SCIENCE HISTORY INSTITUTE

PAUL KEBARLE

Transcript of an Interview
Conducted by

Michael A. Grayson

at

University of Alberta
Edmonton, Canada

on

22 May 2013

(With Subsequent Corrections and Additions)

ACKNOWLEDGMENT

This oral history is one in a series initiated by the Science History Institute on behalf of the American Society for Mass Spectrometry. The series documents the personal perspectives of individuals related to the advancement of mass spectrometric instrumentation, and records the human dimensions of the growth of mass spectrometry in academic, industrial, and governmental laboratories during the twentieth century.

This project is made possible through the generous support of the

American Society for Mass Spectrometry.

This oral history is designated **Free Access**.

***Please note*:** Users citing this interview for purposes of publication are obliged under the terms of the Center for Oral History, Science History Institute, to credit the Science History Institute using the format below:

> Paul Kebarle, interview by Michael A. Grayson at University of Alberta, Edmonton, Canada, 22 May 2013 (Philadelphia: Science History Institute, Oral History Transcript # 0899).

Science History Institute

Chemistry · Engineering · Life Sciences

Formed by the merger of the Chemical Heritage Foundation and the Life Sciences Foundation, the Science History Institute collects and shares the stories of innovators and of discoveries that shape our lives. We preserve and interpret the history of chemistry, chemical engineering, and the life sciences. Headquartered in Philadelphia, with offices in California and Europe, the Institute houses an archive and a library for historians and researchers, a fellowship program for visiting scholars from around the globe, a community of researchers who examine historical and contemporary issues, and an acclaimed museum that is free and open to the public. For more information visit sciencehistory.org.

CHEMICAL HERITAGE FOUNDATION
Oral History Program
FINAL RELEASE FORM

This document contains my understanding and agreement with the Chemical Heritage Foundation with respect to my participation in the audio- and/or video-recorded interview conducted by Michael A. Grayson on 22 May 2013. I have read the transcript supplied by the Chemical Heritage Foundation.

1. The recordings, transcripts, photographs, research materials, and memorabilia (collectively called the "Work") will be maintained by the 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 the 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 recording(s) heard/viewed by scholars approved by the Chemical Heritage Foundation unless restrictions are placed on the transcript as listed below.

This constitutes my entire and complete understanding.

(Signature) Paul Kebarle
Paul Kebarle

(Date) MARCH 24, 2015

OPTIONAL: I wish to place the following restrictions on the use of this interview:

I WOULD LIKE SECTIONS OF THE AUDIO SEALED, AS DISCUSSED WITH THE DIRECTOR OF THE CENTER FOR ORAL HISTORY.

Regardless of any restrictions that may be placed on the transcript of the interview, the Chemical Heritage Foundation retains the rights to all materials generated about my oral history interview, including the title page, abstract, table of contents, chronology, index, et cetera (collectively called the "Front Matter and Index"), all of which will be made available on the Chemical Heritage Foundation's website. Should the Chemical Heritage Foundation wish to post to the Internet the content of the oral history interview, that is, direct quotations, audio clips, video clips, or other material from the oral history recordings or the transcription of the recordings, the Chemical Heritage Foundation will be bound by the restrictions for use placed on the Work as detailed above. Should the Chemical Heritage Foundation wish to post to the Internet the entire oral history interview during my lifetime, I will have the opportunity to permit or deny this posting.

I understand that the Chemical Heritage Foundation will enforce my wishes until the time of my death, when any restrictions will be removed.

CHEMICAL HERITAGE FOUNDATION
Oral History Program
FINAL RELEASE FORM

This document contains my understanding and agreement with the Chemical Heritage Foundation with respect to my participation in the audio- and/or video-recorded interview conducted by Michael A. Grayson on 23 May 2013. I have read the transcript supplied by the Chemical Heritage Foundation.

1. The recordings, transcripts, photographs, research materials, and memorabilia (collectively called the "Work") will be maintained by the 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 the 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 recording(s) heard/viewed by scholars approved by the Chemical Heritage Foundation unless restrictions are placed on the transcript as listed below.

This constitutes my entire and complete understanding.

(Signature) Karl R. Kopecky
Karl Kopecky

(Date) 27 June 2014

OPTIONAL: I wish to place the following restrictions on the use of this interview:

_____

_____

Regardless of any restrictions that may be placed on the transcript of the interview, the Chemical Heritage Foundation retains the rights to all materials generated about my oral history interview, including the title page, abstract, table of contents, chronology, index, et cetera (collectively called the "Front Matter and Index"), all of which will be made available on the Chemical Heritage Foundation's website. Should the Chemical Heritage Foundation wish to post to the Internet the content of the oral history interview, that is, direct quotations, audio clips, video clips, or other material from the oral history recordings or the transcription of the recordings, the Chemical Heritage Foundation will be bound by the restrictions for use placed on the Work as detailed above. Should the Chemical Heritage Foundation wish to post to the Internet the entire oral history interview during my lifetime, I will have the opportunity to permit or deny this posting.

I understand that the Chemical Heritage Foundation will enforce my wishes until the time of my death, when any restrictions will be removed.

Kopecky

PAUL KEBARLE

1926 Born in Sofia, Bulgaria, on 21 September

Education

1952 Dipl. ETH Honors, Chemical Engineering, Swiss Federal Institute of Technology, ETH, Zurich, Switzerland

1956 PhD, University of British Columbia, Chemistry

Professional Experience

National Research Council, Ottawa, Canada

1956-1958 Postdoctoral Fellow

University of Alberta, Edmonton, Alberta, Canada

1958-present Professor

Honors

1965 Member, New York Academy of Sciences

1969 Fellow, Chemical Institute of Canada

1978 Fellow, Royal Society of Canada

1980 Member, Sigma Xi Research Society

1980 Award for Excellence, Province of Alberta

1984 McCalla Professor, University of Alberta

1986 CIC Medal, Chemical Institute of Canada

1989 J. Gordon Kaplan Award for Excellence in Research, University of Alberta

1994 Frank H. Field and Joe L. Franklin Award for Outstanding Achievement in Mass Spectrometry, American Chemical Society

1994 Fred P. Lossing Award, Canadian Society for Mass Spectrometry

ABSTRACT

Paul Kebarle was born in Bulgaria, where his father was a business man and his mother a housewife. Kebarle escaped to Czechoslovakia, ostensibly for treatment for scoliosis, thence to Switzerland, where he studied nonstop to pass the entrance exam for ETH. At ETH he majored in chemical engineering. Kebarle then became a lab instructor at University of British Columbia, where he obtained his PhD in chemistry under Allen Bryce, studying mass spectrometry (MS). He taught himself MS by fixing an instrument made by the National Research Council (NRC); he had to learn glassblowing to plug leaks. He began with pyrolysis MS and built the more specific and comprehensive gas chromatography-mass spectroscope (GC-MS).

Two years of postdoctoral work with Fred Lossing at the NRC produced many publications, some amplifying his thesis on butene-1. Kebarle was next hired as professor at the University of Alberta, where he continued his high rate of important publications, until – he says – his work "disappears" because it has been internalized in the discipline of chemistry. He worked on electrospray MS, publishing with Udo Verkerk what he considers his most important paper. Mandatory retirement age pushed him into a smaller office, but a substantial grant has kept him working and publishing for many years. He and his wife maintain an active outdoor life, biking, walking, and skiing.

Kebarle talks about his family, former colleagues, and the impact of mass spectroscopy on biology. He "fell into" science and urges young people to try it and to work hard at it. He did not experience competition in his field. Kebarle believes that MS will continue to be useful, but that it will not provide the earth-shattering discoveries of the past.

Karl Kopecky added his notes on Kebarle. He explains that Kebarle worked in high-pressure MS, electrospray MS, and ionization MS. He claims that Kebarle's work is so important that it forms the core of the subject in all standard chemistry textbooks. Kebarle's work has implications for thermodynamics, computational chemistry, protein folding, and drug interactions. A humble man, Kebarle made nothing of his more than thirty articles that have been cited more than one hundred times.

INTERVIEWER

Michael A. Grayson is a member of the Mass Spectrometry Research Resource at Washington University in St. Louis. He received his BS degree in physics from St. Louis University in 1963 and his MS in physics from the University of Missouri at Rolla in 1965. He is the author of over 45 papers in the scientific literature. Before joining the Research Resource, he was a staff scientist at McDonnell Douglas Research Laboratory. While completing his undergraduate and graduate education, he worked at Monsanto Company in St. Louis, where he learned the art and science of mass spectrometry. Grayson is a member of the American Society for Mass Spectrometry (ASMS), and has served many different positions within that organization. He has served on the Board of Trustees of CHF and is currently a member of CHF's Heritage Council. He currently pursues his interest in the history of mass spectrometry by recording oral histories, assisting in the collection of papers, and researching the early history of the field.

TABLE OF CONTENTS

INTERVIEWEE: **Paul Kebarle**

INTERVIEWER: **Michael A. Grayson**

LOCATION: **University of Alberta**
Edmonton, Alberta, Canada

DATE: **22 May 2013**

GRAYSON: First off we begin these interviews by stating that my name is Michael Grayson. I am in the office of Paul Kebarle at the University of Alberta on the twenty-second of May in 2013 and Paul is the subject of an interview about his **<T: 10 min>** career in science in general and mass spectrometry in more particular. Having gotten that formal piece of information available so that sometime when someone picks this up and listens to it they'll know what we're talking about, rather than listen to it and wonder what's going on here. I usually like to ask people about their family, and my understanding from what little I know about your early history is you were born in Bulgaria.

KEBARLE: [Yes].

GRAYSON: And your parents were professionals or . . . ?

KEBARLE: [. . .] So I was born in 1926.

GRAYSON: Twenty-six.

KEBARLE: My parents . . . well basically at that time, the mother just stayed at home, looking after the children. But my father was actually, he was born in Bulgaria, but he was half-Czech and half-German.

GRAYSON: That's interesting. But he was born in Bulgaria?

KEBARLE: He was born in Bulgaria. Bulgaria was liberated from Turkish domination, which lasted five hundred years, [. . .] and now Bulgaria is totally without any people trained for various things that are apart from agriculture. And so [my father's Czech grandfather and some of his sons] decide to come to Bulgaria and because they have some experience start a business

that will be to their profit and [the] profit of Bulgaria. [They come] to Sofia [Bulgaria], which is the biggest city. And they start first with a factory for matches.

GRAYSON: To light fires?

KEBARLE: They make a small factory [. . .] to make matches because they see there are no matches. However, the Bulgarians were not accustomed to matches. They used flint.

GRAYSON: Oh, man.

KEBARLE: Flintstone. They were accustomed [to using flintstone] so that the factory didn't do well, and they had to close it, and let me think now. **<T: 15 min>** [My father's] father catches pneumonia and dies, so he's left with his mother, and he starts . . . he has to start very early at an age of [twelve or thirteen].

GRAYSON: Oh wow.

KEBARLE: To work and he was lucky there was . . . Bulgaria had a king [Ferdinand I] at that time who had a park. I mean a . . .

GRAYSON: Like a game preserve?

KEBARLE: Yes, it's a sort of a [. . .] house or whatever would go . . .

GRAYSON: An estate.

KEBARLE: And they were . . . they import some German gardeners to make a park with all flowers, etc. And my father was hired, or managed to get hired [. . .]. He actually liked the work, which was outside a lot, and he had a friend who was very kind to him, and in the evening he would teach my father what they learned in school.

GRAYSON: By the way, can I get your parents' names while I'm thinking about it?

KEBARLE: His name is Paul.

GRAYSON: Paul?

KEBARLE: Paul, also. So I'm after him and—

GRAYSON: What's your mother's name?

KEBARLE: Katherine.

GRAYSON: Is that a K, I think?

KEBARLE: [Yes], K.

GRAYSON: Very good. So you're, I'm sorry, go ahead.

KEBARLE: [Yes], she was Bulgarian.

GRAYSON: And [the] friend, that was teaching—your father's friend?

KEBARLE: [Yes], so he helped him to [learn. And gradually my father made] his way up and [in] the end he became very prosperous and a major shareholder of a company called Transbalkania.

GRAYSON: Transbalkania?

KEBARLE: Trans, the Balkans, that comes from the Balkans. Bulgaria is in the Balkans. And basically they export, say, something from Bulgaria to, say, Germany; it goes in trains, but somebody has to follow that this stuff ends up where it's supposed to end up, and these are the agencies that [take] care as this freight is moved from one place to the other. So there's another company, say Switzerland has a company of that type, which is called Danzas. [So] he managed to become the director and major shareholder [of Transbalkania].

GRAYSON: Wow.

KEBARLE: And actually I had a very nice childhood, and we were very well off; we had a beautiful house.

GRAYSON: In what town, what city was this where you lived?

KEBARLE: In Sofia.

GRAYSON: Sofia?

KEBARLE: In the capital and houses there are built so they last for [a very long time]. It's ferro concrete. That was then [important] some years later because when Sofia got bombed so we could hide in the basement **<T: 20 min>** which could provide us with some . . . . So in essence I went to school and that was to a German school which teaches also Bulgarian [. . .].

GRAYSON: You were learning German and Bulgarian there?

KEBARLE: And Bulgarian. It's required by [the] Bulgarian government that you get Bulgarian.

GRAYSON: Oh, sure.

KEBARLE: But the German was a kind of additional thing because most of the trade of Bulgaria went to Germany, so in essence German was the most important foreign language, and we were exporting fruit and vegetables and so on, and getting machinery from the Germans.

GRAYSON: So you were born in 1926, right?

KEBARLE: Yes, in Sofia.

GRAYSON: So this was a time of pretty much turmoil in your youth up until the time you left Bulgaria where the Balkans were the . . . .

KEBARLE: Well the turmoil that occurred was that now you know there was [Adolf] Hitler, and Hitler starts a war, and he thinks he's going to beat the Russians like nothing. He said, "I'll just kick the door in and the whole house will fall down," but he was bitterly wrong because the Russians had tanks that were twice as large as the German tanks and he did not know that.

