CENTER FOR HISTORY OF CHEMISTRY

CARL S. MARVEL

Transcript of an Interview
Conducted by

Leon Gortler and Charles Price

in

Wilmington, Delaware

on

13 July 1983

Carl S. Marvel
JH
3/15/96

HISTORY OF CHEMISTRY ORAL HISTORY PROJECT

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

CARL S. MARVEL

11 September 1894 Born in Waynesville, Illinois

Education

1915	A.B. and M.S., chemistry, Illinois Wesleyan University
1916	M.A., chemistry, University of Illinois
1920	Ph.D., chemistry, University of Illinois

Professional Experience

	Department of Chemistry, University of Illinois
1920-1921	Instructor
1921-1923	Associate
1923-1927	Assistant professor
1927-1930	Associate professor
1930-1953	Professor of Organic Chemistry
1953-1961	Research professor
1961-	Emeritus research professor
1961-	Professor, Department of Chemistry, University of Arizona
1940-1941	Director, synthesis program, National Defense Research Committee
1941-1944	Director, synthesis program, United States Rubber Reserve Corporation
1944-1946	Chairman, panel to synthesize anti-malarial drugs, National Research Council
1945-1947	Consultant, National Advisory Health Council
1952-1954	Consultant, National Science Foundation
1954-1964	Consultant, National Research Council
1928-	Consultant, Du Pont

Honors

1938	Elected to of National Academy of Sciences
1944	Nichols Medal, American Chemical Society
1945	President, American Chemical Society
1946	Honorary D. Sc. degree, Illinois Wesleyan University
1950	Willard Gibbs Medal, American Chemical Society
1955	Gold Medal Award, American Institute of Chemists
1956	Joseph Priestley Medal, American Chemical Society
1963	Honorary D. Sc. degree, University of Illinois

1964	International Award, Society of Plastics Engineers
1965	Perkin Medal, Society of Chemical Industry
1967	Chemical Pioneer Award, American Institute of Chemistry
1970	Dr. Honoris Causa, University of Louvain

ABSTRACT: Carl Marvel speaks about his life and career as a chemist in this interview. He begins by recalling his youth on a farm and his early education. Considerations of his undergraduate days at Illinois Wesleyan College and of his graduate studies at the University of Illinois follow. Marvel then describes his first teaching job at Illinois, his colleagues, and the workings of his department. The central portion of the interview contains extended discussions about Marvel's consulting work for Du Pont, his direction of the federal government's program on synthetic rubber during World War II, and his research on anti-malarial and chemical warfare agents. Marvel then talks about his postwar research in polymer chemistry. The interview concludes with Marvel's appraisal of his contributions to chemistry and remarks about his family, hobbies, and involvement with the American Chemical Society.

INTERVIEWERS: Leon Gortler is a chemist with an interest in history. Born in 1935, he attended the University of Chicago and then received his doctoral degree from Harvard. After doing postdoctoral work at Berkeley for a year, he began teaching at Brooklyn College in 1963. Ten years later, he became professor of chemistry. Both his historical and scientific research focus upon physical organic chemistry.

Charles Price is a chemist who received his bachelor's degree from Swarthmore College in 1934 and his Ph.D. degree from Harvard University two years later. He has taught at the University of Illinois, the University of Notre Dame, and the University of Pennsylvania. His research has focused upon the mechanisms of organic reactions and the synthesis of organic compounds. Price has published almost three hundred articles, written seven books, and edited several chemical journals. He has also consulted extensively and been president of the American Chemical Society.

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INTERVIEWED BY: Leon Gortler and Charles Price

PLACE: Du Pont Hotel
Wilmington, Delaware

DATE: 13 July 1983

GORTLER: This is Leon Gortler interviewing Carl Marvel at the Du Pont Hotel in Wilmington, Delaware, on July 13, 1983. Charles Price, a long time friend and once a colleague of Professor Marvel at the University of Illinois, is also with us.

Carl, I know that you were born in Waynesville, Illinois, on September 11, 1894. I want first to talk with you about the farm. You were, I believe, the second of four children and had three sisters.

MARVEL: That's right. One older and two younger.

GORTLER: Can you tell me a bit about your family and about growing up in Waynesville?

