went out.

When you looked at it in the antimony mirror on the inside of a lamp, you could see that the darn stuff would disproportionate. It sat, the antimony mirror picked up the chlorine, eventually you got the mirror back to the chloride again, and tomorrow or the next day it would run for another thirty seconds. I tried antimony tribromide [$SbBr_3$]—triiodide [SbI_3] didn't have enough vapor pressure unless we heated it excessively. That [tribromide] worked, but it also went out after too little time, although it didn't junk up the lamp as much as the chloride. I finally found out that the trouble was minute amounts of water vapor, so we got a vacuum manifold.

My personal research staff of two guys, one another chemist and the other a mechanical engineer, made several successful passes of vacuum re-crystallization of the antimony tribromide under vacuum and dry conditions. That worked very well except that the lamp tube and window were made out of Spectrosil. The lamp tube stayed very nice under the electrodes, but on the end where you'd wanted the radiation it fogged up. I made a Rube Goldberg arrangement to determine that crystalline sapphire (aluminum oxide, Al_2O_3) worked. It took me a long time to be able to find some chemically resistant (equal to sapphire) glass tubing with the same expansion rate as aluminum oxide. It shocked me how hard it was to get, even though it was a catalog item. Chemically resistant glass tubing was way in the back of the suppliers' books, not where you'd think. They didn't have any, and they didn't want to make any, but I kept after them and finally got some.

We got some flats and sheet from them for a window and put them on the end of the Spectrosil. Still: pop! As soon as you cooled them after fusing the thing broke. We made them work, so that when you cooled them they were all right, but they were still too fragile. Between the whole discharge tube and the sapphire was a graded quartz seal, so that you could seal it after filling.

By this time, the expenses kept rising and although it was originally a cheap idea, by the time you made it work, with the number of hours it took to do this thing, and with not being quite sure if the commercial appeal was enough—it broke my heart. We had this beautiful lamp and it did just what it was supposed to do, but it was worrisome with all the likely production pitfalls. How do you expect production people to do vacuum re-crystallizations, and then be able to work in a glove box with tiny quantities of very dry antimony salt in the discharge tube? If it had only been easier, quicker, and profitable! [laughter] It definitely was an interesting project.

THACKRAY: Within Isco itself, how is the product research and innovation function organized now?

ALLINGTON: We have two teams associated with the development of each new product. One is a technical and scientific development team, which may include engineers, Ph.D. and other chemists, and one Ph.D. physicist. There is a team leader, who is the principal investigator. He meets with the team, gets their help and advice, gets ideas from the other teams, works at spreading the work around, and so forth. Then there's another team that interfaces with the first team. That's the business-oriented team and they work on the project from a business standpoint, particularly marketing.

THACKRAY: I take it you moved to using salesmen rather than direct mailing at some stage. When did that begin?

ALLINGTON: Yes, maybe in 1977 or earlier—maybe 1975.

THACKRAY: In terms of ideas for new instruments and technologies, the users themselves are very important. Do you to get that feedback?

ALLINGTON: I expect the alpha test people to participate in that quite a bit, but not so much the beta test. The beta test is more about how well the product works. The alpha test has more to do with measuring the qualities of the prototype and seeing how it should be improved. One of our Ph.D. chemists is in charge of one of our two apparently successful lines of chromatography and he's done a wonderful job. Before this, chromatography had been a dying business with us because our HPLC line was not particularly great, as I mentioned. The two successful kinds fill niches: flash chromatography for separating small organic molecules and monolithic columns for separating media for rapid separation of large molecules.

The only things that we were selling were fraction collectors and detectors, and we weren't even selling as many detectors as we should have been. Instead of moving our hands back into the HPLC thing, this guy, Vikas Padhye, got the idea of getting into a new area, where we'd be on a more equal footing with competitors, with an apparatus used for combinational chemistry for drug discovery. Now we've got a nice line of manual and automated flash chromatographs and purpose-made pumps, detectors, plumbing, *et cetera*. One of the chromatographs does combinatorial separations sequentially overnight. Another one does ten simultaneously with ten detectors—multiplex and fiber optics detectors—with much greater throughput. That's something that I've been working on recently.