GRAYSON: Really?

KEBARLE: He was so conceited and the first year they made great progress. They came to Moscow [Russia] but didn't manage to occupy Moscow but then during the . . . he was so conceited he thought he would beat them in a month, so these German soldiers had no . . . they had cotton [summer] uniforms and the winter comes, and they start dying by just cold. Then later the second year . . . and to make the story short that was then in Stalingrad [Russia] when the Germans get surrounded and beaten at a tremendous loss of [lives] because it was too cold. [. . .] Now it's the Russians that are expanding into Europe and they come through Bulgaria.

GRAYSON: Ah, so Bulgaria is located north of Turkey?

KEBARLE: Yes, just north of Turkey but in Europe like Turkey is in Asia Minor.

GRAYSON: Right in between Russia and Germany is Czechoslovakia at the time? I can't remember my geography of that area, but basically the Russians were going to come through Bulgaria, pushing.

KEBARLE: They came to Bulgaria, and we were pretty scared initially that they would . . . I had a sister that was eighteen years old and we were very scared that these Russians would rape every . . . they had a bad reputation but they proved to be on the whole very much better than we were afraid of. They are sort of passing through, but that night they have to sleep somewhere and they come and knock at the door of the house and [we] have to open and they walk in and look at this thing and they say, "Six," and six Russians will be sleeping. So the dining room and the living room, these guys go and they [take over these rooms]. And my sister . . . we sit at the top floor but actually [the Russians behaved well].

GRAYSON: This was about what year? Nineteen forty-on, 1941?

KEBARLE: Yes, ah, something like this that, you know, the war started ’39 so it would be five so something like this. I’m going say [’44].

GRAYSON: But up until this time until the war started you had about ten or twelve years where you had a fairly **<T: 25 min>** pleasant life, your family and even up until . . . .

KEBARLE: Yes, because that’s when I was young.

GRAYSON: So you left about [’47-’48]?

KEBARLE: [. . .] So that was after the war. It is over and then of course we . . . by that time I was close to finishing high school, and then because my father had this business I wanted to work in that business, and I then took . . . it was, sort of . . . it deals with commerce.

GRAYSON: Commerce.

KEBARLE: [Yes], but that was just one year.

GRAYSON: So this is a school like a business school would be here.

KEBARLE: Yes, yes, it’s a business school. You’ll learn about all kinds of things. How useful they were I don’t know but in any case then . . . now it was still, this was sort of a communist [government], you know, they don’t let you leave the country too easily, but I have a defect. My spine is curved. It’s called scoliosis but at that time very little but I thought, “Gee, they want to have only very strong people.” I was actually in very good shape. And actually at that time you’d get an x-ray, they didn’t have the plates. It’s too expensive but they do on the, you know . . . what is this thing on a screen that it’s just like the TV. The guy quickly drew part of my spine and it shows—

GRAYSON: So they didn’t have a film recording of it?

KEBARLE: No. It’s just on the scope.

GRAYSON: On the scope and then you'd draw.

KEBARLE: Basically by hand. I don't think this man could have lasted too long because he is constantly exposed. So anyway but it wasn't very noticeable but now [much more] so and then I got the idea . . . well I found out that in Prague [in Czechoslovakia] there was a doctor that was a great specialist and will fix that but I also thought, "Well I'm already getting out of Bulgaria." ," because the Czechs were not yet the real [communists]; like we had commies at 100 percent, the Czech was 30 percent.

GRAYSON: They were like more of a party, a political party in Czechoslovakia or in Bulgaria.

KEBARLE: Much more at that time. They also got the revolution there but at that time they were not yet commie. And I got there, and the guy said there's nothing I can do for you but I said I thought well that's . . . I'm going to get out of here and the Czechs weren't interested what happens to the Bulgarians. So I went to the Swiss embassy there and I said that **<T: 30 min>** I'd like to go to Switzerland to study, and my father had some money in Switzerland and so I thought that over, but again we . . . the Swiss are very sticky about that. They gave me the [required papers] and I go to Switzerland.

GRAYSON: Now did you do this - with your father's blessing or . . . ?

KEBARLE: Sorry?

GRAYSON: I mean did your father know that you wanted to leave the family and go abroad?

KEBARLE: Yes, yes.

GRAYSON: And he was okay with that?

KEBARLE: Yes, even though it exposed him to some danger but you see they . . . it's not such a highly-organized thing that they would know exactly what's happening to me. I've gone to the Czech thing and in fact when I got a Swiss visa I immediately went to . . . there was no way there, just by plane, and on the plane I happened . . . there was another Czech guy that we were in the same seats and he was a Czech commercial person. They had some trade with Switzerland. Anyway he talked a lot, he was an interesting person to talk to, and so I arrived in

Switzerland, and next day [on February 25, 1948] I was walking on the Main Street in Zurich and I see this guy sitting at one of the . . . they have these coffee shops where it's all outside, tables. I see this guy and he waves at me and he shows me the newspaper, "Look, the commies took over Czechoslovakia!"[1]

GRAYSON: Oh my!

KEBARLE: So I escaped by one day. That was really lucky, and this other guy said, "What am I going to do, I have a family!" [laughter]

GRAYSON: Oh my!

KEBARLE: I never saw him again, but that's . . . then I studied in Switzerland.

GRAYSON: What year . . . was this after war was finished with Germany or it was during the war?

KEBARLE: Oh long, long after.

GRAYSON: Okay, so this would have been in the forties, so do you want to claim six or '46, '47? You were out of high school by then, right?

KEBARLE: But I had . . . well I had a high school . . . from Bulgaria I had a high school diploma but—

GRAYSON: And spent a year in the business school?

KEBARLE: I had. You take a course and then you're given an exam. The exam . . . there would be say two people and the professor which, you know, the examiner and he'll ask questions but I had started working at that time. I was already . . . you know, I'd study. In the early days I hated to study but I've grown up and then in Switzerland I wanted to get in to, it

[1] The Communist takeover of Czechoslovakia occurred on February 25, 1948, after mounting tensions between communist and noncommunist members of the government.

was a very famous Swiss engineering thing, and you have to pass an exam. Foreigners have to pass an exam.

GRAYSON: So what language are you using in Switzerland?

KEBARLE: German.

GRAYSON: German. You're using your German in Switzerland?

KEBARLE: Yes, yes, and I knew it because in Bulgaria I had been to a German school. I took German in Bulgaria. I had pretty good German, so that was very important and then I studied. **<T: 35 min>** I had very little money. I studied kind of day and night with the most hard work ever and I made it because I had to pass an exam.

GRAYSON: This is before you actually went to this . . .

KEBARLE: They did not, [yes]. They don't accept you on . . . you have to pass an exam, and I managed to pass an exam; then I had to choose. There was electrical engineering or chemical engineering. So I thought I knew nothing much of either, but I said it might be a bit easier, the chemical than the electrical. So I went into chemical engineering and there again very frugal life and very hard work. I worked very hard, and I got the degree, and I could have stayed in Switzerland, but they weren't too happy [to let foreigners stay] and in any case I decided I'll have better opportunities [if I] get out and then there was the [United] States, or Canada, or Australia. [I decided to go to] Canada, and again I thought to look to the encyclopedia. I had a map and description of the various places. They had a description of Vancouver [Canada] and I liked the sea, and I thought I'll go to Vancouver and enroll in UBC, University of British Columbia. [I'll] send them my diploma and ask whether they will accept me as a graduate student. So they . . .

GRAYSON: And you already knew you wanted to do graduate work?

KEBARLE: I had finished already in Switzerland.

GRAYSON: Your bachelor's?

KEBARLE: The bachelor's.

GRAYSON: Right.

KEBARLE: So the only thing was then a PhD.

GRAYSON: Okay. I mean, did you think about getting a job and going to work?

KEBARLE: Sorry?

GRAYSON: I say you didn't even think about getting a job and going to work with your chemical engineering degree?

KEBARLE: Ah, no, and I'm glad because you see—that's a good question. [laughter]

GRAYSON: I mean most people I think would think about it anyway. But just to—

KEBARLE: [. . .] I just didn't try. I thought, "Well I will take a doctor's degree." And of course I'm happy that I did that.

Now of course who's going to pay me to survive? Well, you could . . . how was it now? I had to do certain job work . . . supervise their lab, their labs there and their bottles and so on and their—

GRAYSON: As a graduate assistant?

KEBARLE: **<T: 40 min>** [. . .] That was the source of my income, and then I had to choose also a research director. Then the period of say about four years was the most frugal I've ever had to be. I had to always rent a basement room, and I couldn't afford to go eat out in a restaurant or anything, so it had to have some facility to cook there. So I go buy [. . .] only cheap food but I knew how to cook and I'll cook it there. That was a real tough period.

And then I had to choose with who to do my PhD, and there was a young prof there, and I went to see what he's doing and he was in the basement [of the chemistry building], and

he had a mass spectrometer there, and his name was Allen Bryce. [. . .] And actually when I looked at the thing the first time it looked like a monster because it had all radio tubes and . . . the tube for the mass spec that was special stainless steel. As I have mentioned before that actually had been built, I think, [by the] National Research Council in Ottawa [Canada]. It had a lot of glass things rather than metal. Glass, so you had to know how to glassblow if you wanted to do something. So fortunately I became a pretty good glassblower and nothing was working on it.

GRAYSON: So before we get going further with it I'd like to just ask a couple questions . . .

KEBARLE: Sure, sure. Go ahead.

GRAYSON: So you obviously had a very strong desire to become more educated, you know, to get more education. Was that something that, was just in your nature or was that something that reflected your parents' emphasis or something?

KEBARLE: At that point I was far away from my parents. They were in Bulgaria still. **<T: 45 min>** I certainly wanted to succeed. [. . .] I would have liked to be a professor, maybe. Also that work with a mass spectrometer, it attracted me to a certain . . . I mean, I had an ability, if you want. For instance, as I mentioned before, these were all radio tubes, and the resistors, capacitors, etc., but initially I knew nothing of these things, but I read. I got a book and I read about it, because the department did not have an electronics specialist. They had a machine shop that machined some stuff but no electrical, so I read all that stuff and it was interesting and resistors and then meters, you needed and [how to] attach them. And then the biggest thing was leak hunting. [The instrument] had all kinds of leaks, I don't know why, and finally when we would plug the last leak and, lo and behold, the thing went down to 10^{-5} torr and so I could do my work.

Now the funny thing was I was doing a project [with] butene-1. So that's C_4. Anyway, I discovered that already some people had published something, it's called pyrolysis, so you heat it and [investigate] how does it fall apart. That was in England by a very famous . . . they had already done a study.[2] But I looked at what had they studied.[3] They were studying when you heat it does the pressure increase or decrease? I mean, due to pyrolysis, suppose that this breaks into two molecules from one. The pressure will increase. So that's all. They just look at the mercury [pressure] and heat it all, but they had no idea what's really happening. And now with

[2] Kebarle was referring to Sir Cyril Hinshelwood.
[3] Danby, C.J., B.C.Spall, F.J.Stubbs, and Cyril Hinshelwood. "The Formation of CH3D by the Decomposition of n-butane in the Presence of Deuterium." *Proceedings of the Royal Society of London. Series A. Mathematical and Physical Sciences* 228, no. 1175 (1955): 448-454.

the mass spectrometer I looked, and there were about twenty other products. A real super mess. I began to enjoy this stuff.

GRAYSON: So you were doing a pyrolysis mass spec experiment basically?

KEBARLE: Yes, yes, pyrolysis and detect what the products are.

GRAYSON: And [how were you] pyrolyzing? [Was it] a sample in a volume that was heated or was it on a probe? Pyrolysis probably doesn't start until you get about 300 Celsius I would think, right?

KEBARLE: Just let me think now because <**T: 50 min**> if you took the whole thing [. . .] a whole mess of all kinds of compounds [were formed]. So initially it was not very successful, but methane certainly was formed [from pyrolysis of] butene-1, methane was formed. And a lot of other stuff and actually just with the mass spectrometer you couldn't tell [all of the other compounds that were formed].

GRAYSON: Right.

KEBARLE: Even if you tried to take the gas [portion only and analyze it, you] just couldn't do it. It was funny; in the chemistry department there was a German who had no training. He had been just to high school. I don't know exactly what he was doing but we became friends and he told me that there was a method to separate these [compounds from the pyrolysis of butene-1]. This method was discovered by [Archer John Porter] Martin and [Richard Laurence Millington] Synge. I think they were Englishmen and it was liquid chromatography and gas chromatography.

GRAYSON: So the German was aware of this?

KEBARLE: He told me that it exists and I could do quite a bit of glassblowing myself so we then put a gas chromatographic thing [together] and now we could really [separate a lot of the compounds]; propane, propene, this and this. We saw it was a [big mixture] and the Brits who had just measured the pressure increase had totally complete fantasy. And then I got my PhD together, you know, I wrote the thing.

GRAYSON: So this was your doctoral dissertation, the work on the pyrolosis.

KEBARLE: Yes, that's for the PhD.

GRAYSON: And do you recall what you were pyrolizing? Was it a long-chain alaphatic?

KEBARLE: The 1-butene-4-d3.

GRAYSON: Oh, okay.

KEBARLE: [Yes], so it is a gas. Just a little higher [in carbon number and] it starts getting liquid. So like pentane is close to liquid and hexane already is a liquid.

GRAYSON: So then did you put it in a volume and heat the volume up or did you pass it through a hot tube? Do you recall [how you did] the pyrolosis, to get it up to [temperature]?

KEBARLE: It's in a bulb.

GRAYSON: Kind of like a bomb.

KEBARLE: That can take high temperature—a furnace.

GRAYSON: Ah, very good.