MARVEL: Well, I was a farm boy. My father was a native of Logan County, I guess, and my mother was a DeWitt County girl, also of a farm family. In 1878, my father bought the farm on which I was born. It's just a good Midwestern farm on what used to be called the Ridge Road, a road that has a little bit of a hill. I used to go bobsledding down the hill. There are not many hills like that one in Illinois.

PRICE: I remember when I first visited you there and found that the surrounding countryside was very flat.

MARVEL: That's right. Well, if you wanted to see the surrounding countryside, you'd go to the top of the stable. That was the highest place around.

GORTLER: Yours was a corn farm, I suppose.

MARVEL: We raised corn and wheat and oats and clover. We also raised a good many pigs and sheep. My job as a boy was to take care of the sheep, especially at lambing time. That's quite a job, because sheep are not very smart. You have to give them a good deal of attention. I tended the sheep because my father was not too well. I also milked cows.

Although I had to do plenty of chores, my family never kept me out of school. I was generally late to school, but I went every day. I walked about a mile down the road to my grade school. I rode horseback or drove a cart to my high school. It was located about four miles from my home. When the roads were particularly bad, I sometimes used to walk on the railroad ties to get to school.

I was one of the boys in the country who was allowed to go to school all the time. My dad never kept me out of school to do farm work.

PRICE: Smart man.

GORTLER: What was your father's name?

MARVEL: John Marvel.
My mother insisted that all of her family attend college. That's why I went to college.

GORTLER: How much education had you parents had?

MARVEL: Oh, nothing beyond grade school. My mother was a grade school teacher for a while.

GORTLER: She had not had a college education?

MARVEL: No. She had a brother who taught in a school in Minnesota. He advised me, when I went to college, that I ought to enroll in science. He reasoned that if I were going to be a farmer--and I expected to be one--that I should take advantage of science so as to make farming more profitable. That's how I started taking chemistry. Somehow I never stopped.

PRICE: Where did you go to college?

MARVEL: Illinois Wesleyan in Bloomington.

PRICE: When did you start there?

MARVEL: 1911. I did graduate work at the University of Illinois from 1915 through 1920.

GORTLER: OK. Let's backtrack a little bit. You said that your father wasn't too well at the time and so you had to do a lot of work on the farm. What other kinds of influences did your father have on you? Obviously he urged you to get an education.

MARVEL: And work a little bit.

GORTLER: OK. I noticed from one of the autobiographical sketches that you sent me that you went to a private school.

MARVEL: Well, the high school was a private academy, but it was soon to close its doors. When I attended it, only one teacher, an old retired Presbyterian minister, taught. I was the only graduate in my class, 1911. I can have a class reunion therefore any day that I want.
While I attended the academy, the teacher taught what he knew: Latin, Greek, German, a little mathematics, a little history, and a little English. He taught no science.

When he found out that I was going to college, he asked me to read a book on botany and a book on physics. He did so in order to grade me on those subjects. Otherwise, I could not get into college.

Actually, I got a half year's college credit for the two years of Greek I had taken. So, I started college half a year ahead of myself.

GORTLER: What about your family's finances?

MARVEL: Although we lived comfortably, we weren't very well off. Farmers in those days didn't make much money. There wasn't any trouble but we didn't have any extra money.

GORTLER: They could send you to college?

MARVEL: Yes, they did. It cost about five hundred dollars a year to go to college then. It's very different from now. (laughter)

GORTLER: Right. That was still a lot of money in those days. How about your sisters? Did they also get a college education?

MARVEL: All of them graduated from college, one from Illinois Wesleyan and two from the University of Illinois.

GORTLER: How did you happen to choose Illinois Wesleyan?

MARVEL: Oh, it was close to home. Bloomington was only about twenty-five miles away. Additionally, my sister had gone there before me. My choice of Illinois Wesleyan was a fortunate one, because I had a good teacher of chemistry there. I didn't know that when I started. I became very interested in chemistry while attending Illinois Wesleyan.

GORTLER: Tell me about Illinois Wesleyan at the time.

MARVEL: It was a small school. About three hundred to five hundred students attended it. It was also a religious school. We were supposed to go to chapel. I was a bit remiss; I didn't go very regularly.

I took science courses mostly, especially chemistry. I took botany, zoology, bacteriology, and physiology--whatever I needed to get me by. I also took some French.

PRICE: Did you study physics and math there?

MARVEL: Very little. As a matter of fact, we didn't have any physicist on the staff. Oh, I took a second degree course in physics, but I still didn't know any physics. I took a course in physics in graduate school and learned a little bit then.

