CENTER FOR HISTORY OF CHEMISTRY

TADEUS REICHSTEIN

Transcript of an Interview
Conducted by

Tonja Koeppel

at

Basel, Switzerland

on

22 April 1985

THE BECKMAN CENTER FOR THE HISTORY OF CHEMISTRY

Oral History Program

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(Date) 9. III. 1988

(Revised 24 February 1988)

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TADEUS REICHSTEIN

1897	Born in Wloclawek, Poland, 20 July

Education

1920	Diploma in Chemical Engineering, Swiss Federal Institute of Technology (ETH)
1922	D.Ing. Chem., Swiss Federal Institute of Technology (ETH)

Professional Experience

1922-1929	Consultant for an industrial firm in his own lab in Albisrieden, (Zürich)
	Swiss Federal Institute of Technology
1929	Lecturer
1934	Assistant Professor
1937	Associate Professor
	University of Basel
1938-1950	Head, Pharmaceutical Institute
1938-1950	Professor, Pharmaceutical Chemistry
1946-1960	Head, Institute of Organic Chemistry
1950-1960	Professor, Organic Chemistry

Awards

1947	Marcel-Benoist Prize
1950	Nobel Prize

ABSTRACT

In this interview Tadeus Reichstein discusses his long and distinguished career as an organic chemist. He begins by recalling his family and early education in Germany and Switzerland. The interview continues with Reichstein describing his advanced work at the Swiss Federal Institute of Technology (ETH) and recalling his professors and colleagues, especially Staudinger and Ružička. In 1938 Reichstein moved to the Pharmaceutical Institute at Basel and the central portion of the interview focuses on his research leading to the Nobel Prize in 1950. This includes work on Vitamin C synthesis, cortisone and other adrenal hormones, and glycosides. The interview concludes with Reichstein expressing his personal philosophy, his views on the changes in chemistry, and his interest in botany.

INTERVIEWER

Dr. Tonja A. Koeppel received a master's degree in chemistry from the Swiss Federal Institute of Technology in 1944. Since then she has written about chemistry, done research, and taught college chemistry. Dr. Koeppel is also a historian of chemistry. In 1973 she earned a Ph.D. degree in the history and sociology of science from the University of Pennsylvania. She is especially interested in the development of organic chemistry in the nineteenth and early twentieth centuries.

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DATE: 22 April 1985

KOEPPEL: Professor Reichstein, I would like to ask you a few questions about your early life. You were born in 1897 in Wloclawek in Poland. In 1905, when you were eight years old, did your parents emigrate to Germany?

REICHSTEIN: No. My parents emigrated to Switzerland. My father had his business in Kiev, Russia. We went to Poland, where the parents of my mother and father came from, for a summer holiday; I was born there. Then, in 1905, they emigrated to Switzerland. But the family was too big, so they left me in Germany in school for two years until they could buy a house in Zürich; then I could come also.

KOEPPEL: So you were in Jena, Germany, in a boarding school. What grades did you attend there?

REICHSTEIN: No grades. I was seven years old.

KOEPPEL: And you didn't have any formal schooling yet?

REICHSTEIN: No. I was just in primary school.

KOEPPEL: So you did get some schooling in Germany?

REICHSTEIN: Yes. For at least two years. I didn't like it.

KOEPPEL: Why not?

REICHSTEIN: It was kind of a military attitude which was completely foreign to me. I did like two or three boys who were also there but I didn't like the teachers and I didn't like the other boys.

KOEPPEL: Were you glad to go to Switzerland?

REICHSTEIN: Yes, very glad.

KOEPPEL: You went to Switzerland in 1908?

REICHSTEIN: In 1907. I joined the family in Zürich. My father had just bought a house there.

KOEPPEL: Your father had his own office in Kiev.

REICHSTEIN: He spent part of the year in Zürich and part of the year in Kiev.

KOEPPEL: He was a chemical engineer, wasn't he?

REICHSTEIN: Yes.

KOEPPEL: What was his name?

REICHSTEIN: Isidor Reichstein.

KOEPPEL: Did he continue his business in Zürich?

REICHSTEIN: No, he ordered the most important things by correspondence to Kiev.

KOEPPEL: Did he do consulting?

REICHSTEIN: He sold equipment for the sugar industry, for factories that produce sugar from sugar beets. He sold the machines. I didn't exactly know what. I was too small at this time. He had just an office in Kiev. He bought most things by correspondence and he went to the factories.

KOEPPEL: I see that your early work was connected with sugars. Was there any influence...?

REICHSTEIN: No.

KOEPPEL: That had nothing to do with your father's business? But your father, being a chemical engineer, must have had a certain influence on your decision to study chemistry.

REICHSTEIN: No. That was quite by chance. You had to decide when you entered the ETH Zürich, which department you would be in. I wanted to be an engineer. And only three days before I had to make the final decision, my best friend in my class said he was going to study chemistry. And then I suddenly thought yes, sure! I had never thought about studying chemistry because I didn't think it was something really worthwhile. I knew chemistry quite well. I did a lot of chemistry on my own in the cellar in our house and made analyses and all kinds of experiments. I started studying it, I knew much more than all the rest just by practice.

KOEPPEL: You were self-taught, in a way.

REICHSTEIN: Correct. Afterwards I liked it. We had a very good chemistry teacher in Zürich. And he also influenced many of the boys to study chemistry.

KOEPPEL: What was the name of that school?

REICHSTEIN: At this time it was called Industrieschule. Now it's called Oberrealschule. That's just the title for gymnasium without Latin. I didn't like old languages at this time. Afterwards, I was sorry I didn't learn Latin.

KOEPPEL: The school was more mathematically oriented?

REICHSTEIN: Yes. More mathematics and physics and mathematics was always very easy for me.

KOEPPEL: Before you went to the Oberrealschule you had mainly private schooling in Zürich?

REICHSTEIN: Privately, at home.

KOEPPEL: I see. Were your parents involved in this?

REICHSTEIN: My father gave us mathematics.

KOEPPEL: And your mother?

REICHSTEIN: No. She did not. We had a teacher, and he gave some German lessons, and we learned French of course. I had no trouble with French because one had to speak it. I had trouble with English because I didn't learn it. At this time it was not yet very popular. The English teacher wanted to throw me out of school, but he didn't succeed. I entered the school about two and a half years too late. I had to catch up on everything by myself. That was quite easy except for English, because they had already three years of English and I had to learn it myself within three months. I didn't succeed. When I entered the school, it was spring of 1914. I realized I didn't understand what he was saying. He didn't like me and I did not like him. He wanted to throw me out of the school because of my complete ignorance of English. I went to the director and told him, "I know my English is poor because I had no time to learn it but I will go to England during the summer holidays and will try to learn just conversation." He agreed and then the English teacher couldn't do anything. I went to England and stayed there and when I was there the war broke out and I couldn't return. I had to stay until Christmas. Suddenly on Christmas you could pass through France again. I came back for the New Year and my English was not very good but I could understand people talking. I could also talk a little, so this teacher couldn't throw me out anymore.