KEBARLE: And you have a thermocouple to measure the temperature and then all kinds of gases are formed but also some liquid, so it's a real mess. But with the chromatography . . . now the British, they just [found] methane and hydrogen. You put it through the [chromatograph] and twenty compounds [are separated]. [laughter]

GRAYSON: Oh [Yes]. That's a very complicated process.

KEBARLE: So that was then the GC-MS. I mean it's, wonderful.

GRAYSON: [Yes], now I need **<T: 55 min>** to ask a couple of other questions about this mass spectrometer. You say it was built in Ottawa?

KEBARLE: Yes.

GRAYSON: And shipped to Vancouver?

KEBARLE: Yes.

GRAYSON: You know anything about the background of that? It was built by . . . it wasn't built by a commercial company.

KEBARLE: No, no, the machine shop of NRC.

GRAYSON: Oh, the National Research [Council]?

KEBARLE: National Research [Council].

GRAYSON: Okay.

KEBARLE: [Yes].

GRAYSON: So that's where they built it and . . .

KEBARLE: They sent it to [Vancouver].

GRAYSON: Okay, so I guess, this Bryce fellow wanted to have a mass spectrometer?

KEBARLE: He had gotten one from them. Then when I came here [University of Alberta] since I was familiar with this the chair of the department at that time . . . so, I tell you what happened here because we had a very dynamic chairman. In any case when I finished I got my

PhD at UBC, I went as postdoc with Fred [Frederick P.] Lossing. And he was a wonderful man and a good scientist. He had a mass spectrometer.

GRAYSON: And where was he located, when you did your postdoc?

KEBARLE: Ottawa and it is the National Research Council of Canada and that still exists and they did the research there.

GRAYSON: So then after you got your degree at Vancouver—

KEBARLE: At UBC.

GRAYSON: —you [did your] postdoc at Ottawa].

KEBARLE: Yes, and they gave you a salary that was—you can survive. I had already gotten married and I had a very nice time with Fred Lossing. He was a wonderful person, and then I think I did about three years there or so—two to three years. Then we had here in Edmonton [Canada], the University got a lot of money because of oil discoveries. Just not too far from the airport was the first big oil well. So suddenly Alberta gets oil and gets a lot of money and they don't know what to do with it. But they decide, "Okay, we give the University more money," but the chemistry department here was sort of a sleepy place and now they have a lot of money.

They can [now] attract a Canadian who was in the [United] States, a chairman of some [chemistry department]. His name was Gunning, Harry [E.] Gunning and he knew how to spend money. Anything you wanted he listened. But there was a lot of money there. Like physics stayed in the dark ages because they didn't have a proper [chair], but this guy was a real [dynamic fellow]. And he said, "Do you want a mass spec?" Actually he came to NRC when I was with Fred Lossing. [Gunning was] looking for people and Fred Lossing must have said "Paul's doing fine." But [Gunning] had no time [to meet with me]. **<T: 60 min>**

Fred Lossing told me, "He is in the hotel here, and he'll have a drink about 7:00 p.m. That's the best time for you to go and see him." [. . .] And I go there and, sure enough, we have a drink. I forget what I had. At that time people drank a lot of Scotch, so I had a glass of Scotch and Harry Gunning has a glass of Scotch and he says, "I'm offering you this job," so I was very happy. Just like that! He didn't ask [much about me]. I came here and we had a mass spec of the same type that was made at NRC, but not completely. I came here and we put it there and gradually we had two mass spectrometers and three mass spectrometers and—

GRAYSON: So it sounds like the NRC was building mass specs in Canada to supply to universities.

KEBARLE: Not too many.

GRAYSON: But I mean they could, by this time it was 1950 . . . ?

KEBARLE: Something like that, '52, I'd say.[4]

GRAYSON: And there were commercial instruments available that could be bought.

KEBARLE: There were but they were highly specialized. They were designed for analysis of mixtures and also, you know, [the instrument] has to be accessible. You want to make a change so [it is not easy with a commercial instrument]. And we used a lot of inlet systems. Later we had the electrospray thing. We could do it. We agreed about this, we have a glassblower, we have a machine shop guy and, ah, we will do it. Actually, I had this . . . let me see whether I have these photos of . . . I think that was for you. [. . .] So these are the photos of that instrument and my people that . . . so, see the inlet with all the glass . . .

GRAYSON: Oh nice. [It used strip] charts.

KEBARLE: [Yes]. [See, we] had copper tubes for cooling, and it's a real mess compared with a very well-packaged [commercial instrument].

GRAYSON: Oh [yes].

KEBARLE: But of course it's much more accessible. This is an American guy. [This is posed] partially but he said, "This shitty, damn thing is always giving me trouble." So it's an American kid.

GRAYSON: You got this second instrument from NRC when you came to Alberta?

[4] Kebarle started at the University of British Columbia in 1952. He came to the University of Alberta in 1958.

KEBARLE: Yes, yes.

GRAYSON: I know **<T: 65 min>** it was a different . . . it had some differences, but did it work better when you turned it on than the one at Vancouver because apparently you spent quite a bit of time getting the Vancouver machine to even work whereas here now hopefully—

KEBARLE: Yes, yes, and I also knew much more in a sense, and I was a pretty good glassblower. It's actually quite fun to do if you can do it, and I would say that I've had a very happy time because the young people that came, I would say 95 percent of them, I got along very well [with]. We managed, we'd start publishing, publishing, publishing, publishing. And a bit later we bought a triple quad. And that we used also and, I don't know, led to some two hundred papers or so over the years, something like this; I think that maybe two hundred seventy papers . . . .

GRAYSON: Now you came from . . . what were you doing when you were [doing postdoctoral work] with Fred Lossing in NRC? Were you doing more pyrolosis-type experiments or were you . . . there's a lot of analytical chemistry that can be done.

KEBARLE: Ah, you know, maybe we could . . . do I have that? [Yes], just a second.

GRAYSON: List of publications?

KEBARLE: I have to have a look here so that I could tell you. [laughter]

GRAYSON: That's okay.

KEBARLE: See at the beginning it was just . . . Lossing and Kebarle, "Ionization Potential."[5]

GRAYSON: It looks like a lot of ionization potential studies.

[5] Lossing FP, Kebarle P, DeSousa JB, "Ionization potentials of alkyl and halogenated alkyl free radicals", *Advances in Mass Spectrometry*, Waldron JD Ed. The Macmillan Company, New York, 1959, Vol 1 431-442.

KEBARLE: Yes, yes. [. . .]

GRAYSON: He had other people working in his group as well as you for a variety of research topics? See, ionization and rearrangement of esters, electron impact versus . . .

KEBARLE: Yes, ionization potentials. Now if you ask me why was it interesting that you do this, I couldn't tell you. [laughter]

GRAYSON: Well, you know, there is this issue with mass spectrometry where a lot of people thought that the analytical capability was hampered by the fact that if you put in a single compound you got all these other fragmentation pieces and so there was this attitude that it was **<T: 70 min>** like throwing a bowling ball at a brick wall and you get all these pieces and there wasn't any rhyme or reason to it.

KEBARLE: [Yes], but actually, as for an analysis of a mixture if you will, the mass spec by itself is . . . it was the gas chromatography that changed the whole thing. It was hopeless really, a mixture of butene-1 and butene-2 and pentene, it's a mess. However, fortunately, gas chromatography came in, and now [the compounds] come out one by one and as the one peak comes out you've got the mass spec and you look at it. [. . .]

GRAYSON: But still people were upset about the fact that even in a pure compound you still had all these other peaks, and the production of all those fragment ions—

KEBARLE: [Yes], of course.

GRAYSON: —and their appearance.

KEBARLE: Well, if you hit it very hard it falls apart. You have to go down [in ionization potential]. Then you could see only the parent ion, because that requires the least damage.

GRAYSON: Right.

KEBARLE: And so if you hit it very gently, knock off one electron but don't excite it to break

up, again, that has to be electrons that are easily removed like, ah, if you have a double-bond and so that electron from the double-bond is [removed] more easily, so it doesn't fall apart.

GRAYSON: I mean, there's some interest in understanding of the fragmentation, the appearance of the ion.

KEBARLE: The fragmentation is pretty complicated, I think, to explain each time.

GRAYSON: Oh yes.

KEBARLE: [. . .] Actually, my thesis was with butene-1, so that's CH, a double bond and then CH_2 and then, the last is a methyl radical. And, actually, the weakest bond is between the CH_3 and [the CH_2], so you could predict what major ions would be released, or vice versa. If you know the major ion you could tell what a compound is.

GRAYSON: And so you say, you said, probably three years with Fred?

KEBARLE: I was with Fred two [and a half] years.

GRAYSON: Two years, okay.

KEBARLE: [Yes], but it was a wonderful time with the guy. He liked to joke all the time. We just, ah, just once he got mad as hell because we've had to make from time to time some compound and we had a new postdoc that had come and he was quite good at synthesis. [. . .] He was making a methyl cyanide in a fume hood. We were having coffee; always at a certain time of the day we get together and sit down. Now chemists often do stuff like this; well, we need sugar, but why go buy it? **<T: 75 min>** We'd go to the chemistry store and they had sucrose, so we get sucrose and so we had this sucrose, which is sugar but in a special [container]. And so now we're having coffee. We had always coffee once a day with Fred, and he jokes and so on. And now this guy that was working with the cyanide had left it beside the sugar [container], and Fred's taking [some sugar], but they looked very different. [laughter]

GRAYSON: Oh, [yes].

KEBARLE: It's powder. The sugar is sugar and he takes it and just went . . . he looks. Cyanide! And he walked out of the room and he just was as mad as hell. [laughter]

GRAYSON: I can imagine.

KEBARLE: Of course! But I mean it's also a dumb thing to leave it by sugar. That was really quite something, and that kid actually didn't last long. He lasted about—

GRAYSON: Oh, really?

KEBARLE: [Yes], a few weeks [. . .].

GRAYSON: Hmm. That could be very nasty. Not the kind of mistake that you want to have happen.

KEBARLE: No, but chemists do this kind of thing always. You can get it from the [chemical] stores.

GRAYSON: So you met this Harry Gunning fellow, he was the chairman here?

KEBARLE: Yes.

GRAYSON: And he at once offered you a job; probably, I'm sure that Fred recommended you.

KEBARLE: [Yes], I had done well with Fred.

GRAYSON: [Yes], so he figured out over a drink that you looked like you were okay, so come on with me, let's go to Alberta.

KEBARLE: [Yes], actually as I was saying that I went, he was still in the hotel in Ottawa and they said, "Oh, he's at the bar there," and I go to there, and I said, "Are you [Dr. Gunning]?" And he said, "Yes," and I sat down, "Paul Kebarle," "Oh, oh, have a drink here." We sat then

and he said, “Paul, I’m offering you the job.” We just spoke maybe ten minutes, he said, “Welcome.” I said, “Okay.” [laughter]

GRAYSON: I guess he wanted to make sure that you were not weird or anything like that. You were a good guy, so . . . and now this would have been in the early sixties, late—

KEBARLE: 1958, I think.

GRAYSON: —late fifties.

KEBARLE: Fifty-eight, maybe.

GRAYSON: Okay.

KEBARLE: Something like that. I’d have to look it up too.

GRAYSON: [Yes], if I think . . . did you send me a CV?

KEBARLE: [Yes]. Gunning was a real hot shot. I mean, this department had been asleep, and of course I think I mentioned before that they had just discovered those oil wells. The government didn’t know what to do with the money. Well, Gunning knew. And there were new buildings, and you could go and say, “I want to have a second mass spec, it’s going to cost me so much.” “Go ahead,” and so that was a good time.

GRAYSON: So what did you do with the mass spectrometer here, the first one you got from the NRC? You were starting out on your own now. You were on the faculty, you’re an independent researcher, you’re starting to get graduate students, but what—

KEBARLE: [Yes], well, I’m just looking here at the papers.

GRAYSON: —experiments? It seems to me a lot of work with mercury in the early 1960s. Mercury photosensitization. [. . .] There’s a whole series of **<T: 80 min>** publications in that one year where you’re looking at mercury photosensitized decomposition. It’s interesting.

KEBARLE: Well there was also work we started with—

GRAYSON: There's alpha particles.

KEBARLE: —alpha particles, [yes]. At that time also the first nuclear bombs had been developed, and [we used] fast electrons or alpha particles [to study ion-molecule] reactions in the gas phase but why we did that, [I don't know].

GRAYSON: The mercury work polymerization studies, solvation, hydration?

KEBARLE: [Yes].

GRAYSON: All very basic science. [. . .] Alpha radiolysis of methane.

KEBARLE: I think in many cases there was something like—let's say it's an acid. So you have to take H^+ away maybe you send a base and then that takes the H^+ and that happens in the gas phase. And then, of course, in solution the reaction, [. . .] in water would be quite different because there's a lot of water.

And so we went in the gas phase, add water molecules to it, and gradually the reaction that we observe begins to resemble that in water, so maybe we've added six water molecules or seven and already it behaves . . . it's become similar.

GRAYSON: You're studying a gas phase reaction and you add water vapor—

KEBARLE: Yes.

GRAYSON: —and eventually you add a sufficient amount of water vapor that the reaction proceeds as if it was in solution?

KEBARLE: Yes, begins to resemble.

GRAYSON: Oh, wow. That's pretty hard.

KEBARLE: It starts happening around maybe five, six, seven, they become similar. [. . .]

GRAYSON: Because that's still . . . that's a big problem today in the biological business where people are criticizing a lot of mass spec work, and protein analysis, and what not, saying proteins don't behave in the gas phase the same way as they do in liquid phase. And saying that it doesn't work that well.

KEBARLE: [Yes]. **<T: 85 min>**

GRAYSON: But you're saying eventually there is a point where you can do this work and . . .

KEBARLE: My last PhD student was John Klassen, who went into bio, and so he did these mass spec experiments, but he did go into bio. And then, we have here another [department member], not as young. David [R.] Bundle, he is in NMR and the two together do very well. Exactly how they do all this, I don't know now, but basically, ah, of course NMR is a very powerful technique . . .