This chromatograph didn't work very well at first because I didn't pay enough attention to the throughput and all its ramifications, and we didn't realize that multiplex is only viewed 5 percent of the time, so it only got 5 percent of the information and developed four-and-a-half times as much noise. Actually, it was much worse than that—eight times as much noise. By using a simple electronic filter storage device on each detector, I brought it up eight times. Right now I have returned to properly staffed projects and am working on two major projects (pump and monolithic columns), plus one minor project, related to the detector.

Chromatography sales, with the flash chromatography, went up from something like four million dollars to twelve million dollars in just a couple of years, in spite of the continued decrease of HPLC.

Another pet project of mine that I hired a chemical staff for is high speed macromolecular chromatography, like high speed protein chromatography, which is useful now, and may be a big deal for protein-based drugs and drug discovery. We have a patent license on monolithic media (8). Unfortunately we wasted a lot of time in a lawsuit with the patent owner. The monolithic license patent doesn't describe the mechanics of the medium to produce chromatographic efficiency significantly better than conventional medium. It just says, "Hey, it works!" We were fortunate enough to find a new Ph.D., who had been working for five years at

Berkeley [University of California-Berkeley] for two professors who were the inventors of this type of medium. It passed beta study, and right now (since July 2002) it is on sale. It's faster than anything else, and as selective as the best.

THACKRAY: Let me, if I may, peer forward for a moment rather than backward. As you look forward to the next ten to fifteen years, what do you hope to be doing?

ALLINGTON: I'll probably be retiring. I'm sixty-six now.

THACKRAY: That makes you a young man. [laughter]

ALLINGTON: Among people that are polio survivors, it makes me rather old.

THACKRAY: Yes. Will you stay in Lincoln, in your castle?

ALLINGTON: I don't know. I'm not going to worry about that. My wife worries about what it's going to be like for her when I retire. [laughter]

THACKRAY: Is there a company archive? What physical materials do you have? Do you have some that relate to the early days of the company and the start-up process?

ALLINGTON: Yes. We used to have all the materials on shelves in the library next to my office. I haven't looked in the new library to see whether they moved it or not. We can go over and see it, and if it's not there, I can ask a couple of people. We've got physical materials too. We bought back the original chromatographic absorbance detector with the slope sensing. That's probably the most historic thing we've got. Although it was made in 1961, it looks like it was made in 1951, I'm afraid.

THACKRAY: Good. Thank you very much for that. Is there anything else that you would like to talk about?

ALLINGTON: Let me see what I've got here. I can see one thing that's missing from my resume. After we got married, my wife wanted to know why I didn't drive. I told her, "My father said I shouldn't drive." She said, "You ought to put hand controls on that small Mercedes of yours and see if you can drive it." I did that, and it just made me sad. It was a sporty type of sedan and the steering was so stiff that I couldn't go around a corner. To drive it home, I took a long, circuitous route so I could turn corners where there wasn't much traffic. I almost felt near tears when I got home, and I was sure that it was never going to work. "Try my car," she said. I put the hand controls on her car and I could drive it. I didn't have a driver's license, so I had to get a learner's permit all over again. I was so pleased I could drive again I decided, just for the heck of it, after I got the driver's license, to buy a new car and also put hand controls in the big Mercedes that I was too intimidated to drive before.

The big Mercedes drove like a dream. It went around corners as if it was on railroad tracks. The steering wheel turned freely and yet you felt the road. The car had all sorts of fancy features. For instance, it not only had four-wheel disc brakes, but they were air brakes too. That thing ran! It at least acted like it had an automatic stability system, so when you put on the brakes, at emergency level, you didn't hear it much because the car was pretty soundproof, but there was a huge cloud of blue smoke behind you. [laughter] You came to a 75 mph stop just like that!

I started getting migraine headaches that got worse and worse. I had bought a Chrysler Le Baron back when Chrysler Le Barons were nice cars. It was what we'd consider a full-size car now, with all the options: overall leather upholstery, wood, a sunroof, and a 318 engine. All Chrysler steering wheels turned easily at that time. In 1984, the car was getting a little old and rattly, and it would at times come to an unwanted stop. I had a land two-way mobile phone in there for help. That was before they had cell phones. I thought that I'd better get another car, then I started getting so sick from those migraines that I just felt like I wouldn't last that long, so why get another car? I had my eyes on a BMW before I got the Chrysler.