KOEPPEL: He accepted it?

REICHSTEIN: He was not very friendly. I tried to make nonsense as much as I could. I was on very good terms with all the other teachers, so I stayed in the school.

KOEPPEL: But you were a real Swiss by then...coming to this country at such an early age.

REICHSTEIN: We came to Switzerland in 1914 and naturalized.

KOEPPEL: And you spoke Swiss-German fluently, so there was no problem.

REICHSTEIN: No problem. My parents did not become Swiss. There were five boys and they made the five boys naturalized Swiss because my father chose to live half of his time in Russia and half here. He could not speak Swiss-German. Afterwards we were sorry that he didn't make it because he was unable to return anymore to Russia. War broke out and then the revolution. Soon it was quite impossible and he lost everything in Russia. He had most of his valuables there, but he lost everything. He couldn't work in Switzerland anymore. He couldn't find any work. My mother had to rent rooms in the house and take in boarders. To earn something we had to sell our last piece of land. The land was quite big and it was fortunate that we had it. They managed to bring all five of us through. After the war when the financial situation was the worst, I could start to earn money myself. I always had luck with money.

KOEPPEL: You then went to the ETH, the Swiss Federal Institute of Technology?

REICHSTEIN: I studied chemistry and at the same time I could find a job in a factory just to work one day per week. On this one day each week I earned enough to pay my fees at the ETH.

KOEPPEL: You enrolled in the chemical engineering department. What did you take? Was the curriculum the same as it is now?

REICHSTEIN: More or less. First of course, there was mathematics and physics and physical chemistry. Then in the afternoon, we had to work in the laboratory to do analysis and analytical chemistry. These modern things, like atomic structures, did not exist yet. There were some special lectures that I went to, given by physicists on Bohr's theory, which had just come out. It was quite new.

KOEPPEL: Yes, in 1916, when you started, it was a brand new subject.

REICHSTEIN: It was only an elective. A very young man taught it. He's long since dead.

KOEPPEL: You don't remember his name?

REICHSTEIN: Yes. Wolfge. He's not very well known. There were those later who were much better known in the physics department.

KOEPPEL: Who were they?

REICHSTEIN: Einstein was one.

KOEPPEL: Was Wolfgang Pauli there?

REICHSTEIN: That was much later. Then Peter Debye came to the physics department. When I studied chemistry, the physics department was in an extremely poor state. The main representative was mentally ill and they didn't have the possibility of getting him out. They had to wait until he died.

KOEPPEL: What was his name?

REICHSTEIN: Schweitzer. He was completely unknown. Perhaps his work when he was young was quite good, but he had no facilities to teach and he was ill, really ill. Afterwards, Debye came, with Paul Scherrer, and then physics really got started. They attracted many good people, among them Wolfgang Pauli. There was also August Piccard. He went up to forty kilometers into the stratosphere with his balloon. It was the highest point that could be reached at this time. There were no rockets yet.

KOEPPEL: What was the chemistry department like?

REICHSTEIN: The chemistry department was quite good. My chief was Hermann Staudinger, who worked on polymers. At this time he was the only one who believed that polymers, like proteins and caoutchouc, are really big molecules held together by coordinated bonds. The general view was that there was this association of small molecules. That means that the formula of cellulose would be C_6 and held together by some unknown forces which they called coordination complexes. Staudinger was quite obstinate. He was possessed by this idea. He didn't think of anything else when he worked on his polymers. And he was right. I was quite sure that he was right. But I didn't like his methods. In every lecture he gave officially, he repeated the same things--but that was necessary of course. He had to defend his ideas.

KOEPPEL: How did he try to prove it experimentally? By what methods?

REICHSTEIN: With quite reasonable methods which even afterwards were accepted by the physicists. Molecular weight determinations were impossible and they don't work on this for quite simple reasons. These molecules are not stable. They can move around like a snake. Therefore, they behave as if they were smaller parts. He developed quite good methods. But they were not methods which the physicists liked. For instance, the Roentgen diagrams of cellulose gave a repetition unit of C_{12}. So, many of the chemists accepted that as the proof that cellulose is just a double of glucose. And that was an idea that was not acceptable. Cellulose is built of such units but they are held together by real covalent bonds. That's what Staudinger always propagated, and it turned out finally to be correct. Physicists admitted this, but only about ten or twenty years later. I didn't work on this. I didn't like his methods because...it's a kind of brutal chemistry. He liked everything which made noise and caused explosions. These were the things he liked. He came to the

laboratory, perhaps twice a year, to work there himself for two hours. Afterwards everything was full of broken glass and...

KOEPPEL: That sounds awful. How could he work only twice a year? In addition, did he also worked in his own laboratory?

REICHSTEIN: He had many assistants.

KOEPPEL: Oh, you mean he worked in the student laboratory twice a year.

REICHSTEIN: No, in his own laboratory, where normally two assistants worked. They knew how to work.

KOEPPEL: And he himself didn't work there more often?

REICHSTEIN: When he worked there, then everything was...

KOEPPEL: Everything exploded?

REICHSTEIN: Yes, because he only liked such explosive reactions which made noise. His lectures were very good, but the high point was always when he would give the lectures on nitroglycerine. It's an explosive. He put a little separatory funnel at the ceiling with nitroglycerine so that a drop was coming down every twenty seconds onto a black metal sheet which was heated from below. When the heat was low, the drop made a little noise. And the hotter it became, the more noise it produced. At a certain temperature--it was about 450 or 500 degrees--it made a terrible noise like a gun shot, every drop. Then, when you heated it still more to make it red hot, the noise went down again. His mood went exactly the same way. He said, "Now listen, listen." He stood like this and then he came up and when the reaction was at its maximum, he was quite...

KOEPPEL: He jumped?

REICHSTEIN: Yes, and he was very happy. Then, when the reaction was going down, he also went down like he was...he repeated that at least twice--from the lowest temperature to the highest and then down once again to show how well it could produce noise.

KOEPPEL: I bet the students loved it.

REICHSTEIN: Yes. It was interesting.

KOEPPEL: You did take your doctoral work with him and you wrote a thesis under his guidance. What was the thesis about?