GRAYSON: Definitely. [. . .] So John's working on the mass spec side.

KEBARLE: Yes.

GRAYSON: The other fellow is working on the NMR side?

KEBARLE: Yes. They've done very well together and in fact they got some award recently for something. That's my last PhD student but there was the GC, gas chromatography. GC-MS.

GRAYSON: That was really hot when it came in?

KEBARLE: Yes.

GRAYSON: My analysis shows that you were publishing papers, on average, I would say six to eight papers a year.

KEBARLE: [Yes], that was in the good times.

GRAYSON: From probably the mid- or early mid-sixties to around 2000, late nineties.

KEBARLE: [. . .] So let's see, Kebarle and Verkerk, "Electrospray from Ions in Solution to Ions in the Gas Phase, What We Know Now."[6] I would say by 2010 my work as a scientist disappears.

GRAYSON: That's only three years ago.

KEBARLE: [. . .] We switched to electrospray [in the 1980s].[7] It was very interesting.

GRAYSON: Well, didn't everyone?

KEBARLE: [Yes]. It's ideal.

GRAYSON: It was probably, I mean, most people are doing it for the biological applications, but you were doing it because it was good for your fundamental **<T: 90 min>** studies, right?

KEBARLE: [Yes]. Well it's an analytical method. It is because now you can see what's [going on with things in] solution. Well that's where really all the action is, in the solution. So with the electrospray you can, in a sense, analyze what's in the solution.

GRAYSON: There's a lot of work it seems on solvation and hydration.

KEBARLE: I mean, it's here, "Prediction of the charge states of folded proteins on

---

[6] Paul Kebarle and Udo Verkerk. "Electrospray from Ions in Solution to Ions in the Gas Phase, What we know now." *Mass. Spec. Rev.* **2009** *28* 898-917.

[7] Ikonomou, Michael G., Arthur T. Blades, and Paul Kebarle. "Investigations of the electrospray interface for liquid chromatography/mass spectrometry."*Analytical Chemistry* 62, no. 9 (1990): 957-967.

electrospray ionization."[8] Well, if you ask me what it is I can't tell you. But we had a paper there, 2004. [laughter]

GRAYSON: The charge states are important in proteins because that helps in the determination . . . getting the number of charge states is useful.

KEBARLE: [Yes], well here it's two hundred fifty. "Ion-Ion and Ion-Molecule Reactions at the Surface of Proteins Produced by Nanospray. Information on the number of Acidic Residues and Control of the Number of Ionized Acidic . . . ," basically it's just . . . I told you I understand this but . . . [laughter][9]

It's a long title. [Yes], well electrospray, I mean this guy got a Nobel Prize [John B. Fenn, Nobel Prize, Chemistry 2002], which is actually quite interesting. It's sort of by accident that he got involved with it. He died, ah, some five, ten years ago, something.

GRAYSON: Ah, I think it was just a couple, not too long ago. So you really had never . . . you just decided you were going to go for education and go into academia and you just went straight ahead, you didn't think about any other career choice?

KEBARLE: No.

GRAYSON: [. . .] I was wondering if there were any mentors or any teachers that you had in your college career or your high school career that influenced you in any way?

KEBARLE: You mean from high school?

GRAYSON: Well anybody that—

KEBARLE: I think I'd mentioned to you [clearing throat] until I was about seventeen I was totally uninterested and very lazy.

---

[8] M. Peschke, U. H. Verkerk, P. Kebarle. "Prediction of the charge states of folded proteins on electrospray ionization". *European J. Mass Spectrom.* **2004**, 993-1002.

[9] U. H. Verkerk, P. Kebarle. "Ion-Ion and Ion-Molecule Reactions at the Surface of Proteins Produced by Nanospray. Information on the number of Acidic Residues and Control of the Number of Ionized Acidic and Basic Residues". *Journal of the American Society for Mass Spectrometry* **2005**, *16*, 1325-1341.

GRAYSON: Oh, okay, you didn't tell me about the lazy part. [laughter]

KEBARLE: Mostly interested in girls and things like that. I began to change at a certain point, ah, and of course it just begins to show up and as I told you, when I was in Switzerland, suddenly I could work. Now that would kill me to work [so hard]. I would work say twelve or thirteen hours a day, fourteen hours a day every day, every day; Saturday, Sunday. <**T: 95 min**> To make it into . . . to pass the exam.

GRAYSON: So this exam that you needed to take, did you have any idea, was there any guidance as to what subjects you needed to be proficient in?

KEBARLE: [Yes], they even had one school that you had to pay to go to in Zurich and it was called Minerva and they specialized, among other things, in preparing people for the entrance exam that would let you get into chemical engineering. But they took two years. I didn't have the money at the time, so I said I'm going to do it in about four months and I worked. I mean I never worked like that [before or since] . . . until twelve o'clock every night, until twelve, starting in the morning from eight o'clock to about twelve, just eat a little bit of something and work like crazy and then I made it. I mean it was . . . I never worked that hard ever.

GRAYSON: You went from a real goof-off to a real hard worker?

KEBARLE: Yes, you change at a certain point. I think that it's not so unusual. Some people do it earlier.

GRAYSON: The Swiss education was, basically, your basic fundamental chemical engineering?

KEBARLE: It was good.

GRAYSON: And when you did your PhD work was that more like in chemistry or chemical engineering or did you even have a PhD in chemical engineering at Vancouver?

KEBARLE: No, it was chemistry.

GRAYSON: Chemistry?

KEBARLE: [Yes].

GRAYSON: So even though you had a degree in chemical engineering they accepted you as a graduate student for work in chemistry?

KEBARLE: [Yes], they considered that just to be the first four years at the University.

GRAYSON: So were there any students or I mean any teachers in their Swiss education that inspired you in any way or you were just self-motivated all the way?

KEBARLE: [Yes], but they were far removed [from the students]. They had at the ETH two who were, Nobel Prize winners.[10] One guy was a Nobel Prize winner in chemistry and he was a prof giving [lectures], but he was, as far as a lecturer [was concerned], the worst and also the most demanding. I remember I had something to hand in and it took me practically a week to get to him. He was a Nobel Prize winner. Now, he's not interested in the students at all. He's all about more research, more things, so actually some of those [teachers] were really [not interested in students] . . . it was very different.

But mostly they let you alone. They give you a little piece of paper and say, "Prepare this." That's it. "Prepare—synthesize—this, **<T: 100 min>** you have to go now and study the literature." But the worst thing that I had happen to me was the guy who said at very high pressure, you can make the thing react. And we have this autoclave and I had to add ammonia but it was liquid ammonia. "We want this in, say, three days." And now I had [liquid ammonia in a dewar]. That was a really dumb thing. There was this big autoclave, which is a steel thing and I thought, "Well I'll pour this and quickly close it." I pour it and this goes, phhhooo! And all this ammonia goes around and I almost passed out. [laughter]

GRAYSON: Oh [yes].

[10] Kebarle was referring to Leopold Ruzicka and Tadeus Reichstein who won Nobel Prizes for Chemistry in 1939 and Physiology or Medicine in 1950, respectively. For more information on Tadeus Reichstein see his oral history. Tadeus Reichstein, interview by Tonja A. Koeppel at Basel, Switzerland, 22 April 1985 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript # 0040).

KEBARLE: Actually, in chemistry you can sometimes do things, if you don't think ahead properly you can really mess things up.

GRAYSON: Oh [yes], definitely. So when you got to Vancouver you were, like, a graduate assistant, teaching or helping in the labs, that kind of stuff?

KEBARLE: Yes.

GRAYSON: That helped to pay for your expenses?

KEBARLE: Yes, yes, 100 percent.

GRAYSON: And also you had enough money for meals and a place to live?

KEBARLE: At that time, it was something like . . . the [Canadian] dollar was [worth more than it is today]. I think I had like one hundred bucks a month, eighty-something. [Yes], there I had another interesting thing. The wife of the chairman of the department was also working there and she was very [strong on discipline]. I was supervising a lab. You know, you have to watch that because these are kids. First year, I mean they're not really going to take chemistry but they have to take a chemistry course. She said, "Well you supervise them," and then she tells me, "You're not doing well at all, you're just letting them do whatever they want." [clapping hands] You have to tell them. Now that wasn't my nature, but now I'm trying it and you gave demerits and then I said, "You get two demerits if you spill this." And then suddenly I see all the kids and they say, "Boo!" And I thought, "My God, here, why am I doing that? This damn woman!" Tries to make me a tough bastard. [laughter]

GRAYSON: Now then eventually when you got to Alberta you had to teach things.

KEBARLE: Yes.

GRAYSON: So what was your teaching load like in there?

KEBARLE: [. . .] I had first -year chemistry, and the classes were very large, like one hundred and fifty to two hundred. For the vast majority of them it was just a requirement. They were not

going into chemistry and <**T: 105 min**> they felt they didn't need it and probably they didn't need it. Some needed it; like, we had never any problems with the pre-meds. The pre-meds, they knew they have to have high marks to make [it]. They worked hard, but there were others like Home-Ec. So I had a class of Home-Ec, mostly girls. And I'm teaching them all this complicated chemistry and first of all they forget it as soon as possible and they don't need it. I mean Home-Ec is you're making soup or cooking, so how the hell are you going to apply chemistry? I don't know. [. . .] Anyway, I went to the Home-Ec people one day, and I said, "What can I do that is in your area so that they would be interested?" I said you know they are totally uninterested. They took chemistry but you don't need it for cooking. And I said please, [can you find something]. They said, "We can't find anything." So they had to admit that in effect you shouldn't [have to take chemistry].

GRAYSON: They didn't need to take chemistry?

KEBARLE: But I had problems when there were lots of people in there, like two hundred people and at the back they are coming and going during the lecture. They come in, then twenty minutes later I see them, they're going out. And some [. . .] leave even from the first.

GRAYSON: Oh, wow!

KEBARLE: Not quite the first but so they're leaving and then I said, well . . . I mean I have to find out something to keep them and I then did manage. I started doing some experiments. I had . . . I forget what it was . . . Jello. [Yes], I forget exactly what it was, but I was to show them [why] gelatin [gets] so viscous and all this thing and then I would even . . . I had actually Jello that's already [set]. I'm showing, I'm pouring this, and pouring this and then I said and now then when it's chilled you see it's just Jello. And I go out to the first row and say, "Do you want some Jello?" And they are so scared even of Jello, you've showed the chemistry. It was really funny with the Jello. [laughter]

GRAYSON: Jello's okay except if the chemist makes it?

KEBARLE: That's it. I mean, they wouldn't touch it.

GRAYSON: So you had other classes as well, to teach besides—

KEBARLE: I liked the physical chemistry. There was a physical chemistry class and they needed it.

GRAYSON: And this was a smaller group?

KEBARLE: Much smaller.

GRAYSON: [Yes], they were.

KEBARLE: They were about twenty.

GRAYSON: Chemistry majors mostly or physical?

KEBARLE: I forget, to tell the truth, exactly. It wasn't just chemistry, no, but it's second year and they were also more mature. I enjoyed it. I mean I enjoyed the teaching. And we became friends and I'd say, you know, after the lecture I'll stay and if you have any questions please stay [. . .]. Then they would come and they'd talk and we'd talk also about other things.

So I would say second and <**T: 110 min**> third year if they needed chemistry it was very enjoyable [. . .]. Here they don't do much demonstrations. In Europe that was very much the case that they do demonstrations, sometimes even to excess [. . .] But this demonstration-making is amusing them if you want, in a way, but—

GRAYSON: [Yes].

KEBARLE: —it's chemistry. I like that.

GRAYSON: Did you feel the teaching load was not terribly onerous? How many hours did you have to—

KEBARLE: I didn't mind teaching. I hated it when I see I'm not succeeding, but the teaching part I enjoyed and also kids, also smaller classes. We had a certain point I was teaching advanced physical chemistry, which already had some quantum in it. If you want to explain it well you have to put in a lot of effort, but I have a class of only five. I finished the class, but they would stay there and they would talk about it and so on. So that was teaching a small group who needed it.

GRAYSON: You have to have funding.

KEBARLE: Sorry?

GRAYSON: You have to have funding, money. You have to have money for your research. [. . .] Initially it was probably pretty easy to get money, but was it always easy?

KEBARLE: We, as I said that's because of all this oil and they—

GRAYSON: Did you always go to the same funding? National Research Council is the primary research funding operation in Canada?

KEBARLE: I think I had, I was getting from them something.

GRAYSON: Did you get any through the University?

KEBARLE: [Not direct funding. The University supplied the funds for the purchase of some major equipment, like my mass spectrometer. The chemistry department had an excellent machine shop, electronics shop, and glassblowing shop. They made whatever equipment we needed for our research, and we did not have to pay for anything out of our own funds. Also, we could get chemicals and other supplies we needed from the chemistry "stores" without having to pay for them.]

GRAYSON: This was primarily to support graduate student stipends and maybe some specific equipment?

KEBARLE: [The NRC funds supported the postdoc stipends. Also the conference travel.] We weren't using funds for the mass spec . . . once you have it, it didn't cost [you]. We weren't needing a lot of, you know, large amounts. You need just a teensy bit of this and that, so it was the instruments that you had to have [significant funds for].

GRAYSON: Those were primarily funded by NRC?

KEBARLE: Sometimes we got them [in other ways]. We had the triple quad and the company **<T: 115 min>** sent us one. It had been a prototype and they [. . .] made some changes on this prototype. They thought also that it would be some kind of, if you want, propaganda if we have a triple quad and we start publishing. The triple quad [was from] a company [AB Sciex] in Toronto [Canada] and one of my PhD students got a job there, and he gradually worked himself up to be a top dog on the technical thing. [. . .] That triple quad, I think we got it for nothing. They had it and they didn't know what [to do with it]. They had more advanced models and they couldn't sell this old thing. So we had that triple quad and used it.

GRAYSON: Do you remember the name of this graduate student who was, ah, so successful that he had it?