I'd been taking too much aspirin, trying to get rid of the migraines. Suddenly I had lost about half my blood supply to a stomach ulcer. I went into the hospital for packed red blood cells and the doctor told me, "No more aspirin." I was taking a fantastic quantity of drugs: eight Tylenol-3 codeines and twelve Darvon one hundreds a day, plus aspirin, and regular Tylenol. On nights when I couldn't sleep, Mary would get an ice bag and bring it to me and I'd put it on my head. I was talking to my doctor about it; he tried me out on all sorts of different drugs, and sent me some reading on migraines. I happened to read elsewhere about Verapramil, a heart drug that prevented heart blood vessel spasm in some people, it occurred to me that it might prevent blood vessel spasm in the head too. By now I had been having migraine headaches that lasted a month. Since I had tried all these other unsuccessful anti-headache drugs, he gave the Verapramil to me at my request. I left it on the shelf at home, because I was trying out a bunch of other things sequentially, but I finally got to it. I had had a solid unremitting headache for little over a month.

I took the Verapramil when I woke up one morning. That morning I was too sick to go to work, but before noon, the headache was gone. For the first time, instead of starting again the same day—in the past, I'd only been free of the headache a half a day a month—it [the migraine] didn't come back, so I just kept taking the Verapramil. I haven't had a serious migraine since. Wow! I ran out and bought a BMW 735i. [laughter] I got it on the black market. At that time, BMW retail dealers would have over-charged me. They wanted sixty thousand dollars for that car when the German retail price was thirty thousand. I got it for thirty thousand dollars, not on the actual black market, but from an importer who was not a BMW dealer, but who had bought it from a German dealer.

It was a nice car. I knew when I got it, because I'd checked it, that I wouldn't be able to turn the power steering because it was too sporty and hard to turn. I had tried it out at the dealer's first. I got a look at the manual on the power steering unit before buying the car, and there was a sectional view that showed how it worked. I noticed that between the steering wheel and the set of servo valves there was a torsion bar. On the other end of the torsion bar was the connection to the ball screw that worked the wheels. What would happen was that as you turned the steering wheel, any load on the wheels would be reflected back up that torsion bar, which would work the valves in the other direction, making it hard to turn. All I needed to do was just buy one of those and turn down the diameter torsion bar.

It was a simple equation. Stiffness was proportional to the fourth power of the diameter. I wanted three-times softer turning, so I shut the diameter down by a factor of four to the three root. The steering made funny noises, and it shook a little bit sometimes, but not often. It would only shake if you turned the thing over one lock or the other, and I could put up with that. I thought, "I'd better really test this thing," so I took it out to Superior Street to the Interstate. I went downtown from Superior Street, and put the pedal to the metal. I went zooming along, rocketing toward downtown at 90 miles an hour listening to the radar detector. I thought, "What would happen if I made a fast lane change?" This car had always impressed me with the lane changes; it would pop sideways, instead of bumbling around. I made a fast lane change, and it popped sideways, but then it kept on going! [laughter]

The steering wheel adopted an oscillation. I wasn't strong enough to hold it still. I don't think anybody would have been. The thing was going "groan, groan, groan," all the way back and forth across the road. Fortunately there was nobody else on the road. I was barely able to keep it on a two lane expressway road. I didn't want to apply the brakes for two reasons: I was afraid I'd make the stability worse; and I'd have to take one hand off the steering wheel to work the hand control for the brakes. So I just let it coast down to 70 mph, at which point it damped out. I thought about that for a while. I needed to increase the damping in the steering wheel mechanism. I studied and figured out that I could do this by decreasing the size of an orifice. I calculated the type of oscillation I had, and I assumed I had a second order system. I decreased the orifice, but kept the flow by enough to try and bring the damping factor down to critical damping—and I got it. I took the car out to Superior Street and zoomed down the Interstate ramp at 90 mph. I would make a fast lane change, and the car would just snap to the other lane and glide! [laughter]

THACKRAY: All right! [laughter]

ALLINGTON: I liked that big Mercedes so much, but I sold it because I liked the BMW more! I had a lot of fun with the BMW. However, you could do some strange things in the big