REICHSTEIN: That was during the war. I finished in 1920. It was just after the war but the problems were still the same. He wanted to make some medicinally useful things and that was a line which I was especially interested in. I told him I would like to work in this field, and he told me to make an artificial substitute for atropine. At this time the nitrogen-containing

part of the molecule was the difficult one--two rings together, three rings--and the synthetic approach was not very well worked out. So he made a suggestion to make a similar compound with one ring missing. That's a very general method--how to transform or make variations. I liked this approach and I started and it went quite all right. The product which you get contains three asymmetric carbon atoms. Therefore quite a number of isomers are possible. He didn't like complications or tricky problems. When he came to visit me (he came once a week) I told him that I followed his suggestion and as he could easily see there were at least six different isomers which I wanted to separate. Well, he became furious because he didn't like such tricky things like separating isomers. He left immediately and didn't come back for two weeks. Afterwards, he came again and told me what I should do and what I should separate. "Oh yes.", I said. "I told you that before." You see, he always came and told you the things which you suggested to him as if they were his ideas. It went quite well. I could separate the isomers. It was not so difficult.

KOEPPEL: Did you use fractional crystallization?

REICHSTEIN: Yes, of some different salts. There was this one salt where you could crystallize one form out. I think it had some biological activity, but he never told me that. He wanted always to make a profit in some way. I was not interested. The project was finished in one year and I told him that it was finished. He said, "Oh no. That's too short a period of time." He invented additional problems, and suddenly he was interested in coffee flavor. He had an idea how to isolate the flavor of roasted coffee. From this moment on, my other work was quite sufficient for a doctoral thesis. He said that I could write it up and send it off, if I would like to analyze the coffee flavor (1). So I was ready to do it. I finished the thesis and took my examinations. Then I started to work on the coffee flavor. There I realized that it was a very difficult job because it's a very bad mixture. Some compounds are extremely volatile and some are not stable. They will deteriorate in a few days. The sense for flavor is very delicate. If you have such a mixture and you take only one of the things out, the rest will go flat. For instance, what I realized at this time was that a very good smell in some flowers, jasmine or roses or violets-the really good smell is only produced by some compounds present in very small quantities which smell awfully bad--terrible--if they are alone or concentrated. But without them, the good smell is not natural. It is like a cheap coiffure shop.

KOEPPEL: Is that something like musk for instance?

REICHSTEIN: Musk is also a special case. There are different compounds which have the odor of musk. There are animal compounds and also vegetable compounds. But these are big rings.

KOEPPEL: Yes, but the effect is similar if you take it away.

REICHSTEIN: Musk as a pure compound doesn't smell bad. It must be diluted very much.

KOEPPEL: So you worked on this coffee aroma in your own lab?

REICHSTEIN: No. I had to arrange that with an industrial firm because it soon became apparent that it would be very expensive. We had to find somebody interested to pay for this. And I could make an arrangement with the firm which was producing malt coffee.

KOEPPEL: What was the name of the firm?

REICHSTEIN: Kathreiner's Malzkaffee. They were interested because they thought they could add a little flavor to make their malt coffee smell like real coffee (2). They were very pleasant people. I worked through many tons of coffee to get only a few cubic centimeters of the flavor.

KOEPPEL: Did you work on that in Zürich? Did they finance it?

REICHSTEIN: Yes. I worked for eight years. My lab assistant who is coming today to visit me is now over eighty years old. He started then with me.

KOEPPEL: What is his name?

REICHSTEIN: J. von Euw.

KOEPPEL: Oh yes. You have a number of publications with him. And then you went to the ETH?

REICHSTEIN: Then Leopold Ružička came to the ETH.

KOEPPEL: Staudinger left?

REICHSTEIN: Yes, he went to Freiburg. He was followed by Richard Kuhn. Kuhn was quite young; I think thirty-five. He was probably the youngest professor in the ETH. He was very good and was an excellent lecturer. He had a very broad background. At one time he gave lectures in physics for two years. He was quite able to do it.

KOEPPEL: In addition to chemistry?

REICHSTEIN: Yes, and his chemical lectures were excellent, in a very different style. Staudinger also gave very good lectures. But in a rather primitive style.

KOEPPEL: A little flamboyant?

REICHSTEIN: Yes. It was quite good for beginners. But Richard Kuhn had a much better foundation on general aspects and modern theories. He didn't stay long.

KOEPPEL: When did he leave?

REICHSTEIN: I can't remember the date. He stayed only about two or three years.

KOEPPEL: Where did he go?

REICHSTEIN: He went to Berlin, to the Kaiser Wilhelm Institute; which is now the Max Planck Institute. He worked mainly on vitamins at the ETH. Therefore, he was on very bad terms with Professor Paul Karrer. Professor Karrer had the idea that vitamins were only his domain.

KOEPPEL: Did that influence his decision to go?

REICHSTEIN: I don't think so. He wasn't quite happy in Zürich. He liked the big style of life.

KOEPPEL: Yes. He really couldn't have that at the ETH.

REICHSTEIN: Not very much. He was not unhappy in Zürich. He brought about eight very good assistants. Two or three became good friends of mine.

KOEPPEL: Did they stay on?

REICHSTEIN: No. They had to search for jobs when they were finished.

KOEPPEL: Kuhn got the Nobel Prize?

REICHSTEIN: Yes, and Staudinger also.

KOEPPEL: Did he get it for some work done at the ETH?

REICHSTEIN: You see, such work cannot be done in one place. You start somewhere, but the main work was, I think, already done in Münich. Here he had very good assistants. Two of them stayed in academic careers. The others did not.

KOEPPEL: Did they stay in Switzerland? What were their names?

REICHSTEIN: No. Wasserman was in some university in Germany. Being of Jewish origin, he went to America when he still could go.

KOEPPEL: I see. And then Ružička came? You were his assistant?

REICHSTEIN: Later. I knew Ružička when I worked for Staudinger because Ružička worked with Staudinger. He worked in the souterrain [basement] where he had a very obscure cave. When I had the time I always visited him to look at what he was doing because he was an excellent experimental worker, just the opposite of Staudinger. He was a very poor lecturer and did very good experimental work. He was always working from morning to

evening in his cellar. Once when Staudinger was away, I went down and worked with him for two weeks to learn a little about his methods.

KOEPPEL: On natural products, I guess. That was his specialty. Then you also had a lecture?

REICHSTEIN: Yes. Ružička asked me whether I would like to go back to teach at the ETH. Otherwise I would have never gone. I knew that with him I would be free to work on what I liked and that he would always help me if necessary.

KOEPPEL: You lectured on methods and on heterocyclic chemistry?

REICHSTEIN: Yes. Afterwards I taught what they call physiological chemistry. That's called biochemistry today. It was in a very primitive state at that time.

KOEPPEL: It was not well developed as a separate discipline at the ETH for a long time, was it?

REICHSTEIN: There was Winterstein who...

KOEPPEL: Yes, I attended some of his lectures on medicinal chemistry. Did he later go to America?

REICHSTEIN: That was his son.