KEBARLE: [Yes].

GRAYSON: And was the name of that company . . . was that Sciex or . . . ?

KEBARLE: Sciex, [yes].

GRAYSON: Sciex.

KEBARLE: Bill Davidson, I think it was, Bill Davidson.

GRAYSON: Well, see, that's the problem today, in the purchase or in the running a research group, getting grant money is much more difficult, at least in America, than it was in your time and even earlier in America, and I don't know how hard it is to get grant money today in Canada for research, but it's very tough, too much competition for too little money in the States.

KEBARLE: Well, of course, you see the graduate students of course they pay some kind of tuition. I mean it wasn't free. To what extent did this tuition pay for all the expenses is a question. Probably it was a small fraction . . . in the sense that tuition . . . I think that here probably there was considerable government support and the oil money helped and things like this. I think that the University . . . I don't know what it is now. I haven't got the foggiest idea. It'd be tough to ask the chair where the money comes from. I think that still probably there is considerable support from the government.

GRAYSON: That's good.

KEBARLE: That's different from the States, I imagine.

GRAYSON: [Yes], well there is money available but it's very hard to get in the States. It's very tough competition in the grant game. Now have you been the recipient . . . have you bothered to patent anything for your research?

KEBARLE: No, I haven't. To tell the truth I forgot. If we have taken a patent it would be only one. I don't really remember. That was not at all a priority here. [. . .] That could have changed now with the younger people.

GRAYSON: Now your interactions . . . you've obviously traveled quite a bit, probably going to conferences and so on around the world. Have you had a lot of good interactions with your peers in different **<T: 120 min>** countries and different institutions?

KEBARLE: Well, there were conferences and not direct interaction that we mutually cooperate. But of course we met. You go and give a talk and there's all these people listening, so in a sense it was always science and not money. We would talk what is happening and—mostly it was with the United States. I would go to conferences, it would be the US, or invited lectures and so on in the US.

GRAYSON: Do you recall the first ASMS [American Society for Mass Spectrometry] meeting that you went to?

KEBARLE: [Yes].

GRAYSON: Probably . . . I mean, you were doing mass spec from the beginning, so I wouldn't be too surprised if you went to one of their early conferences.

KEBARLE: [Yes].

GRAYSON: Or ASTM E-14 [American Society for Testing and Materials Committee E-14]?

KEBARLE: ASMS, I guess it was, American Society for . . . ASMS. I went regularly to those, [yes], regularly.[11] It was a friendship there. Of course from Canada there would be, maybe, five and from the States there would be maybe fifty. Something I guess like that. Quite [a lot of] friendships developed. I had the name. [. . .] The name that popped in my mind . . . Jack Beauchamp.

GRAYSON: Oh. Okay.

KEBARLE: I became close friends with Jack. Jack was a really fine person.

GRAYSON: It seems like a lot of the work that you were doing would have been interesting to people like Field—Frank [H.] Field.

KEBARLE: Yes, yes. I was good friends with Frank Field. [. . .] In a sense we were in competition with Frank Field.

GRAYSON: [Yes], that's what I would think. But he's . . .

KEBARLE: See, I don't know whether he's still alive. [Frank Field died in 2013] He retired at sixty-five. I stayed on and for me, it wasn't any burden. I enjoyed doing it, so I stayed maybe to the seventies, I don't know but Frank Field had decided he'd retire and I don't know what happened to him. He actually was interested in music and I forget whether it was a cello or some [other instrument]. We had the guy Fred Lossing with whom I was in Ottawa at the National Research Council. He had some other instrument. I forget, so they actually in the early days they'd meet and have a quartet and one was Frank Field. I liked that. We were good friends with Frank Field. Ah, at times he was a bit explosive. On the whole—

GRAYSON: Well he had this loud, booming voice. If Frank said something, you could hear it two rooms down the hall.

KEBARLE: Yes, he was from New York [New York].

[11] Kebarle first attended an ASMS meeting in 1957 in New York City.

GRAYSON: Yes.

KEBARLE: [Yes], he was from New York. At some point I was on the board of the American [Society for Mass Spectrometry] and I could listen to what's going on. Maybe three years before I was on the board **<T: 125 min>** and Frank Field, who was in New York, he said, "I can't understand; we've been here, and here, and here, and here, and here, and here, but we have never been in New York and I would insist that [we do have a meeting there]." But I think people didn't like to go to New York. I don't know why actually. It's not such a bad place. [laughter]

GRAYSON: No. I think a lot of people perceived it as being expensive.

KEBARLE: [Yes]. A bit dangerous.

GRAYSON: [Yes], probably it was more dangerous then than now perhaps. I don't know. It just seemed like the mass spec people [. . .] were just as happy being in a quiet small town as in a big town.

KEBARLE: I think we had one—

GRAYSON: [Yes], we did have one in New York. I remember going to that conference in New York. Frank worked with Joe [L.] Franklin and . . . Did you know Joe Franklin?

KEBARLE: Oh [yes]. I know Joe Franklin. He died quite early.

GRAYSON: [Yes], he did.

KEBARLE: I forget, a heart attack or something. I mean, Frank Field lasted many, many years after, but initially they were together. We also had a lot of [meetings in Europe] and so on. Just mostly to have fun, you know, to be at a different place.

GRAYSON: [Yes], I think Frank maybe died earlier this year or late last year, Frank Field.

KEBARLE: Oh see, I didn't know. It's gotten so now I'm totally out of the thing. We got along well although he initially . . . there was some competition. We had said it goes this way and Frank Field, it's going that way. And I was damn sure that he's wrong.

GRAYSON: Hah!

KEBARLE: And then we organized to have a meeting, but now I forgot exactly what happened in the meeting, but he finally gave in. He was very stubborn. But he finally gave in on this thing. We were good friends. He was very kind of talkative.

GRAYSON: When you had a conversation with Frank you wanted to be on very firm ground discussing science because he was very knowledgeable. [laughter]

KEBARLE: [Yes].

GRAYSON: He didn't suffer fools lightly, one of those persons.

KEBARLE: [Yes], I don't know [. . .] how he switched into mass spectrometry.

GRAYSON: I think it was pretty much similar to you actually. He went to the University of Texas at Austin and, more or less given a crateful or a boxful of parts and, "This is a mass spectrometer."

KEBARLE: [Yes].

GRAYSON: You know, "It's yours if you want to do it," and that's how he got started, [laughter] which was not unlike your situation, where you see this instrument that at least it's semi-assembled, but it's still . . . I guess it basically just had so many leaks in it that if you could ever get it to work. But once you had the leaks fixed.

KEBARLE: [Yes].

GRAYSON: It's amazing. I guess, in shipping from Ottawa to Vancouver, the instrument must have developed some leaks or some breakage or what not along the way.

KEBARLE: Well also the person that had put it together had had . . . we found out had some problems at home.

GRAYSON: Ah.

KEBARLE: And he was to finish the whole thing and check it but he didn't do that. So for instance the biggest leak wasn't a leak, but it was where you collect the ions. There would be an electric current since ions are coming in, this is in the vacuum and **<T: 130 min>** so there is a little wire and it will go to the outside, and so you measure the current that hits there. So this was a little thing which is attached to a stainless steel plate and there is the little thing where the wire has gone through and they had forgotten to solder this thing. So it was a wire going to a little tube but it leaks like hell, of course.

GRAYSON: [Yes].

KEBARLE: At that time they used solder because you didn't heat that pipe and we looked for a leak and it didn't occur to us to look there. [. . .] And then finally we said there they did not solder the damn thing.

GRAYSON: Right. So you were using a helium leak detector?

KEBARLE: [Yes].

GRAYSON: **[**To tie it up?] But there was all that glassware being shipped from Ottawa to Vancouver?

KEBARLE: Yes, but in essence it was a really good training.

GRAYSON: Oh, [yes]. [laughter]

KEBARLE: As I maybe mentioned before I had just gotten started studying about the electronics.

GRAYSON: Well you sort of became an electrical engineer anyway. Well, I think for most people with instruments in those days you had to have a set of skills in electronics in order to keep it running because otherwise you know you were not going to get very much work done, but you had to be able to repair, take care of your own problems.

KEBARLE: [Yes], and so that was the case, especially with this thing which was sort of homemade at NRC. The guy . . . where we had all these problems is that the guy who had been putting it together and had to do all these things had marital problems.

GRAYSON: He wasn't concentrating on his work.

KEBARLE: He was overcome by these marital problems, and he didn't do the work properly. So there you are. [laughter]

GRAYSON: Did you have schematics for—you know, electrical schematics—for the instruments, so you knew how it was supposed to be?

KEBARLE: Well, we would get the circuit things.

GRAYSON: A circuit diagram?

KEBARLE: The circuit diagram . . . [yes], we had the circuit diagrams, but you had to know all these things. I mean, you weren't doing mass spectrometry. It was kind of electronics, and [laughter] mechanics, but that made it more interesting. [. . .]

[END OF AUDIO, FILE 1.1]

GRAYSON: At the University did you start . . . I guess, you retired from official capacity . . . when? About 2006?

KEBARLE: [Yes], well, I said I don't really remember. Ah, Karl [Kopecky] and I, we both retired at the same time.[12]

GRAYSON: But the University provides you with an office?

KEBARLE: Yes, but that's all. Well, of course it's kind of them. I imagine that if a great scarcity, say, developed that they would push us even closer together. I mean, my office [. . .] was twice as big as this. Now it's half as big.

GRAYSON: Now, do you come in to the office every day or just every now and then?

KEBARLE: It depends, but I am here much more often than at home [on weekdays]. At home [. . .] we could go either near there, or for a long way along the river valley. It's very pretty. Or we drive out somewhere and go for a walk. So in this sense when I come, it would be around 10:00 a.m. I don't come at 7:30 a.m. But I would be about 10:00 a.m. I'll come and I'll leave at about 2:00 p.m., so I don't spend really that much time here.

GRAYSON: I just want to get this for the record. You rode your bike from home to here this morning?

KEBARLE: [Yes].

GRAYSON: You bike back and forth. You say it's about fifteen minutes' bike ride?

KEBARLE: [Yes], or a bit more. With the biking, it's actually pleasant. It's fun to ride it. Just that now they started doing a lot of street repairs and that can be a nuisance because there are all these [obstacles]. . . You have to dismount because a big truck has to go this way, but otherwise I really enjoy it. In fact, sometimes Beverly and I will go on a . . . we have sort of two things, either on foot or on bikes, and we have a very nice route with bikes where we cross the one bridge and go to the other side and then there's special—there's quite a lot of stuff here especially for bikes. Then you also feel much safer because there's no cars, nothing. It's just

[12] Kebarle retired and became emeritus in 1991, Kopecky in 1996. Kebarle continued receiving NSERC (formerly NRC) grant money with enough to support two postdoctoral fellows and did active research until the mid-2000s when he did not apply for a renewal. He continued writing and reviewing articles until about 2009.

bikes and pedestrians. You have to watch that you don't bump into a pedestrian. It's actually, in this sense, the bike is very useful. In the winter, no biking. [laughter]

GRAYSON: No, right.

KEBARLE: I fell off a bike once, and if you fall on cement it's rather unpleasant. It took me a while to not limp anymore. [laughter]

GRAYSON: Hmm, and so ah, just for the record as well you were **<T: 05 min>** born in 1926. You're probably . . . eighty-six?

KEBARLE: Eighty-six.

GRAYSON: Eighty-six going on eighty-seven? And you and your wife are still biking around town?

KEBARLE: She's three years younger.

GRAYSON: Okay. Well that's good. Then you say in the winter you actually do—

KEBARLE: Cross country [skiing].

GRAYSON: Cross country.

KEBARLE: [. . .] We used to do a lot of that. In fact in the photos that I had given you, that consists of . . . there's a [lodge] somewhere in the mountains. You pay for the [lodge], you get a small bedroom and the food is included. It's pretty good food and then every day at about 9:30, 10:00 a.m., we have a guide. Because there is a danger of two things; avalanches and—what was the other one—cornices.

GRAYSON: What was that last one?

KEBARLE: Cornice.

GRAYSON: Cornice?

KEBARLE: What a cornice is . . . at the ridge of the mountain and there is a prevailing wind [. . .] and as it blows it carries a bit of snow particles and then they form a cornice.

GRAYSON: Like a lip or a mouth?

KEBARLE: It's actually just like this and it's very weak if you go on it. But if you are going here, you have no idea that this is there.

GRAYSON: Well [yes].

KEBARLE: So a guide is very useful in this aspect. He knows this is a cornice. He knows this can be an avalanche here. We always had a guide, but once Beverly made a mistake. We had fallen behind. [. . .] She walked [off the main path] and we heard a noise but we couldn't make out what it was. [Then on our route back down, we discovered that a huge block of snow had fallen off of the cornice and landed on the slope below. Another group had been going down that lower slope before us, and it was lucky that they were not in the way when the snow block fell.]

GRAYSON: Oh [yes].

KEBARLE: In a sense it was very nice to go in the mountains but you had to . . . it wasn't like on a ski hill where there's [a ski lift and lots of people around].

GRAYSON: [Yes], well that's definitely an important thing to have somebody who knows the lay of the land or the way of the snow, so to speak.

KEBARLE: Yes, similar in the [summer]. We have grizzly bears here.

GRAYSON: Oh really?

KEBARLE: So that's one sometimes *unpleasant* encounter that you walk and then you see a grizzly. Again we had a guide, it was a woman, and we saw that grizzly just sitting there. She said, "Don't worry, this grizzly, they're just friendly." And indeed in this case we went by the grizzly just sitting but **<T: 10 min>** two years later we hear that this same guide had been going down the mountain. She was with another young woman. Somehow, they had not noticed but there was a grizzly. You know, they get scared and the bear gets upset, and so he now goes towards them in a challenging way. But they were near a tree [. . .] and they climbed on that tree and the bear sat there. They [spent almost the whole night up there].