Mercedes. I had to swing over to Omaha a number of times to supervise the restoration of the stained glass in our house, and I would take my oldest daughter with me. At that time I was having those migraine headaches. I always wore dreary dark glasses and a Greek fisherman's cap. It was a leather cap that put some pressure around my head and gave me a black visor to shade my eyes. I wore turtleneck shirts because I hate neckties. I said, "Why don't you get in the back seat, Sheri [Hyde]? Get dressed up and see what happens." We went through the town with her in the back seat, and I never realized how many people in Omaha had chauffeur-driven cars before. The chauffeurs came up to us, their lights would flash, and the guys would wave. [laughter] The chauffeur had some lady in the back seat of his car. [laughter]

THACKRAY: Joining the chauffeur's union? [laughter]

ALLINGTON: That was quite an experience. We passed a grade school yard where a group of kids were playing. Almost all of the girls came out to look at us as we went by at about 1 mile an hour. [laughter] That was something you could do with no other car! But all in all, the BMW was more fun. Some years later, I bought a replacement, which I've got now. I had to do the same thing with the power steering, although I avoided the ninety-mile-an-hour test. I knew how it would behave for stability, and when it would be completely stable. I think it took me two or three iterations to get the steering right on this car. After this, the steering wheel turns with minimum effort and has sporty performance.

Up until recently I have been working on two research projects. One, (leading position), is for a family of pumps for gradient liquid chromatography with monolithic columns. It has some neat features for integrating the gradient capability. The other, (advisory position) is a sensitive detector for monolithic packed capillary liquid chromatography. Patent disclosures were made and have been filed at the patent office.

At this time I started thinking seriously about retirement and became more attentive to offers from other companies to buy Isco. I was pleased to receive an expression of interest from Teledyne Technologies Incorporated as they desired not only to buy the company, but also to maintain our Lincoln, Nebraska, location, and to keep our present employees and product lines. Further they gave me a two-year employment agreement. That sounded particularly good as I have accumulated vacation and wanted to take a long ocean cruise with Mary. Both of us will be in our seventies in another year.

I signed a binding agreement on 7 April 2004 to agree to sell my controlling interest in Isco stock to Teledyne Technologies pending their due diligence investigation of the company. It was expected that the transaction closing would take place in June or July 2004.

A few days after this agreement was signed, my wife was diagnosed as having an advanced and incurable form of cancer. We took her home from the hospital and put her in her favorite room at home. There was a member of the family with her at all times and a hospice nurse with her about two-thirds of the time. She died on 16 May 2004. It was a terrible shock to me. I can't explain how much I miss her and grieve for her. I never will get over it.

At that time, Teledyne started an economic review of all current Isco products, including those under development. The projects for the pump and detector for use with monolithic columns were not selected to be brought to market and were cancelled.

About that time, I began having severe back pains, which were tentatively diagnosed as an aneurysm in my abdomen. With the 1 September deadline on completion of this oral history and my major surgery to correct this condition scheduled 8 September, I thought it best to bring this document up to date and submit it to you.

[END OF TAPE, SIDE 8]

[END OF INTERVIEW]

NOTES

1. William Gerald Golding, *Lord of the Flies* (New York, New York: Berkley Publishing Group, 1959).

2. Robert Allington, “Compound Optical Filter Providing a Sharp Cut-Off.” U.S. Patent # 3,243,595. Issued 29 March 1966.

3. Robert Allington, “Certain Applications and Relationships Involving the Kerr Effect,” Master’s Thesis. University of Nebraska-Lincoln, 1961.

4. Robert Allington, “Apparatus for Making Chemical Separations.” U.S. Patent # 3,202,188. Issued 24 August 1965.

5. Robert Allington, “Heat of Interaction Detector.” U.S. Patent # 3,967,492. Issued 6 July 1976.

6. David R. Lide, ed., *CRC* [*Chemical Rubber Company*] *Handbook of Chemistry and Physics* (Boca Raton, Florida: CRC Press Ltd., 2003).

7. *On Her Majesty’s Secret Service*. West Hollywood: United Artists Studio, 1969. Filmstrip.

8. Shaofeng Xie and Robert W. Allington, “Separation system, components of a separation system and methods of making and using them.” U.S. Patent # 6,749,749. Issued 15 June 2004.

INDEX