KOEPPEL: Then you became assistant to Ružička in 1931. From your curriculum vitae I read that you became an assistant professor in 1934, and an associate professor in 1937.

REICHSTEIN: That's just official titles.

KOEPPEL: And afterwards you went to Basel.

REICHSTEIN: Then I got into some difficulties working with Ružička.

KOEPPEL: Was that the reason why you went to Basel?

REICHSTEIN: Yes. That can happen.

KOEPPEL: Well, I don't know if you want to tell us what the difficulties were or not.

REICHSTEIN: You know, he always had a cooperation with industrial people. He worked mainly on steroid hormones. Through his contracts with industry he was in a slightly delicate position because I had started to work on some things which were interesting for medical use. The first project I started was on Vitamin C. That was in 1933, when we succeeded in getting results which made Mister Karrer furious (3). He asked Ružička why he allowed some of his assistants to work on vitamins. Ružička told him that he doesn't prescribe his assistants' work,

that they can choose their own work. Karrer couldn't do anything. He was at the University of Zürich and they had no connections with the ETH. But, Ružička could always get along with Karrer. He often told him quite funny things which nobody else was allowed to tell him. Kuhn was on extremely bad terms with Karrer. They didn't speak to each other. They behaved in a silly way, like children.

KOEPPEL: Well there was a lot of competition--all these people working in the same field. But you managed to achieve the synthesis of Vitamin C and I would like you to tell us about that story.

REICHSTEIN: This helped me to become a little independent. When it was over, I wanted to work only on compounds of medical interest. I had good friends in Holland. Dr. Tausk, a medical man, had a very broad view on what was necessary in medicine. I spoke with him and told him that I would like to do some chemical work which is of interest to medicine.

[END OF TAPE 1, SIDE 1]

Dr. Tausk is still living. He was the scientific director of Organon at this time. He knew a lot of medicine, and he suggested to me four or five different things which would be interesting if the chemistry could be solved and an approach made by synthesis. One was Vitamin B_{12}, another was the hormones of the adrenal cortex. I looked at the literature the next evening for what I could find out about these problems. I told him the next day that I thought the only ones which were really ready to be worked on with chemical methods were the adrenal hormones, and that I would like to do this work if he could procure the materials for me. You must have extracts of the adrenal glands and the technique needs to be improved to get the hormones. That was no problem for them because they had prepared the hormones already. I made a contract with him and all was going well. I accepted this assignment because from the literature I learned that these compounds were water-soluble, not soluble in ether and fats. I thought that they could not be steroids because steroids were always insoluble in water, but soluble in ether, and so on. That was the only thing which was known about them. I didn't want to work on steroids because I knew that we would get into trouble with Ružička because he had a contract with CIBA to prepare them.

The funny thing is that after a few months when, I had the first pure compounds, I immediately saw that they were steroids, but of a different kind. They were more hydroxylated and therefore partially soluble in water. Since I couldn't stop anymore, I told Ružička about it. His industrial people started to object that he allowed the researchers in his institute to work for the competition. So, he more or less gave me the choice: either I had to leave Zürich or work on something else. I told him that I could not change because I had a contract, and

he made me leave the ETH.

I didn't know where to go. The next morning Dr. Barell from Basel turned up in Zürich and asked whether he could speak with me for fifteen minutes. He was a representative of the Kuratel, the body which is responsible for the University. They work as unpaid volunteers and only in special cases do they make decisions for the university. He came on behalf of the University and asked if I would accept a position at the Pharmaceutical Institute in Basel. He said that he knew it was not sufficient for my ambitions but he was obligated to ask me anyhow. I told him, "No way. It's not too little for me. I will think about it, but I can tell you right away that I will accept it with pleasure if the Institute can be renovated in such a way that you can really work there." He was quite astonished. The next morning he telephoned me and I went to Basel to look at the Institute. I brought a few technicians with me to tell them what they would have to change. After three days, it was already arranged. I could speak with Regierungsrat [State Senator] Hauser, who chaired the Department of Education. He said that there would be a committee to decide, but if he says yes, the renovations will be done. He arranged everything so that we could start in October. On the fifteenth of September the project was finished and it was, I think, the cheapest Institute they had in Basel because it was a very old house from the fifteenth century where Paracelsus had worked. It's very interesting. They only had to restore it on the inside. For instance, the floor was going this way. They had to renew several things, but the whole thing was about 265,000 francs. That's nothing for a really modern University Institute.

KOEPPEL: That was the cost in 1938?

REICHSTEIN: Yes. That was really, even at this time, very cheap. And, it was a very good Institute.

KOEPPEL: You became the head of the Institute?

REICHSTEIN: Yes. I had to teach the pharmacists. There wasn't much lecturing, but I didn't mind. I was always interested in pharmacy. My uncle was a pharmacist and when I was five years old, I worked in his pharmacy. I never had other ambitions. I was quite happy at this Institute. It was really a very nice, small institute. I went over to chemistry in 1946.

KOEPPEL: I see. This was really a pharmaceutical institute. Then you headed organic chemistry?

REICHSTEIN: That was not easy because at this time there was much opposition against the University in the population of Basel.

KOEPPEL: Why?

REICHSTEIN: They said that it means too much money, and that they needed the money for football stadiums, for sports, and for the Gewerbeschule, a school for learning a trade. (It is a very useful school.) But I told them "that is something else and I am quite convinced that you must get a new one. The old Gewerbeschule is really in a bad state, but that doesn't mean that you don't need a university." Most of the people who were to decide, the "Grosse Rat" [State Assembly], were on the whole very reasonable people but they have never studied and they didn't know what chemistry was for. They only know that there are some big chemical factories in Basel and if they are very rich, they can build their own laboratories.

I had to extend invitations to groups of these representatives and show them what we were doing, and that the Institute was not only for the rich people. Sons of workers are studying there today. Not very many, but there are quite a number. It was really worthwhile, but I spent two years on nothing else than talking to people and explaining to them what the University is for and what the Chemical Institute is for and why they should give the money which is necessary for the new Institute. The new Institute was more expensive. It cost more than ten times as much to rebuild than the Pharmaceutical Institute because we couldn't leave the walls. We had to tear everything down and erect a new building. After two years of my efforts, there was a vote and not a single one was against it. It was very hard work and in these two years I was very nervous because I also had to look after about fifty students working on their doctoral degree, spread out in different laboratories all over town. There was no institute. Well, there was an institute but it was absolutely unusable.

KOEPPEL: Did you get funds from the chemical industries?

REICHSTEIN: Some. The main part came from the city. It cost 3.7 million francs [approximately $860,000]. When it was finished, many people were invited and the people from the chemical industries told me that they would never be able to get such an institute for this price. They would have to pay at least twice as much. I had much help from the town, the architect didn't cost anything, and the technical staff was already there. They had only to mobilize it and they did it with much interest. It was very well built. It's still in a first class state now, more than thirty years later. [The new Chemical Institute was completed in 1952.]