PRICE: You did take calculus?

MARVEL: I took calculus but very little physics. Oh, I studied subjects like ethics and economics, but mostly I studied biology and chemistry.

PRICE: What made you decide to go to graduate school?

MARVEL: When I was in my senior year the professor of chemistry asked me, "How'd you like to go to graduate school?"

I said, "What's that?"

He told me a little bit about it and said that I could earn a fellowship to graduate school because I had good grades. He also said that the top student at Illinois Wesleyan who wants to go to graduate school would receive a fellowship to the University of Illinois.

I said, "Well, I'll talk to my father about it." I did.

My father said, "Well, if somebody's going to pay you to go to school, maybe you'd better go. You might accidentally get a good job out of that school. You'd better try it."

That's how I went to graduate school.

GORTLER: Your father was actually encouraging you.

MARVEL: Yes. He wanted me to be a farmer, but he knew that I wasn't a very enthusiastic farmer. I didn't mind becoming a farmer. In fact, I didn't think of doing anything else when I started school.

GORTLER: Who was the chemistry teacher at Illinois Wesleyan?

MARVEL: He was a fellow named Homberger, A. W. Homberger. He received his Ph.D. from the University of Illinois. He worked as a graduate student under Professor Noyes.

PRICE: W. A. Noyes, Sr.?

MARVEL: Yes, W. A. Noyes, Sr. Homberger was a very attractive person and a good teacher. He's the one who got me to like working on chemistry.

GORTLER: We'll go back to him in a moment. Were there any other people at Illinois Wesleyan who were influential in your development?

MARVEL: Well, the fellow who taught biology and who wanted me to become a medical man. He told me that I was equipped to go to medical school if I wanted. I decided, however, to be a chemist. The old professor of German was a pretty good advisor too. He was an amazing individual and very pleasant. I would say though that Homberger affected me the most. The other professors were good, but not outstanding.

GORTLER: You even did some research as an undergraduate.

MARVEL: I did. My senior research explained why beer turns turbid if not handled properly. I made glucose and maltose solutions and examined them. If the solutions were not properly sterilized, the molds in them sprouted but didn't grow. The solutions became turbid.

GORTLER: According to American Men of Science you took a master's degree at Illinois Wesleyan.

MARVEL: Yes, I got both the bachelor's and the master's degrees because I had this half year of Greek head start. So, I had extra time when I got through.

GORTLER: I see. Did you have any perceptions of being a chemist at that particular time?

MARVEL: Well, I didn't know what a chemist did. I knew that I liked chemistry. It was fun. Actually, the chemical profession started to expand in the United States just about when the World War started. The United States was short of chemicals and that stimulated the growth of the chemical industry. When I went to graduate school, demand for chemists picked up a bit, so, there was greater interest in it then. I liked chemistry. It was fun to do. As far as the future of chemistry, I didn't know where it was going. There wasn't any industrial chemistry at that time. It all developed during the time I was a graduate student, really. That's when the research laboratories began to open, the manufacture of chemicals in this country began to develop, and jobs began to become available.

Before that time, the only thing a chemist could do was teach. If he hadn't studied in Germany, he couldn't even get a teaching job. I never went abroad. After I got my Ph.D. therefore, when Adams wanted to hire me to teach at Illinois, the dean said, "Oh, you can't hire him, he never had foreign training. He's not competent."

But Adams said, "You'd better give him a chance because we need him." So, I got the job.

GORTLER: Is this the same dean who made you work so hard?

MARVEL: No, that was the dean of the graduate school, old Dean Kinley. He looked at my undergraduate records and said, "Well, you've got a scholarship and you're supposed to get an M.A. in a year. I don't think you know very much so I'm going to give you a heavy load." He did. Although teaching four units per semester was standard, he gave me five units to teach. It was a pretty heavy load because those were mainly lab courses. Yet, I got through it.

GORTLER: You did a fair amount of synthesis.

MARVEL: I did a lot of synthesis because I enjoyed it.

The ordinary student did fifteen or twenty preparations; I did sixty-five or seventy.

GORTLER: Were the labs at Illinois well equipped?

MARVEL: They contained standard laboratory equipment, nothing fancy.

I always liked to do synthetic work. During my first year at Illinois as a graduate student, Derick started what we used to call organic manufactures, that is, the making of chemicals. I wanted to work with him during that summer, but he said I wasn't experienced. I got the job the next summer, however, and then, years later, directed that work.