GRAYSON: [laughter]

KEBARLE: And she was a guide. So we meet her and we knew of the episode and [we asked], "When are you going back there as a guide?" And she said, "Never." [laughter]

GRAYSON: You don't want to spend any more nights up in the tree?

KEBARLE: [Yes].

GRAYSON: You were teaching classes up until the time that you retired?

KEBARLE: Yes.

GRAYSON: Some [places] want you to retire at a specific age and others don't care. I guess the policy here about retirement, it's pretty liberal?

KEBARLE: [. . .] Now, I think they're letting people stay longer. But they had [a different policy], when I was essentially kicked out. Certainly, [I received] no salary but the pensions were good. I guess I stayed quite a long time. I have a [good] pension. On the financial [side] there was no problem. So I was kind of neutral. I have more time. I've given so many lectures, so why not stop.

GRAYSON: The other thing I wanted to revisit was something we discussed at lunch, and that is that when you left Bulgaria then you really left your family behind—

KEBARLE: [Yes].

GRAYSON:—and never really went back or either saw your mother or father or any of your other family after that?

KEBARLE: [No. My brother and then my sister got out of Bulgaria some time later than I did. And several years after that, my parents also managed to get out. By that time my parents] were both quite old, so they could not be an enemy of the state because they could barely walk, and probably if they're sick they have to go to a hospital. Then the [government] let them go. They [went to Switzerland, where my brother was living.] By that time I was already living in Canada for quite a while.

My brother, who is five years older than I am, and also a chemist, [. . .] was interested in pharmaceuticals, and he took his PhD in Zurich [Switzerland] with a famous guy. Paul Karrer . . . y were studying [curare]. There were [natives in the Amazon] and they had bows and arrows still. And they used a kind of a material that **<T: 15 min>** the tip of the arrow, they dip into this and it would paralyze [the animals]. Then it was a question that may be a nice way to anesthetize people. So they were doing research and his supervisor was another Swiss who had a Nobel Prize [Chemistry, 1937]. His name was Paul Karrer. [. . .] My brother's name is Heinrich. He had to be very careful not to prick his finger when he worked with this thing or else he [could get] paralyzed. [laughter]

GRAYSON: How do you spell his name? Your brother?

KEBARLE: Heinrich . . . Henry.

GRAYSON: Henry?

KEBARLE: In German, it's Heinrich. H-E-I-N-R-I-C-H.

GRAYSON: Oh, okay.

KEBARLE: It's Henry in English.

GRAYSON: Sure, and he ended up, ah, with a PhD in chemistry also?

KEBARLE: Yes, so when he got his PhD . . . Switzerland is very strong on pharmaceuticals. [. . .] He went to work for [a company called Ciba, later called Ciba-Geigy] and was very successful. Promoted, etc. But then they have compulsory retirement. But he had a fat pension. He's still alive in good health.

GRAYSON: And is he still in Europe then?

KEBARLE: Sorry?

GRAYSON: Your brother is still in—

KEBARLE: In Basel, Switzerland.

GRAYSON: —Basel?

KEBARLE: [Yes].

GRAYSON: And so you say your parents could leave . . .

KEBARLE: They left Bulgaria and my father knew German, so they stayed in Basel. [They had a small] apartment near to where my brother lived, and then my father died of a stroke, and my mother died later.

GRAYSON: But basically, once you left Bulgaria then you never really saw them again?

KEBARLE: [No. I did see them a few times in Switzerland, and they even came to Canada to visit us.]

GRAYSON: One of the papers that was pointed out to me was this work . . . apparently you were having, I don't know if it was a competition or discussion with someone. About whether you could ionize something with alpha particles versus electrons and some of those early papers, ah, let me see if I can get the title of the paper. These were early papers that—

KEBARLE: Well I think that, when I started work at high pressures you had to have a way to ionize the molecules that you want to do mass spec with because they have to have a charge. To ionize them you either put a proton on them or you pull an H^- **<T: 20 min>** away. So it must be something like this.

GRAYSON: Well the "Study of Ions from the Alpha Particle Irradiation of Gases at High Pressures" is the paper.[13]

KEBARLE: Yes.

GRAYSON: I guess, there was a discussion or a question as to whether or not you could do that by using alpha particles or radiation?

KEBARLE: [. . .] When the Americans started developing a nuclear bomb and there became the question of what to do if somebody was exposed to high radioactivity or something like this.

I think a certain amount of research was done on the interactions between alpha particles and . . . something, I've forgotten now. [. . .] So alpha particles just ionize. They're highly accelerated and fly. If they fly fast they'll ionize either atoms or molecules, so you could use it as a sort of ionization rather than say using fast electrons as you do with a mass spec. So ionize with alpha particles.

GRAYSON: And so, that worked by removing an electron or by an attachment?

KEBARLE: Sorry?

GRAYSON: Would that work by a collision that removed an electron or by attachment [of the alpha particle]?

KEBARLE: [Alpha particles are] a convenient form rather than a filament. [. . .] It can work at

[13] P. Kebarle, A.M. Hogg, "Study of Ions from the Alpha Particle Irradiation of Gases at High Pressures", *Advances of Mass Spectrometry Vol. IV*, p. 233 (1964).

high pressures, which a filament can't do because it will burn. If there was oxygen it will burn out or . . .

GRAYSON: Ah, yes.

KEBARLE: We did some work with the alpha particles. We got them from . . . this is again a period of first nuclear bombs. They had a company supplying the Americans, and we could order a little source with the alpha particles and they sent it to us. One advantage was that they interact so strongly that they can't come out, so if they're in a closed box you are not much exposed to any radiation.

GRAYSON: After they do the ionization they end up running into the sides of the chamber; they can't get through [the sides of the chamber,] generally.

KEBARLE: Well, they sent it to us. **<T: 25 min>** I don't know how it came. It interacts so strongly. Say it's a plus, two plus and heavy and it doesn't radiate [very far]. I think it was something like this. But we were always careful too.

GRAYSON: You were aware of the hazards?

KEBARLE: Yes.

GRAYSON: And so, it seems like there's a lot of work in ionization cross sections, charge transfer, fragmentation.

KEBARLE: [Yes].

GRAYSON: Photo sensitization. Mercury . . . you used a mercury lamp to photosynthesize compounds? Xenon-sensitized ionization of ethylene.[14] So you would essentially deposit energy into the molecule with photo energy—photons—into the molecule to change the ionization potential?

[14] Kebarle, P., and R.M. Haynes. "Ion—Molecule Reactions in the Xenon-Sensitized Ionization of Ethylene." *The Journal of Chemical Physics* 47, no. 5 (1967): 1676-1683.

KEBARLE: Well photo ionization is using light, so you won't get photo ionization shining the light on this linoleum, but if you have certain materials [and] you are in the ultraviolet where it has more power. [A vessel containing a gaseous hydrocarbon together with some mercury vapor was irradiated with ultraviolet light, which resulted in electronically excited mercury atoms. Collision of these excited atoms with the hydrocarbons resulted in their decomposition, and the decomposition products were analyzed by mass spectrometry.] We did work with these things, [but] you have to [take] great care to keep it in the metal box. But at the end we switched back to [using a] filament, like in a mass spectrometer, and to protect it from burning out we had very, very, very large diffusion pumps.

GRAYSON: Let's see, basically on the work side you are currently pretty much retired. You're not doing any science at this point in your life?

KEBARLE: [Yes].

GRAYSON: Which I guess is okay?

KEBARLE: What I would say is that at eighty-six, your intellectual powers are greatly reduced. And you forget a lot of the stuff that you knew. You just forget at that age. [laughter]

GRAYSON: So do you have any sense of the impact of your research on mass spectrometry . . . whether it made much of an impact?

KEBARLE: I would say it made an impact at the time, but [I don't know about] its impact today. There is also a certain amount **<T: 30 min>** of [research [that is done]. It's interesting, but it's not really necessary for humanity, but in terms of science, providing more of a background to science, there some of the stuff would go into textbooks. In this sense a contribution was made, and somebody else may pick them up and make an additional [contribution]. Maybe he gets additional recognition, but he was inspired by the previous work to do something. So while initially a lot of people knew of you, [you gradually] fade away even though you might have provided a basis for certain things.

GRAYSON: Well, I don't know about fading away. You have some very highly-cited papers.

KEBARLE: Yes. I think the last one.

GRAYSON: Many, many highly-cited papers.

KEBARLE: I think the last one was the most quoted. Let me see.

GRAYSON: That one, of course. I think anything on electrospray back in the beginning was really . . . .[15]

KEBARLE: Yes. [. . .] I don't know whether you have a list like this.

GRAYSON: I do have that list.

KEBARLE: This is 253, Paul Kebarle and Udo Verkerk. That was my postdoc. A very bright guy. "Electrospray from ions in solution to ions in the gas phase, what we know now." [. . .] So that was a review but it's been very . . . the most quoted of all my papers.

GRAYSON: That was in when?

KEBARLE: The paper is 2009.

GRAYSON: 2009.

KEBARLE: [Yes], *Mass Spec Reviews* [*Mass Spectrometry Reviews*].

GRAYSON: Got it.

KEBARLE: Now I could give you the . . .

GRAYSON: [Yes].

---

[15] Kebarle, Paul, and Liang Tang. "From ions in solution to ions in the gas phase-the mechanism of electrospray mass spectrometry." *Analytical Chemistry* **65**, (1993): 972A-986A.

KEBARLE: Udo Verkerk and Kebarle.

GRAYSON: And *MS Reviews*, okay. Well you've got work going back to 1980—1990—that was cited over one hundred times.

KEBARLE: Which one is it?

GRAYSON: I'm looking at a 1990 paper and it was published in *JACS* [*Journal of the American Chemical Society*]: "Production and Study in the Gas Phase of Multiply Charged Solvated or Coordinated Metal Ions."[16]

KEBARLE: Just a second. 1990?

GRAYSON: 1993. I don't have **<T: 35 min>** them, unfortunately, by the number reference you have there, but it would have been a 1993 paper on—

KEBARLE: [Yes], 1993, oh.

GRAYSON: —metal ions, production in *JACS*. "Production and Study in the Gas Phase of Multiply Charged Solvated or Coordinated Metal Ions," 1990. [. . .] That was apparently a pretty popular paper.

KEBARLE: Yes.

GRAYSON: It says in the abstract this work is a breakthrough in the area of alkali earth and transition metal M^{++} gas phase ion chemistry.

KEBARLE: Yes, well I agree with that.

---

[16] P. Jayaweera, A.T. Blades, M.G. Ikonomou, P. Kebarle. "Production and Study in the Gas Phase of Multiply Charged Solvated or Coordinated Metal Ions", *J. Am. Chem. Soc.* **112**, 2452-2454 (1990).

GRAYSON: Why was this so important?

KEBARLE: I don't know. [laughter]

GRAYSON: The gas phase ions . . .

KEBARLE: I would have to re-read that thing. I mean, it's been '90 [to] 2013 . . . .

GRAYSON: It's been twenty-three years.

KEBARLE: Twenty-three years. It's a little bit asking too much! [laughter]

GRAYSON: But there's a lot of your early work that has well over one hundred cites.

KEBARLE: What happens is . . . at a given time say some kind of breakthrough occurs in an area and then a lot is published. It's like a group [of researchers] and they're together doing this thing, and it will last maybe for fifteen years or ten/fifteen. And then it peters out because okay, now we know that, we move on. So at some point it moves on and then it's seldom cited, but some continue for a very long time.

GRAYSON: [Yes], well, that's one of the interesting aspects of the digitization of data. You can find now with SciFinder, how many times a paper has been cited in literature. And then you can also find in a listing of all the papers that cite that one paper. You can find out when it was cited last.

KEBARLE: [Yes].

GRAYSON: Who cited it, what they were studying at the time, and so on. So it's an interesting way of trying to reconstruct how events occurred because you can see the impact that one paper has **<T: 40 min>** and . . .

KEBARLE: [Yes], but in a sense science is like this, it goes on and on, and on, and at a certain

point your old stuff forms like a basis. Okay, you know, this is on a sound base, but people go on.

GRAYSON: Oh [yes].

KEBARLE: And also there's a change. It's a change of interests, like now the change is into bio, I mean that's very typical.

GRAYSON: Oh [yes].

KEBARLE: So people that did that kind of stuff now would not be paid . . . there's nobody that's interested in that stuff or very little, I'd say. A few very intelligent. [laughter]

GRAYSON: Okay. Well, I don't know if you have any other thoughts or comments or questions that we want to pursue about your career. I've listed some names here that were primarily selected on the basis of the people that you published the most number of papers with.

KEBARLE: [Yes], I guess; now do I have that with me? [. . .] I think you gave me that.

GRAYSON: I don't know if you want to comment about your [work with them]. I assume they're mostly graduate students and postdocs that had worked with you.

KEBARLE: Blades, Arthur [T. Blades] is actually the same age as I am.

GRAYSON: Oh, really?

KEBARLE: [Yes], he is a good friend I knew for some time. He was working for a provincial research laboratory. [He was] doing very basic research, but they wanted him to change to applied,] and so he quit and came to work with me, and I'd say he stayed about ten years or so. [. . .] [Jan] Sunner, he's a Swede, so that's Sunner. He's a Swede, very bright, ah, his father was a famous . . . I forget exactly. It was more into medical things. [. . .]

GRAYSON: It looks like you did some work on FAB [fast atom bombardment] towards the end of your collaboration there.

KEBARLE: [Yes].

GRAYSON: Studies of the basic modeling of fast atom bombardment.

KEBARLE: Now do you want the others? I mean . . .

GRAYSON: [Yes], let's go through a couple of others.

KEBARLE: Very quickly, so there is Hiraoka, Kenzo [Hiraoka]. We're still very good friends. He became professor in Japan and travels a great deal. He's very successful, and his wife is very sweet, very nice people. We're still very good friends, and he was here maybe four years ago, gave a talk.

GRAYSON: Oh, really?