KOEPPEL: Until when did you head it?

REICHSTEIN: 1967.

KOEPPEL: Then you retired and became a Professor Emeritus and you stayed on to do some research. I would like to ask you some questions about your work. Your first work was on sugar and Vitamin C. Could you tell us about the Vitamin C synthesis? There are so many interesting stories connected with it.

REICHSTEIN: It was my first work which was with an industrial background. In the ETH, I had no other position, just the permission to work there. And I received 300 francs per month as an assistant.

KOEPPEL: That's not much.

REICHSTEIN: It's not meant to be much. It's just a little help. You cannot live on it forever, though. At this time I was really not convinced that I would stay at the ETH because the situation was not very pleasant. I went there only because Ružička was there and I was sure that I could work with him. I have always followed the literature about vitamins and there was a formula for Vitamin C, which was first isolated by Szent-Györgyi. He's still living in America. He will be ninety.

KOEPPEL: Do you know where in America?

REICHSTEIN: I'm not quite sure. Princeton, I think. I never had any correspondence with him but I met him two or three times. He isolated it from adrenal glands, and called it hexuronic acid. He gave the correct formula for it and found out, afterwards, that it's really active in preventing scurvy in guinea pigs. It has to be tested in animals which need it besides people and apes. The rat can make its own. That's one of the reasons that people think human beings came from the tropics because the food there is very rich in Vitamin C. In my work on coffee flavors, I had to do very much with furans. There are many furans present and I did work on furans. The first formula which was published on Vitamin C contained a furan ring system. So I said, "If we worked so long on furans, why not try and synthesize this compound if it is a furan. Oppenauer, a young Austrian who unfortunately died early, came to see me. He asked whether he could do a thesis with me. I said, "Yes, on what?" He said I should suggest something. I told him that I would think about it and that among other things, would he like to try to make Vitamin C? Perhaps, if this formula was correct, he could suggest some ways to prepare it. He came the next morning and suggested about five different methods. I looked at them and told him in his case I would start this one. It's the quickest way.

KOEPPEL: Which was that?

REICHSTEIN: It was with the reaction of an osone with hydrocyanic acid.

KOEPPEL: Osone of what?

REICHSTEIN: Of xylose. Also with hydrocyanic acid. That would give us the six carbon atoms. First we made a model with glucose, got a C_7 homologue of ascorbic acid, and he started to work immediately. Then starting with D-xylose (easily available) we obtained D-ascorbic acid, the antipode of the natural product. To make L-ascorbic acid we had to start with L-xylose. This compound was not available. It had to be the L-form. It was not

really published but I could see from the results that it must be the L-form.

KOEPPEL: Was it just a guess?

REICHSTEIN: It was a guess from the rotation that was given somewhere for a degradation product.

KOEPPEL: From the natural Vitamin C that had been isolated?

REICHSTEIN: Yes, from natural Vitamin C, from the degradation product that was identified from the rotation by Haworth of the English school. They worked for many years on that and they worked rather slowly. Carefully but very slowly. Then we had to prepare the L-xylose and that is not very easy. There are methods described on how it could be done. We needed about four or six weeks, working nearly day and night to get it. All three of us, Oppenauer, von Euw, and myself, worked to get the L-xylose. We had obtained about two or three grams after four or five weeks. With this we made L-xylosone in poor yield and from this we could produce a few milligrams of the correct ascorbic acid. We published this and Karrer was, of course, upset (4). Mr. Haworth was slightly shocked but he didn't show it. He invited me to give a lecture in Aberdeen. Afterwards, I had some difficulties with him. He was not an easy man but he was quite correct.

KOEPPEL: Well, he was also a very famous sugar chemist.

REICHSTEIN: Yes. He was a great specialist. I was not a sugar chemist and I made some formulas he didn't like. I knew that the compound could be made, but this method was completely useless on a large scale. I tried to figure something else out and found the approach via sorbose, another sugar. It was promising but we couldn't tell it yet. We tried to get sorbose, but it was not available at the time. It was known that it was possible to get it from sorbitol, which is easily produced from glucose by reduction. It was already on the market. It can be made by the ton without any difficulty.

KOEPPEL: That's with hydrogen reduction?

REICHSTEIN: Yes. Just regular reduction with Raney nickel, that's the cleanest method.

KOEPPEL: A good yield?

REICHSTEIN: Yes, nearly 100% yield with no difficulty, because it doesn't introduce any new asymmetric center. It's only a reduction of an aldehyde group. To make sorbose from sorbitol, the only good way is a biological process, by oxidative fermentation. The organism which does this was not very well known. It was described as a so-called xylose bacterium. In German it is called Essigmutter, a slimy mass. It was used to produce vinegar from wine. That's exactly the same reaction when

you oxidize a hydroxyl group to an aldehyde group, or in this case, to an acid group in vinegar. I tried to get it but the organisms which I got from different places (there are laboratories which cultivate different bacteria for industrial use), degenerated into something, I don't know what. They were still alive to multiply, but they didn't produce any sorbose. Then I read an article by Mr. Bertrand, an old French chemist, who described in the 19th century how he got sorbose (5). You take some sugar, add some wine and a little water for dilution, and let it stand to attract Drosophila, the fruit fly which always has the active bacterium in its intestine. The fly carries the bacterium to the sorbitol, which will immediately be transformed into sorbose. After I read this carefully, I tried it. I made a solution of sorbitol with yeast extract--and a little wine to attract the flies. I was told by a bacteriologist that that's always good food for the bacteria. But it was already October and very cold at night. I didn't believe that any flies would come at this temperature. I put ten beakers with this liquid on the window sill of my cellar laboratory at the ETH. When I came in on Monday, they were all dried out, but the bottom of two of the beakers were full of crystals. I tested them. They were pure sorbose. In one of the beakers you could even see a drowned Drosophila. And from its body the crystals radiated out, like from the center of a star.

KOEPPEL: That's amazing.

REICHSTEIN: All I had to do was to nucleate other samples of the media and let them grow. But, it was a terrible mixture. There were not only the good bacteria but many others. I didn't mind because I knew that the mixture could stand very strong acid. I could add about two percent of acetic acid to it to reduce growth of everything but the desired reaction, which goes very well; the final yield was the same. Within two days, we could produce about 100 grams of sorbose quite easily. Afterwards, when I turned this method over to Hoffman-LaRoche, they used the bacterium which I gave them because it was the best they could get. They tried very hard to raise better strains and succeeded, I think, about a year afterwards. During the first year they could use this strain but they had to purify it, which is not difficult for bacteriologists. Then, the rest worked like the program. They really got a good yield. I brought it to Roche, and together with a friend of mine we made a contract with Roche to produce it. Still today, it's done more or less according to the same principle.