PRICE: That's right. Derick was the man?

MARVEL: He was then a professor of organic chemistry. He left Illinois that first year. National Aniline hired him to be its research director.

GORTLER: National Aniline?

MARVEL: National Aniline at Buffalo. Roger Adams followed him as professor of organic chemistry. Oliver Kamm was also at Illinois at the time. When I got my degree, however, Kamm left Illinois to accept a job with Parke-Davis. His departure left a place on the staff for me.

PRICE: I remember him.

GORTLER: Who was your research director during your first year at Illinois?

MARVEL: Noyes. W. A. Noyes.

GORTLER: You published with Noyes and with Kamm and with Roger Adams.

PRICE: Well, I did organic synthesis with Noyes and with Adams.

GORTLER: I see.

MARVEL: During my second year at Illinois, I shifted from being a teaching assistant to doing manufacturing work. Theoretically, I was a full-time assistant assigned to make compounds. I did that for two years. That's how I learned my chemistry.

GORTLER: That's when you were a Du Pont fellow?

MARVEL: No, I got that fellowship during my last year at Illinois.

GORTLER: I see, OK.

MARVEL: I did the manufacturing work during the war years when the government wanted stuff for the Chemical Warfare Service. I remember, for example, one assignment that we got. Adams, who was then in Warfare Service, called me and said that we needed to make three very pure one ounce samples of octane very quickly. He wanted any octane except normal octane. Nobody ever knew why the Warfare Service wanted the samples. We had to start from scratch and had only two weeks in which to complete our task. That was a pretty hectic time. We worked from eight in the morning until two the next morning.

GORTLER: How many people were involved in that project?

MARVEL: Well, I was the one who was supposed to do it. Ernie Volwiler, who was a graduate student, helped me.

PRICE: He worked for Roger Adams, didn't he?

MARVEL: Yes. Volwiler was in his last year of graduate studies at the time. He helped me to complete my task. The samples were eventually shipped to England. We never knew why the English wanted them. We simply knew that we had done war work. That occurred in the early days of the octane problem.

GORTLER: Do you remember anything about the courses that you took when you were in graduate school? Do you remember who was teaching and what textbooks were used?

MARVEL: Well, I generally worked in organic chemistry under Noyes. He had written a book.* I took biochemistry under H. B. Lewis and bacteriology under a fellow named Tanner. I remember using Cohen's Organic Chemistry as a reference book.** Adams lectured in organic chemistry and we used his notes mainly as a source of information.

GORTLER: Was it standard for all students to take bacteriology at that time?

MARVEL: No, but a good many people did. I used it as a second minor. I majored in organic and took biochemistry and bacteriology as minors. As a matter of fact, one summer while I was an undergraduate student, I did a lot of bacteriological work on my own. I classified bacteria found in spoiled foods. I bought cans that were swollen, took out the bacteria, and determined the kind of bacteria.

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* William Albert Noyes, A Textbook of Organic Chemistry (New York: H. Holt, 1903).

** Julius B. Cohen, Organic Chemistry for Advanced Students, (New York: Longmans, Green & Co., 1907-1913), two volumes. The second edition was published in 1918. It consists of three volumes.

GORTLER: I was fascinated by that article that you wrote with Homberger in which you mentioned that you had identified a mold.*

MARVEL: Yes. I was an expert on molds. When we took botany, one of the requirements of the course was to identify the flowers found in our region. The professor would occasionally bring one to class to be identified. I would always tell him what it was, because I knew the flowers. Finally, he said, "It's no use for you to do that. You pick something else to study." So, I studied mosses. I collected about forty or fifty different mosses.

PRICE: Your interest later shifted to birds, didn't it?

MARVEL: Yes it did, at about the time that I met Bob Frank. That was when I started doing war work and I didn't have time to go to the woods in order to go fishing. I found then that I could do bird watching from the train.

GORTLER: Do you remember taking any kind of advanced organic course? I guess that was in Adams's time.

MARVEL: Yes. I don't remember how many advanced organic courses there were, but I took them every year. One of Adams's specialties was the stereochemistry course. He also lectured in general advanced organic chemistry.

GORTLER: OK.

MARVEL: I also had a course that specialized in the chemistry of drugs. Adams was interested in that also.

GORTLER: Adams taught that too?