KEBARLE: [. . .] There's Terry [B.] McMahon, he's very well-known. [. . .] He made a career. He's in the East. So McMahon was very, very bright and very hard-working. Caldwell. I think Gary [W.] Caldwell is the guy in one of the photos [I gave you]. He is the guy with his fist at the . . . mass spec. I mean he's acting because these, you know, the circuits—

GRAYSON: Yes.

KEBARLE: —often gave out or something. We'd spend a whole day trying to find what's wrong, and so Gary would say, "There she goes again."

Eric [P.] Grimsrud, he's an American, so is Caldwell [. . .]. Eric Grimsrud is still a very good friend. He lives in the [United] States and he was professor and now he's retired. John [S.] Klassen was my last PhD [student] and he is extremely successful. He was hired here, and he's in that new building that we [passed] through now.

GRAYSON: He's working here now.

KEBARLE: He has there a number of mass spectrometers. He's done very well, and it's all

bio. So that's John Klassen. He did both his PhD and a postdoc with me. And Udo Verkerk. [. . .]

GRAYSON: He's relatively recent. You published something with him in 2010. <**T: 50 min**>

KEBARLE: Udo Verkerk.

GRAYSON: On the mechanical . . . on the mechanism of electrospray ionization, ES-IMS [electrospray-ion mobility spectrometry].

KEBARLE: [Yes,] Udo Verkerk, brilliant guy, really brilliant guy. We're still friends. Unfortunately, he did not manage to land an academic position. He's in Toronto [Canada], brilliant guy. It's sad sometimes, somebody really, absolutely, outstanding. [. . .] He has a job now but much less than what he deserves.

GRAYSON: Those are unfortunate things, but they do happen. Well, I think that covers most of the things that I had there. I mean you've told me quite a bit about your career, and we've got a pretty good list of your publications. You have these papers selected and benchmark papers in physical chemistry at the very end of your bibliography.

KEBARLE: [Yes].

GRAYSON: These are papers that other people chose for inclusion in this list of benchmark papers. "The Solvation of the Hydrogen Ion by Water molecules in the Gas Phase."[17]

KEBARLE: Well you know these papers don't need to be so very special but the journal gave itself the name, *Benchmark Papers in Physical Chemistr*y. [. . .] There are five [whole] papers there. I guess they were selected by somebody as the best.

GRAYSON: They look like they were pretty much <**T: 55 min**> thermodynamics-related.

[17] P. Kebarle, S.K. Searles, A. Zolla, J. Scarborough, M. Arshadi, "The Solvation of the Hydrogen Ion by Water molecules in the Gas Phase. Heats and Entropies of Solvation of Individual Reactions: H+(H2O)(n)-1 + H2O = H+(H2O)(n)", *J. Am. Chem. Soc.* **89**, 6393-6399 (1967).

Okay, well, I think unless you have any other things that you want to say, at this point you can wrap it up if you [want].

KEBARLE: Well that's fine. I think we did cover a good amount of territory.

[END OF AUDIO, FILE 1.2]

GRAYSON: We're just going to talk [while video recording] in a more philosophical tone about your whole experience on becoming a scientist. I mean, why did you decide to become a scientist? Do you have any understanding as to what it was that drove you to that type of a career?

KEBARLE: I never thought I would become a scientist, never even crossed my mind, but it gradually happened. I saw that I enjoy science, that there's so many things that are interesting, and rather than reading about them in the newspaper I wanted to do it myself. And the more I did it the more I liked it. There is a certain joy when you succeed in discovering something. There is a very special thing.

GRAYSON: So it's like the first time that anyone has ever seen this particular phenomenon and that's a special feeling?

KEBARLE: Yes, there is a special feeling. In fact, the feeling is not that you suddenly will impress others, but you felt good that you discovered something that is interesting that nobody had known about before. So that I found very exhilarating and also that I liked to work. I never disliked work because it was so interesting, and even if something broke and we had to fix it I kind of wouldn't get upset about it knowing we're going to get it done.

GRAYSON: What advice would you give to a young person who is thinking about becoming a scientist?

KEBARLE: The advice that I would give them is to try. Some may think that they would do very well, but they might not do so well, so just see how it will go. For instance, I had thought I'd never be a scientist and it went in such a way that it was the opposite, that actually I managed to not only be a scientist, but enjoy it.

GRAYSON: During your career there has been a change I think in the number of women in science, and I'm just wondering if you have any thought or comments about women being scientists?

KEBARLE: Well, this is a very delicate question. And is one to be sincere or is one to be a diplomat? You know, a diplomat, [would] say and of course one always has Madam [Marie] Curie, say, as a very famous scientist. I personally think that men are much better in science. I mean this might sound like an insult, but to me it's a fact. It's an overwhelming fact. **<T: 05 min>** That doesn't mean that I look down on women, quite the opposite. But just that particular area is not well-suited to them.

GRAYSON: [Yes]. You've gotten to your point in your career by being mentored by different individuals with time. Is there any one person who advised or helped or mentored you that is, ah, did a particularly good job, and why was that mentoring so useful to you?

KEBARLE: I wouldn't say that it came from outside, that somebody encouraged me. I just . . . it just grew by itself. In fact, initially, I thought I might not be good at it but it turned out that I did well. I surprised myself that I can do that.

GRAYSON: In the process of your career as an academic you've mentored a large number of different individuals in their scientific careers. What is the guiding principle that you use when you're advising young people who are in your lab as to how to proceed in their careers?

KEBARLE: I always treated the young men that came to work with me as equals and as friends. I tried to enjoy being together, and I would say that better [than] 80 percent, we got very well along. We did not specifically discuss whether they would be good scientists or not, but we were friends and we were attacking the same problem. There was a certain camaraderie there. We were together trying to figure out what the hell is going on.

GRAYSON: Science, like most other areas, has a certain amount of competition in it between individuals and groups working on problems, one branch trying to get ahead of the other or get more information faster. Do you think that competition between people and groups is a good thing for science?

KEBARLE: In my career I don't remember such a competition. In a sense I had my area. I think . . . yes, there was, there was a competition now that I . . . it was a different instrument. I mean that's the Fourier transfer. Fortunately, the conditions of what we were measuring were

very different and so there was place for both groups—what we did and what they did. I don't think that I ever felt jealousy about it. I thought we're doing fine and they're doing fine, that's all.

GRAYSON: You've had a fairly long career in the field, and I'm just curious if there's any significant changes. What are the most significant changes in mass spec from when you started to the end of your career?

KEBARLE: I would say to my view, the **<T: 10 min>** big change and the interest of the field is now into biochemistry. And one might even think mass spectrometry is not all that suited but from colleagues that I have, in fact, former students of mine, they found that they can do very useful experiments into the advancement of biochemistry.

GRAYSON: So finally, what you consider to be the future of mass spec?

KEBARLE: That's hard to say. I see no reason why it will not continue. What one may question, is whether it will continue to expand. It is possible that the type of . . . I mean, there would be improvement, but not most significant improvement. There might be not the rapid growth that occurred in the early days. It would become somewhat more routine then.

GRAYSON: Very good. Well if you don't have any other comments to make . . .

KEBARLE: That's fine.

[END OF AUDIO, FILE 1.3]

[END OF INTERVIEW]

INTERVIEWEE: **Karl Kopecky**

INTERVIEWER: **Michael A. Grayson**

LOCATION: **University of Alberta**
Edmonton, Alberta, Canada

DATE: **23 May 2013**

GRAYSON: This is the twenty-third of May and I'm in the Office of Karl Kopecky.

KOPECKY: [Yes], Kopecky, it's a Czech name. [Pronounced Kopetzky, it's a Czech name.]

GRAYSON: Okay.

KOPECKY: If you can say "[Wayne] Gretzky," you can say "Kopetzky."

GRAYSON: Okay. So from Czechoslovakia. Let's see, I said, I think, it is the twenty-third of May, and we're at the University of Alberta in Edmonton, and Karl and I want to talk a little bit about Paul Kebarle's career. I had interviewed him yesterday at some length and he's a very kind and wonderful gentleman, very interesting, but I didn't get as much as I would have liked to have gotten for him to expound on various part of his career.

Karl is very much familiar with what Paul has done, and I think you mentioned that he really began to really develop scientifically in his research when he was challenged with something to do with ionization potentials. So what happened?

KOPECKY: [Gordon Freeman was a radiation chemist, well, he's still here. He's retired now, but he was bombarding] solutions containing various substances with cobalt-60 radiation.

GRAYSON: Okay. Now that's a hot radiation, is the cobalt-60.

KOPECKY: That's hot, oh [yes], that's . . .

GRAYSON: Gamma rays primarily?

KOPECKY: Gamma ray, [yes].

GRAYSON: [Yes], okay.

KOPECKY: [Kebarle was at the PhD thesis defense of one of Freeman's students and the student was making some sort of statements about the] . . . I knew at the time what the statements were but I'd forgotten. About the mechanisms of what happened in those solutions as a result of the ionization effects of the radiation. And he made some presumptions about the identity of these things that gave him the signals, the ESR [electron spin resonance] signals. And Kebarle said, "You don't know what's going on."

GRAYSON: So he was doing a spin resonance measurement?

KOPECKY: That's right. [Yes]. And he thought to himself, "I can do something like that in a mass spectrometer. And I'm going to put something in the mass spectrometer that will cause ionization and see what happens there. I can get an accurate mass on the particles that are formed." And that's what started as I understand it, his odyssey in high-pressure mass spectrometry.

GRAYSON: And so he was using an alpha source?

KOPECKY: He was using an alpha source, which . . . when I first started thinking about it, when I found out that you were coming I knew what the alpha source was but I don't have it in my head anymore. [Kebarle used a polonium alpha source.]

GRAYSON: Sure.

KOPECKY: Now it will be in . . . probably in this first paper here.[18]

[18] Kebarle, P. and E.W. Godbole, Mass-spectrometric study of ions from the α-particle irradiation of gases at near atmospheric pressures. J. Chem. Phys., 1963. **39**: p. 1131-2.

GRAYSON: You're right, [yes]. I was looking at the literature and I saw some, ah, papers on the alpha ionization process.

KOPECKY: [Yes], right, right. He started with just looking at the hydration of protons that were formed as a result of the . . . alpha particle bombardments. Some really quite successful, pioneering stuff going on there.

GRAYSON: And so he had to run the source at a reasonably high pressure in order to get some ionization to go forward?

KOPECKY: Well, the main thing was to get a high pressure for clustering to occur.

GRAYSON: Clustering, okay.

KOPECKY: Right, [yes]. He had to have a fair amount. Also, you need high pressure in order for these clusters to become stabilized as a result of collision with your gas, right. You get thermal neutral equilibrium there.

GRAYSON: [Yes].

KOPECKY: Right, right. He also had the insight to make an ionization chamber in which you could vary the temperature. Then he could get the equilibrium constants at various temperatures and therefore determine very accurately the free energy—

GRAYSON: Wow.

KOPECKY: —and entropy of these processes.

GRAYSON: So this is really fundamental thermodynamic data on the molecules he was studying?

KOPECKY: That is correct and that was . . . [Frank] Field at one time mentioned in one of his

papers that this was a breakthrough that mass spectrometrists had been looking at for a long, long time. A very important breakthrough.

GRAYSON: Okay, so those guys really recognized the work as being truly something.

KOPECKY: That's right. And as you'll see in that paper that I give you, **<T: 05 min>** a number of people think that his contribution is as basic and fundamental to thermodynamics as was the contributions of a number of Nobel Prize winners who measured equilibria in various other systems. I cite the names and what they did in that blurb there.

GRAYSON: Okay, good.

KOPECKY: [Yes]. He was speaking about this, I think, informally to some graduate student in the department about this and the graduate student said, "Hey, you know, you ought to be able to do this with sodium and potassium ions."

GRAYSON: So he went to the alkali metals?

KOPECKY: He went to the alkali metals and once he went there and found it worked he put anions in there: fluoride ion, and iodide ion, and really got some really good fundamental data on that. Now his results on ion solvation in the gas phase were very important to physical organic chemists so that they could understand what happened in solution containing ions in organic reactions.

GRAYSON: Okay, this would be in a liquid solution?

KOPECKY: In liquid solutions, [yes]. In aqueous and non-aqueous solutions. Now, reactions in aqueous solutions and in non-aqueous solutions, say like dimethyl sulfoxide or dimethyl formamide, they proceed at vastly different rates in those two different . . . protic solvents, reactions are slower, they are much more rapid in aprotic solvents like the dimethyl sulfoxide And his data was really fundamental to explaining what the reasons for the differences. And his results had been incorporated into textbooks of organic chemistry and every textbook of physical organic chemistry has a compilation of his data there.

GRAYSON: Wow.

KOPECKY: They may not refer to it explicitly but the data is compiled in some standards journal, and everybody goes to that reference data and pulls that stuff out, so he influenced greatly the writing of textbooks. Every undergraduate chemist who has studied organic chemistry in the last twenty-five years has been exposed to these concepts.

GRAYSON: [Yes], wow. And so, this all basically happened kind of in a nonlinear, serendipitous way, it sounds like. It started out in one thing and then—

KOPECKY: [Yes].

GRAYSON: —another idea came along and it went a different direction.

KOPECKY: Right, [yes]. That's right. Now he was able to design his system to give very accurate and precise results. In fact those results are so precise that the theoretical chemists use the data to adjust the parameters on their equations.

GRAYSON: Wow, okay. Computational chemistry kind of thing?

KOPECKY: That's right, so they can now compute very accurately the energetics of systems for which there isn't any experimental evidence.

GRAYSON: Wow, that's impressive.

KOPECKY: [Yes].

GRAYSON: You know I was . . . I'm glad we're getting this insight because Paul seemed to be less interested in his scientific accomplishments than just about anything else in our conversation. I know him from seeing him at ASMS meetings, which I went to regularly. I knew he was doing some fundamental work, but . . . it's the name that you see and know and recognize the —

KOPECKY: Right, right, [yes].