KOEPPEL: You received the patent on the method, didn't you?

REICHSTEIN: Yes, and I could finance the rest of the laboratory work from the royalties (6).

KOEPPEL: That's wonderful. You were in a way a pioneer in biotechnology.

REICHSTEIN: Yes. It was, at this time. But the chemists didn't like any bacteriological process because they knew that it was sensitive to unknown disturbances from the air, etc.

KOEPPEL: They couldn't handle that, probably?

REICHSTEIN: This was quite easy to handle. As far as I know there were no difficulties with this one. It's not as difficult as with penicillin which must be kept completely sterilized. This works even under quite dirty conditions. They now make it under sterile conditions.

KOEPPEL: It's amazing. They are still using the same process?

REICHSTEIN: Yes. There are no other means to get cheap sorbose than by a biological process.

KOEPPEL: Did you have any contact with Pauling over Vitamin C?

REICHSTEIN: No. The only contact I had with Pauling was when he needed something, some signature, or if he wanted to start good work for something.

KOEPPEL: I see, his political causes. To go back to Vitamin C, you say that Hoffman-LaRoche in Basel sponsored or was interested in your Vitamin C work?

REICHSTEIN: Yes. They bought the patent, but only to check other possibilities. Very often you can make substitutes which are not quite natural analogs. They wanted to know if there was some other analog that would even be better than Vitamin C. I had to synthesize quite a number of analogs and homologs.

KOEPPEL: Did you find any activity?

REICHSTEIN: Yes. There was some activity but none was greater. With vitamins it's difficult. A vitamin is usually the optimum. You sometimes can find some improvement to make it more resistant to degradation, because most fungi and bacteria know how to destroy a natural vitamin. If you introduce a methyl group, they can't do it anymore. But in this case, there was no reason for it to be better. There were only a few which were also active in the scurvy therapy.

KOEPPEL: But nothing special. So actually your sugar work was finished rather quickly. You published about thirty (or more) papers. Next you worked on hormones. Could we talk a little bit about that? Your main field of investigation were the hormones of the adrenal cortex--the corticotropic hormones for which you received the Nobel Prize in 1950 with Hench and Kendall.

REICHSTEIN: We always had a kind of competition with Kendall. He worked in the Mayo Clinic. Kendall was in a single way obsessed with adrenal glands like Staudinger was with polymers. He had the idea that the adrenal hormones were good for everything. You could cure every ailment and make everything with hormones. Therefore, he was just on one track. That was his strength but it was also his weakness. He did good work but we were always a little quicker. He had more material and support available. We had perhaps a little more experience on how to work with small quantities and how to use the reactions which are necessary with these hormones.

KOEPPEL: I read that you had a magic touch when it came to crystallization. I guess that played a role too.

REICHSTEIN: I liked to work in the laboratory. The problem with crystallization came just in the end with aldosterone. It was the most difficult one. Kendall called one part the amorphous fraction. That's not a very appropriate name, because there were thousands of amorphous fractions: anything which doesn't crystallize is an amorphous fraction. But the one he meant was the fraction which contained the aldosterone.

The thing for which the adrenal gland is famous is that it is necessary for life. That was known because if you take it out or if it disappears, people die; that is Addison's disease. It was lethal before these things were known. It is caused by several factors, but the main one is that the regulation of mineral salts is lost. You can keep the adrenalectomized animals alive by giving them high diets of kitchen salt. At first it was known that you could keep them alive by injecting them daily with extracts from adrenal glands. Therefore, it was shown that it was really a material matter, a "hormone" as they say today, that is responsible for the life maintaining action of the gland. Then, the second point was to get a test for it. Several tests were developed at the time I started and when Kendall did his work. There was a test developed by Swingle with adrenalectomized dogs (7). If they could keep these dogs alive by giving them daily injections with adrenal extracts, they could use these dogs to test the activity of samples and also of pure compounds. This test in dogs is mainly a response to the presence of aldosterone. There are three different active principles in the gland. In the first approach, there are more than that. One is hydrocortisone. It's the most complicated compound and this is not very active in this test. It is the most important from a medical point of view today because it's responsible for its effect as an anti-allergic agent. But to keep the adrenalectomized dog alive, the aldosterone is the most important. It is about a thousand times more active than the hydrocortisone. Kendall was trying to isolate it but never succeeded.

KOEPPEL: You crystallized it?

REICHSTEIN: We crystallized it finally in 1953 (8). The primary important work was done by two English people--Simpson and Tait. They found a test which is very specific and could be done even with extremely small quantities (9). They could test it by chromatography. They could verify the aldosterone by the place of the spots in the chromatogram. There are very many compounds and just this one is the really active one. Afterwards we worked together with Simpson and Tait. We made separations here in Basel and sent them the fraction which we thought was the correct one, but it was the wrong one. We also sent them the crystals and these were the correct ones.

KOEPPEL: Did you work together with Americans on hormones?

REICHSTEIN: No, not directly. I corresponded a great deal with Wintersteiner. He's an Austrian but he worked at Columbia. He was the first one, I think, who isolated more or less pure compounds. Then I also corresponded with Kendall. I also met him once in America. Wintersteiner was a much better chemist, but he gave it up.

KOEPPEL: Do you mean he gave up hormones?

REICHSTEIN: He gave up this work. He had even isolated cortisone (10).

KOEPPEL: But you worked on its constitutional elucidation?

REICHSTEIN: Yes. I also got it afterwards (11), but he was the first one to isolate it. He gave it up because it was inactive in the tests. He used the dog test and cortisone is inactive in that test.

KOEPPEL: Who found that it's active...

REICHSTEIN: In other tests. Kendall used what they called Ingle's Test (12).

KOEPPEL: Did he find some activity?

REICHSTEIN: He found some activity but it was much less active in his test (13).

KOEPPEL: I think Merck sponsored a lot of this work in America.

REICHSTEIN: Yes. Merck prepared the first five grams of cortisone.

KOEPPEL: I see. They eventually tested it on humans?

REICHSTEIN: Yes. When it was finished they didn't know what to do with it.

KOEPPEL: They didn't know that it was an antiarthritic drug?

REICHSTEIN: It was made because there were rumors that the Germans used such compounds for their pilots when they were attacking the troops by descending on them, a very dangerous thing.