MARVEL: Yes. Practically all of my graduate work consisted of his giving lectures in organic chemistry.

GORTLER: Do you remember anything from that period about chemists' perceptions of bonding or of the atom?

MARVEL: Well, at that time Langmuir's theory was just coming out. Before that, Professor Noyes thought, for example, that nitrogen could either be a positive atom or a negative atom. If it were connected to hydrogen it would be negative; if it were connected to oxygen it would be positive. He thought that there was a difference in the nitrogens, whether they were negative or positive. If you make a cyclic aliphatic diazo compound (unintelligible) that theoretically was it.

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* A. W. Homberger and C. S. Marvel, "Rate of Turbidity in Beverages Containing Maltose, Glucose, or Maltose and Glucose," Journal of the American Chemical Society, 39 (1917): 156-162.

That's what the view was then. One of these came from an amine and the other from nitrous acid. You ought to have a plus and a minus nitrogen. That ought to make that carbon asymmetric. That's what I worked on for my thesis. I always was interested in that.

At about the same time, the octet theory of valence became important. Of course that theory didn't fit very well with the old idea the professor had. Nontheless, I kept working on my thesis topic. Professor Noyes was very disappointed when I didn't find the asymmetry of those compounds.

GORTLER: How did you happen to choose a research mentor?

MARVEL: Well, mainly because Homberger, who had worked with Noyes, suggested that I work with him. I enjoyed working with Noyes. He suggested once that I might switch to biochemistry. I said, however, "No, I'll just stay in organic."

GORTLER: Let's see, we've mentioned Noyes, Adams, Kamm, and Lewis.

MARVEL: H. B. Lewis.

GORTLER: Also Tanner. Anybody else on the staff at that time?

MARVEL: Oh, Hopkins was on the staff. Hopkins taught inorganic and G. McPhail Smith was the analytical man. Later, Beal, George Beal, was the analytical man.

GORTLER: OK. Noyes was chairman at that time?

MARVEL: He was chairman of the department. Yes.

GORTLER: Do you remember any other graduate students at the time? Who were you talking to about chemistry or anything else?

MARVEL: Well, as I said, Volwiler was a graduate student for a year or two while I was there. Then he got his degree and left. A fellow named Hufferd was a graduate student who got his Ph.D. degree. Ralph Hufferd. He later worked for the oil industry. I don't remember any other outstanding people although there were a lot of good students.

GORTLER: With whom did you talk about chemistry? Was the department at Illinois informal enough that you could talk to the faculty a lot?

MARVEL: Yes. I talked to anybody who would talk with me.

PRICE: It was always easy to talk to the faculty. That was one of the wonderful things about Illinois.

GORTLER: That's the impression I've gotten from everyone.

MARVEL: It was a very, very close family relation. Remember Ralph Connor?

PRICE: Yes.

MARVEL: He described it once. He said, "At Illinois, the faculty was like your family. You thought they were good even though you knew that they made mistakes. If anybody else said that they made a mistake, however, it made you angry and you fought them. You backed your faculty, even though you knew they were good but not perfect."

GORTLER: Connor was an Illinois man too?

MARVEL: Yes. He was an undergraduate there.

PRICE: And he taught there one summer.

MARVEL: One summer, yes.

PRICE: One summer only, I guess.

MARVEL: He worked with Fuson, did senior research, and then went to Wisconsin. He then went to Pennsylvania before he started the NDRC work. After that, he went into industry.

GORTLER: Were there seminars when you were a graduate student?

MARVEL: Yes, there were seminars. We had them for the organic courses. We also had one general seminar for the whole faculty. Each graduate student had to give one general talk to the whole faculty each year. That made us squirm a little bit, having to talk before everybody. Yet, it was a good experience.

GORTLER: Do you remember whose papers you were reading at that time?

MARVEL: In organic chemistry, I read Karl Ziegler's papers an awful lot. I had to write a big report about his work. At that time Ziegler was interested in triarylmethyls and I got quite interested in them too. I actually did a good deal of research on that topic during the first two or three years that I did research work.

GORTLER: I wondered from where that interest came. I knew that Gomberg had done work much earlier, and...

MARVEL: Well, I followed Karl Ziegler's work because I had been interested in what he'd done. He had made a compound that he claimed was a tetramethyl benzyl ammonia. I tried to make pentalkylamines, with five R groups instead of four,

and with a halogen. Doing that work led to my making the first synthetic polyethylenes that anybody ever made. At that time nobody was interested in it.