GRAYSON: —and I didn't really understand his career that much. Any other [things you want to mention], besides these . . . I mean he's doing these very fundamental thermodynamic measurements, experiments that are difficult.

KOPECKY: Right, right.

GRAYSON: Any other types of thermodynamic things that he was [working on]? I know that he was very much interested in **<T: 10 min>** electrospray. It seems like a lot of his fundamental work would have been essential to understanding electrospray.

KOPECKY: That is right, [yes]. He made important contributions to the understanding of the electrospray, and he wrote some really good articles. One of the best review articles written recently about the electrospray is, I think, 2009 or 2010 review article.[19]

GRAYSON: I've got his bibliography and a lot of stuff off of the web too.

KOPECKY: [Yes], right, right. Now did he ever mention yesterday about his experiments with potassium ion—

GRAYSON: No.

KOPECKY: —and benzene in the gas phase?

GRAYSON: No, no.

KOPECKY: That is a remarkable observation. He found out that in the gas phase potassium ion binds more strongly to benzene—or benzene is bound more strongly to potassium ion than water is bound to potassium.

GRAYSON: Wow.

---

[19] Paul Kebarle and Udo Verkerk. "Electrospray from Ions in Solution to Ions in the Gas Phase, What we know now." *Mass. Spec. Rev.* **2009** *28* 898-917.

KOPECKY: People couldn't comprehend that for some time.

GRAYSON: Well [yes]. [laughter]

KOPECKY: But now, it's accepted, right? And he called this process cation-π interaction. The π cloud or the benzene interacts with the cation.

GRAYSON: Why did he do that? [laughter]

KOPECKY: That I don't know.

GRAYSON: Well I guess he just figured he'd just try it, I guess, or I don't know, maybe.

KOPECKY: I don't . . . that I really don't know. Now, ah, he did not pursue that particular line of work, but it was immediately taken up by other people who looked at lithium, and sodium, other positive ions. And somebody else used it, looked at ammonium ion in the gas phase.

GRAYSON: Ah, okay.

KOPECKY: It binds strongly to benzene, and then they looked at protonated amines. They bind strongly. Now it turns out that in amino acids . . . I mean, in proteins, you have protonated amino acid residues, and you have aromatic containing amino acids.

GRAYSON: Sure.

KOPECKY: Those guys interact.

GRAYSON: Ah!

KOPECKY: Which is an important contribution to protein folding. So all of the x-ray crystallographers have gotten onto that, they've looked at that and they cite Kebarle's

experiment with . . . they go back to cite Kebarle's experiment with benzene and potassium.[20] [. . .] I don't think he even realized it was effective as it is.

GRAYSON: I mean, from where we're sitting here to a person who doesn't understand too much what we're talking about: the idea that there would be an interaction, such a strong interaction between benzene and a positive ion of any kind is just kind of strange, okay.

KOPECKY: That's right.

GRAYSON: The knowledge that that did happen is important to people in the biological community because of the number of aromatic residues, the number of residues in a protein that has an aromatic constituent in it. Then it's able to interact with the protons.

KOPECKY: Exactly right, [yes].

GRAYSON: So that affects the folding of the protein and of course and I think form is function or function [controls] shape or whatever it is.

KOPECKY: [Yes], for sure.

GRAYSON: And so, it's a fundamental thing that if people didn't know it they'd still be scratching their head and wondering [what's going on].

KOPECKY: [Yes], right.

GRAYSON: Wow.

KOPECKY: So that sort of interaction . . . now people realize is involved in drug receptor interactions.

---

[20] J. Sunner, K. Nishizawa, P. Kebarle. "Ion Solvent Molecule Interactions in the Gas Phase. The Potassium Ion and Benzene", *J. Phys. Chem.* **85**. 1814-1820 (1981).

GRAYSON: Oh wow, okay, sure.

KOPECKY: Ion transport through membranes, people are doing immense amount of research now. Well, they've done research on ion transport through membranes, but they didn't understand the mechanism really, right? So the ion is passing through there, interacting with, ah, with aromatic residues in the membrane of the cells.

GRAYSON: Well, I know one thing, in the process of looking at his literature . . . there's probably over thirty—certainly close to thirty if not more—**<T: 15 min>** of his publications that have over one hundred citations.

KOPECKY: That's right, [yes]. You're acquainted with the H-index or something like this.[21]

GRAYSON: Well I'm actually using—at least primarily—SciFinder as an option where you can have the listings of the references by number of cites that it's had. Just a very convenient tool to, you know, do a back trace to a guy's publication history.

KOPECKY: [Yes]. There's something called an H-index.

GRAYSON: I'm not familiar with that.

KOPECKY: The H-index, I think, it compares the number of citations . . . well anyway, the number of papers that have more than a certain number of citations . . . is roughly what the H-index are. And his H-index is one of the highest in science. And so that indicates that a lot of people have cited this.

GRAYSON: Well, he was doing fundamental work and doing it very well.

KOPECKY: [Yes], right.

[21] Peterson, A., and H. Schaefer. "H-index ranking of living chemists." *Chemistry World* 4 (2007): 1-14.

GRAYSON: That recognition, ah, probably, you know, contributed to people checking in with his publications on a pretty regular basis.

KOPECKY: Right, right; [yes]. He's also done some good work with protein mass spectrometry. You know the structure of proteins in a gas phase and so on. He's well-known as well for that, which is different from his high pressure mass specs.

GRAYSON: Sure, [yes].

KOPECKY: [Yes], so he's branched out in his later years.

GRAYSON: So when did he retire from the . . . basically they didn't have a "kick them out at sixty-five" here, I don't think, did they?

KOPECKY: We have a mandatory . . . when he retired there was a mandatory retirement age of sixty-five.

GRAYSON: Ah, okay.

KOPECKY: He retired from teaching and academic duties, but I think he had a large research grant and ran a reasonable research program with a couple of postdocs . . . until . . . into 2005, 2006, something like that.

GRAYSON: The University allowed him to keep plowing away with this research activity?

KOPECKY: That is correct, [yes].

GRAYSON: Which was nice of them.

KOPECKY: [Yes], right, right, and he made some important contributions, especially to electrospray *after* his official retirement.

GRAYSON: Well he's, I'm guessing, eighty-six now?

KOPECKY: That's correct, [yes].

GRAYSON: He gets along physically pretty well. I guess, his scoliosis has really affected his back quite a bit.

KOPECKY: [Yes], did he talk at all about his—

GRAYSON: A little bit about his early diagnosis. And it's almost like that was an opportunity for him to get out of Bulgaria.

KOPECKY: That got him out of Bulgaria, [yes].

GRAYSON: [Yes], which is . . . . [laughter]

KOPECKY: In time. I mean, when he could still get out.

GRAYSON: Right, and it's a shame that, I guess, he never saw his parents after he got out of the country, from what I could figure.

KOPECKY: Well, they were able to leave Bulgaria and they—

GRAYSON: He said there was his brother.

KOPECKY: —in the 1970s or so. And [they] went to live with his brother in Switzerland and they came to visit a couple of times.

GRAYSON: Oh, okay.

KOPECKY: I've met them.

GRAYSON: Oh, okay, very good. He didn't mention that part. Well that's nice because, you know, it'd be a shame to just walk away from your family at age seventeen or so and never see them again.

KOPECKY: His scoliosis did not really affect him all that much physically and he's still quite active physically.

GRAYSON: Oh yes.

KOPECKY: He goes cross-country skiing. And until, oh, maybe five or six years ago, he would go downhill skiing.

GRAYSON: Oh my. [laughter]

KOPECKY: [Yes], and he was a good downhill skier. He learned in [Bulgaria].

GRAYSON: Wow, there you go.

KOPECKY: [Yes].

GRAYSON: That's the place to learn. **<T: 20 min>** When we left last night he got ready to hop on his bike and bike home. [laughter]

KOPECKY: [Yes].

GRAYSON: I'm not sure I could manage something like that when I'm eighty-six. But I guess if you do it a lot then . . . that's a good skill. [laughter]

KOPECKY: Right, they used to invite people over for supper, right?

GRAYSON: Sure.

KOPECKY: And the ritual was: you eat your supper and then after supper you go for a walk. We'd walk down into the river valley, right, and then back up because they live close to the river down there.

GRAYSON: [Yes]. Well he's certainly a charming fellow and has had a career that is much more meaningful or will be much more meaningful to people in the future thanks to your contribution and your awareness of the importance of his work, and I'm glad that you stepped forward and contacted me because . . . it's a good interview, but I just really wasn't able to get him to talk about some of these things. I'm not even sure he understands how important and what a large impact his work has had on so many areas.

KOPECKY: That's why I contacted you because that's the feeling that I have.

GRAYSON: [Yes].

KOPECKY: Well I'm glad you're doing this. We need to get a broader audience even than he has for his work.

GRAYSON: Well, what happens is the conversation I had yesterday and this conversation as well will be transcribed at CHF [Chemical Heritage Foundation] into a [Microsoft] Word document, then you get a chance to look at what we've said, and he'll get a chance to look at what he said, and check it and correct it, and change things that he thinks maybe shouldn't get out in public. Then, when all is said and done, three copies will be created. One will go to the CHF Library [The Othmer Library of Chemical History], and one the ASMS Library, and one to Paul. And I think probably make sure that you get one as well that you have for your own personal . . . see ASMS likes to get all these on the ASMS website, transcripts . . .

KOPECKY: [Yes].

GRAYSON: And then the little video I did yesterday, I think it lasted about ten or eleven minutes, is very general, large philosophic questions about career in science, you know, what would you recommend, how would you encourage young people to get into sciences stuff, and so I got a nice video of him speaking on these topics and his own scientific career and what he found exciting, you know, just the idea once again of finding something out that no one else knew and he knows. And recognizing that you had created new knowledge. He didn't at the

time even know whether it would be particularly useful but as we can see now it's been very useful.

KOPECKY: Right, right, yes.

GRAYSON: So he's been probably lucky because he can do his fundamental research. His funding was mostly from the University or from NRC?

KOPECKY: From the NRC, [yes], right. I think that's the only place that he got funding was from NRC. Of course we had a very good machine shop here and electronics facilities and then that helped things out really very well.

GRAYSON: [Yes]. That's very . . . that's a good stake in the world of what we do, that this fundamental research, that most people would think is worthless or some guys out there working this little field . . . that it has such a powerful influence in the science that follows.

KOPECKY: [Yes], that is correct.

GRAYSON: It's good to know that it was funded and sad to know that it's harder to do today, and we need to make more people aware of how this basic work is so valuable and maybe part of this will help. [laughter]

KOPECKY: Right, right.

GRAYSON: Who knows?

KOPECKY: Hopefully, yes. I want to give credit also . . . in a general background sense to our former chairman of the department, Harry Gunning, who arrived here in 1956 to take over the leadership of the department. He got his degree originally from the University of Toronto. He was a photo chemist, **<T: 25 min>** a gas-phase photo chemist. He went to, I think, he went to Rochester University in New York then to Illinois Institute of Technology and was fairly successful, and he then was invited to come up here in 1956. They were just starting to design a new chemistry building . . . I don't know whether it was a condition or whether they were already planning to do this, but they started the PhD program here the year that he arrived. He was a very astute person, he had good foresight, and he realized the potential that could be up here. The oil and gas industry was just taking off. They discovered oil here, a big oil field here

in 1945, about twenty miles south of Edmonton, and that was the first breakthrough discovery. After that every time they poked a hole in the ground oil came out.

So the programs became very prosperous. While they were poking holes in the ground sometimes they didn't get oil but they got gas, and so we have a big natural gas industry—exporting industry—as well. And Gunning was able to convince the government that a way to exploit and advance the interests of the oil and natural gas industry was to fund the department of chemistry, so he was able to draw immense amounts of money. We had the best-equipped laboratory in the world, I would say, from about 1960 to 1970. We would get the first commercial NMR [nuclear magnetic resonance] instrument or the first commercial this or first commercial that as a result of his efforts.

GRAYSON: How long did he run the department?

KOPECKY: Ah, he was department chairman from 1956 until about 1974, I think.

GRAYSON: Okay, quite a long run.

KOPECKY: That's right and the University community as a whole was so impressed with chemistry and what Gunning had been able to do that they drafted him to be president of the University. Right at the time there was a change in the provincial government and they became much more, ah, conservative as far as funding the universities were concerned. We had a cutback in funding. Gunning was not able to do the free-wheeling and dealing for the University that he had been able to do for the department as before and so he had actually a disappointing career as university president through really no fault of his own.

GRAYSON: [Yes].

KOPECKY: His methods were not suited . . . .

GRAYSON: Not suited to the new government. [laughter]

KOPECKY: Now while he was here he had a double degree from Toronto in English and chemistry. He was very widely read and he would give lectures to the English Department and to the Classics Department—

GRAYSON: Oh wow.

KOPECKY: —and the President of the University, I think, after the four or five years that he was here, was a classicist, right? He was able to communicate effectively with the president of the University in his terms.

GRAYSON: So that liberal arts background served him well?

KOPECKY: That is correct, [yes]. [laughter]

GRAYSON: Good.

KOPECKY: And he recognized that it was important for a chemistry department to have good support staff, so we had a good machine shop, we had a good electronics shop.

GRAYSON: That's good.

KOPECKY: Right, right, and we still have . . . we are still able to keep that going. And a glass shop, a glassblowing shop.

GRAYSON: Very good. Well, I think . . . unless you have any other comments that you want to make with regard to Paul's career and the University?

KOPECKY: No, no.

GRAYSON: Okay.

KOPECKY: No, I don't.

GRAYSON: Then I appreciate your taking the time and talking to us about this because it's . . . **<T: 30 min>** I think, it will [enrich the] interview with Paul considerably.

KOPECKY: Okay, I hope so.

GRAYSON: Yes, it will.

KOPECKY: Good.

[END OF AUDIO, FILE 1.1]

[END OF INTERVIEW]

INDEX