[END OF TAPE 1, SIDE 2]

The American government then encouraged industrial enterprises to produce cortisone. Among these was Sarett and his group at Merck, who made the first five grams of cortisone. Then the war was over and they had no use for it anymore. They couldn't try it out with such pilots. Perhaps they didn't believe in it anymore. Kendall has always maintained that cortisone was good for everything. But Hench was more precise. He found that very severe arthritis is not cured but reversed in two conditions, pregnancy and jaundice. He asked himself what the reason could be for these two conditions that have nothing to do with each other. He found that in both conditions, the content of cortisone in the blood is much higher than normal and suggested that it may be worthwhile to try cortisone in rheumatoid arthritis. He applied to get some of Merck's five grams to try it out, and it worked.

KOEPPEL: Was he a doctor or a chemist?

REICHSTEIN: He was a doctor in the Mayo Clinic.

KOEPPEL: But Kendall was a chemist?

REICHSTEIN: Yes, he was a chemist. Hench tried it out on patients who were in wheelchairs and couldn't walk anymore, crippled completely. He gave them injections and they could stand up and walk. It was like a wonder.

KOEPPEL: A miracle drug.

REICHSTEIN: They found afterwards that it's not a real cure but nevertheless, it gave a clue that the condition is reversible, not irreversible. They found many other good applications and now it's produced in enormous amounts. It is also misused also because it is not quite harmless. No drug is harmless.

KOEPPEL: No. There are always side effects. When you got the Nobel Prize, that must have been quite an event. How did you learn about it? Did they send you a telegram?

REICHSTEIN: Yes, they sent something. But a friend of mine came from Sweden to tell me.

KOEPPEL: Oh, really. He knew about it already?

REICHSTEIN: He worked with us in the Pharmaceutical Institute. He worked there for a year or more. He also got it afterwards.

KOEPPEL: What was his name?

REICHSTEIN: Sune Bergstrom.

KOEPPEL: Did he get it for medicine or for chemistry?

REICHSTEIN: For both.

KOEPPEL: Did they celebrate you? There must have been quite a celebration in Basel?

REICHSTEIN: Yes. More than necessary.

KOEPPEL: More than necessary? Oh, you're too modest.

REICHSTEIN: The Nobel Prize can be very useful at times. You can get things which you otherwise wouldn't get.

KOEPPEL: You get funds. Who sponsored your hormone research? Was that the Dutch company? I thought you had some CIBA funds.

REICHSTEIN: Afterwards it was CIBA. I could make an arrangement because I was free. I had no strings attached.

KOEPPEL: They never made any suggestions or anything? There was never a conflict of interest?

REICHSTEIN: No.

KOEPPEL: Professor Reichstein, you were instrumental in the structural elucidation of cortisone and of other corticosteroids. Could you tell us a little bit about your work concerning the relationship between structure and bioactivity?

REICHSTEIN: I think it would be a little too long. There are two main (there were many more but there were two important) biological activities known at that time. One is the regulation of the mineral metabolism, in which the aldosterone is the most active compound. The other is the regulation of the carbohydrate metabolism, in which the cortisone like material is the most active. For both activities, a special chemical structure is important in the molecule, which was not known at that time: that's the oxygen atom in position 11. In order to synthesize or make a partial synthesis of such compounds, we were looking for a material which contained oxygen in the eleventh ring position. There were very few natural products with this structure. Among them are some cardiac glycosides and we therefore investigated many of them. The first reason was really to get the starting material for products like cortisone. But that did not lead to much success. When such a material was finally found, other people found other approaches which were more appropriate for industrial production, namely fermentation with special organisms which were able to introduce oxygen in this position. That's the way they are produced today, in large amounts.

KOEPPEL: That's biotechnology again.

REICHSTEIN: Yes, it's also an oxidative fermentation, but with very special organisms which are necessary.

KOEPPEL: You mentioned glycosides, which really turns out to be your next big field of interest. It's worthwhile to note that your two fields, sugar chemistry and your steroid chemistry, are combined in the glycosides.

REICHSTEIN: Yes, but usually you have very special types of sugars in glycosides. We were also interested in studying them (14).

KOEPPEL: That was pure basic research. Did you have any special goals for medicinal purposes?

REICHSTEIN: No, not directly.

KOEPPEL: Did the aglycones turn out to be cardiac active?

REICHSTEIN: Only in low order. The glycosides have much higher cardiac activity, but very few of them are really used. It's one of the examples where natural products are still used and cannot be synthesized in a reasonable way and cannot be made better by molecular modification. Some of the natural products which are used are digitoxin, digoxin, and similar products.

KOEPPEL: What are the basic starting materials? I read that you extracted the glycosides from seeds and all kinds of plant material, like digitalis.

REICHSTEIN: Yes, we investigated just as many plants as we received. They can be found in quite different families, but most work was done with Strophantus, the African genus of the Apocynaceae family where we could get the first eleven-oxygen-containing steroid compound. It was sarmentogenin. Therefore we investigated a lot of Strophantus. It was also interesting to correlate the chemical structures with the botanical classification (15).

KOEPPEL: Is that what got you into botany?

REICHSTEIN: No, I was always interested in botany because I often had to get in touch with botanists. It is very difficult to get well-identified plant material for chemical investigation. If you get plant material, you must know exactly what you are analyzing, otherwise it's worthless. It's not always easy to get well-identified material.

KOEPPEL: Did any commercially important drugs come out of this research?

REICHSTEIN: No.

KOEPPEL: Could you name trade names of hormone products that you would say you have prepared or researched?

REICHSTEIN: I was only involved in the isolation and structure proof of the adrenal cortical hormones, mainly corticosterone, hydrocortisone and aldosterone.

KOEPPEL: You also did some work on toad venoms?

REICHSTEIN: Yes, that was with some co-workers. We tried to investigate them because they are closely related to the plant glycosides and some have very similar structures, only the size of the ring is different. They contain a six membered ring instead of a five membered one. They are also rather active and probably used as a defense mechanism.

KOEPPEL: Like the cardenolides? The heart poisons? There is some interesting group that represents a defense mechanism in insects.

REICHSTEIN: Yes. Some insects can use them.

KOEPPEL: How do they use them?

REICHSTEIN: They just store them. They become poisonous. They must develop the possibility to ingest them without being killed themselves. If they can do that they become so poisonous that they are avoided by predators.

KOEPPEL: I see. But how do the predators know it? Do they smell it?

REICHSTEIN: Some of the insects also develop an ability to produce very impressive colors, such as red and yellow, and they don't hide. They display themselves and if a bird has once eaten such a thing that is red and yellow, he will know that it is not good for him.

KOEPPEL: He recognizes it? That's interesting. In botany, which has become your main field, you published a great number of papers in the past years . Was it twenty years or...

REICHSTEIN: Yes, my first little botanical paper was published in 1960.

KOEPPEL: You're actually becoming well-known in botany?

REICHSTEIN: Yes, I specialized a little in ferns.

KOEPPEL: And you have a fern garden next to your house which is your big hobby now?

REICHSTEIN: Yes.

KOEPPEL: What do you do?

REICHSTEIN: I breed them and I make hybrids in order to establish their ancestors.

KOEPPEL: I see. But you're not investigating them chemically?

REICHSTEIN: Yes, I did with some of them.

KOEPPEL: Would you use them medicinally?

REICHSTEIN: No. I did work on a special group, the so-called dryopteris, which was once used for medicinal purposes against tapeworms (16).

KOEPPEL: Oh, yes. In the form of tea?

REICHSTEIN: Yes, an extract. It is obsolete today. It's too dangerous, too toxic. But the things which are toxic can be used quite well for identifying of the plants.

KOEPPEL: Professor Reichstein, I would like to wrap this up gradually but I still have some more questions for you. We have mentioned the Nobel Prize in 1950. You also received the Marcel-Benoist Prize in 1948 and you are doctor honoris causa of seven universities. Are there any American universities among those?

REICHSTEIN: No.

KOEPPEL: Are you a member of a scientific society in the United States?

REICHSTEIN: Yes, several.

KOEPPEL: Could you name them?

REICHSTEIN: American Academy of Arts and Science and there's another Academy in New York, not chemists, and also the American Fern Society.

KOEPPEL: Do you have any special relationship with anybody in the United States, with a university, or special friends?

REICHSTEIN: Yes, there were many.

KOEPPEL: Could you name a few?

REICHSTEIN: I have very few now. Recently, I was visited by Professor Pettit from Arizona.

KOEPPEL: There must be many other people who visit you in Basel?

REICHSTEIN: Claus Hoffman from Pittsburgh, but he is also retired now.

KOEPPEL: Have you given many lectures in the United States?

REICHSTEIN: Yes. Once, in about 1946, I was in America for two months and I gave quite a few lectures. When you are invited you give a lecture in one town and it pays your ticket for the next town. Thus, you go from the East coast to the West coast and I ended up in Pasadena. I had a friend there who was in astrophysics and we went up to Mount Palomar where they now have the large telescope. At this time, there was only a very small hut on top of the mountain. The road was already finished and we took some food with us for five days. There was nobody there. He had the key and he took a small telescope with him. He worked during the night and I looked around during the day. It was probably the nicest place that I could have found. We didn't see a single soul. He worked on supernovae. He found them.

KOEPPEL: What was his name?

REICHSTEIN: Fritz Zwicky.

KOEPPEL: Oh yes. He was of Swiss origin and very well-known.

REICHSTEIN: He always had difficulties with people. He had a position at Caltech and had to spend time at a factory for rockets. He developed rockets and I think he was the one who told them how to produce these things which are used so much now.

KOEPPEL: Well, to go back to chemistry, you have, of course, published a lot. You have been prolific, with over 700 papers, partly even in English. Mainly, you published in Helvetica Chemica Acta and Pharmaceutica Act Helvetiae, some in Nature and Experientia. Are there other journals you would like to mention? Maybe you published in the United States, in the Journal of the American Chemical Society?

REICHSTEIN: No. At that time, I didn't like to publish in English. Now, I publish everything in English because normally, nobody else reads it.

KOEPPEL: Yes, I noticed, that all of a sudden, your titles appear in English! Finally, if I may ask you a few philosophical questions. First of all, you have attained a very high age and you're still in excellent shape. I wondered if you have a secret for longevity.

REICHSTEIN: There's no secret, but I think that as long as you are interested in life, and you can work, this is probably the best you can do for yourself. If you stop working and...it's not necessary to be always too active. I think you must have an interest in some activity and a focus.

KOEPPEL: You have seen a lot of changes in chemistry, from a classical approach with the structural elucidation that took years, into instrumentation. You also changed from purely chemical approaches to UV spectroscopy and other methods.

REICHSTEIN: Yes. You must of course take advantage of the possibilities which are available, if you can make a structural determination in two weeks...

KOEPPEL: ...Instead of two years. So you were comfortable with the change. Some chemists were not.

REICHSTEIN: It's not always easy to adjust to things which are going on now. But for structural determination, if you have a good friend who makes an X-ray for you, you should use it. I can't do it myself. I would not be interested in learning it. There's too much computer work.

KOEPPEL: Too mechanical? Now, one of my last questions: would you study chemistry again in its present state or would you think it had lost its appeal?

REICHSTEIN: Why not? I would probably study it more from the biological point of view, biochemistry.

KOEPPEL: But you basically really liked your field and were satisfied. One question that I had which is a touchy subject today--what do you think of animal experiments? There is so much opposition against it!

REICHSTEIN: I think one should try to perform animal experiments in a humane way. That's the most important point. Probably one could reduce quite a lot of them. Many animal experiments are already replaced by other methods.

KOEPPEL: You don't think that we can part entirely with these experiments?

REICHSTEIN: No. You can do it so the animals don't suffer too much.

KOEPPEL: It's a good trend to demand the more humane approach.

REICHSTEIN: Yes. I would think so. It's a very good trend.

KOEPPEL: I have one last question of a more technical nature. When you collect your papers, where do they go? Where are they filed?

REICHSTEIN: I have collected the papers and just bound them together.

KOEPPEL: But are your personal papers going to an archive?

REICHSTEIN: Letters, no.

KOEPPEL: You don't collect anything? You don't want to have them stored for posterity?

REICHSTEIN: No, I don't know what for.

KOEPPEL: They are not of scientific interest...?

REICHSTEIN: There are very few people who work on the same thing. The many letters which I have collected are still useful for my own use.

KOEPPEL: You haven't designated a place where they will go and be stored for historians of chemistry to have access to?

REICHSTEIN: No.

KOEPPEL: I think that should conclude our interview. Professor Reichstein, I thank you very much for agreeing to it, and giving me so much insight into your life and your work. It has been a great experience.

REICHSTEIN: Thank you very much for your interest.

[END OF TAPE 2, SIDE 1]

NOTES

1. Tadeus Reichstein, Über das offenkettige Tropin und einige seiner Homologen (Weida i Thur: Thomas und Hubert, 1924).

2. Herman Staudinger and Tadeus Reichstein, "Method of Producing Artificial Coffee Aroma." U.S. Patent 1,696,419, issued 25 December 1928 (application filed 15 October 1926).

3. Tadeus Reichstein, A. Grüssner, and R. Oppenauer, "Synthese der d- und l-Ascorbinsäure (C-Vitamin)," Helvetica Chimica Acta, 16 (1933): 1019-1033; Reichstein, Grüssner, and Oppenauer, "Synthesis of d- and l-Ascorbic Acid (Vitamin C)," Nature, 132 (1933): 280; Reichstein, Grüssner, and Oppenauer, "Eine ergiebige Synthese der l-Ascorbinsäure (C-Vitamin)," Helvetica Chimica Acta, 17 (1934): 311-328.

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