GORTLER: That was when you tried to put 5 on arsenic.

MARVEL: Yes. I did it on nitrogen, arsenic, and phosphorus. I made the first ylides of phosphorus that later became Wittig's reagent. In that series of work with the arsenic, we got a byproduct of gas from lithium ethyl. We analyzed the gas. It was ethane. You can't write a reaction that makes sense that gives a yield of all ethane. You ought to get ethane and ethylene or butane. Yet, I had practically pure ethane with just a little ethylene in it. That's when I postulated that the lithium had polymerized the ethylene. So, I made an experiment to show that it did, and I got polyethylene out of the solution. Nobody was interested in polyethylene at that time, however, so I didn't publish my results or do more research into that topic. That's why I missed having linear polyethylene to my credit and Karl Ziegler did.

GORTLER: You then had another sort of accidental experience with...

MARVEL: Bromoamines. I made bromoalkyl dialkyamines. They polymerized and gave linear products that had some ionic and some nonionic bromine. By comparing the amounts of each product I was able to tell how big the molecule was. So, I got a couple of polymers. That's how I got interested in polymers.

About that time, I started consulting for Du Pont. Elmer Bolton said to me, "Here's a reference in the English chemical literature to a reaction between sulfur dioxide and ethylene. The reaction gives a product that is polymeric." He asked, "Do you think that reaction would go?"

I said, "Certainly it's not orthodox and you wouldn't expect it to go, but if you're interested, why don't I look into it?"

Well, we couldn't work with ethylene because of pressure. We didn't use propene and butene. I worked mainly with cyclohexene first, and of course we got a good product. I worked for about ten years on reactions of sulfur dioxide with olefins.

PRICE: You were working on that when I came to Illinois.

MARVEL: Yes, I worked on that for about ten years, off and on.

GORTLER: None of those polymers were very useful?

MARVEL: Not until lately. They're very useful now. Bell Telephone uses them.

What we did was to make a polymer and to use it as the matrix around which to build other polymers. We heated

what we had made, thereby driving out the original polymer. We then placed the other polymer into the open spaces.

GORTLER: I remember, in one of these little notes, that you mentioned that you tried to make poker chips out of these polymers. I wondered why in the world you wanted to make poker chips?

MARVEL: Well, because one of the easiest ways to test a polymer is to make a mold of just the size of a poker chip.

GORTLER: I see. It had nothing to do with your interest in playing poker.

MARVEL: No. That was just the standard way of testing the polymer. We got beautiful clear chips, as clear as any chips made in a factory. There was always a star in them, however, because they decomposed a little bit. We never did stabilize them. So, they never were useful as molding resins. They were useful as resins that you wanted to discard later because they'd decompose completely and leave volatile products.

GORTLER: Let's go back a moment before we go on. You became an instructor at Illinois in 1920.

MARVEL: Yes.

GORTLER: Were there any other jobs available?

MARVEL: No. As a matter of fact, I took that job with a starting salary of about eighteen hundred dollars per year. Oliver Kamm who was also supposed to be teaching there, left before the fall semester began. Because of that, Illinois gave me a raise of two hundred dollars before I started teaching. So, I actually started teaching with a salary of two thousand dollars per year. Industry was not hiring chemists at that time. It was right at the end of the war and a lot of chemists had already been hired. Industry hadn't really begun to fully utilize them yet. So, jobs were extremely scarce in 1920.

GORTLER: Had you thought of doing anything else at that point?

MARVEL: Well, I always thought I'd be an industrial chemist. Never had any other idea. But I didn't get a job in industry at the time.

GORTLER: There was already that orientation at Illinois.

MARVEL: Yes. Industry was always well thought of at Illinois.

GORTLER: I think that's interesting because at most other institutions in this country--certainly at the ones that I

attended--chemistry students were trained to be academic chemists even though most of them eventually became industrial chemists.

MARVEL: Well, that was characteristic of most schools, but Adams was always interested in industry.

PRICE: Leon went to Chicago and Harvard. Those schools were certainly oriented towards academia!

MARVEL: I guess that about ninety percent of my own students went into industry.

PRICE: How much do you think the preps program had to do with that?

MARVEL: Well, it might have had some effect. I don't know. I was always a practically-minded chemist. I didn't like to work on anything for which I couldn't see some use.

PRICE: I agree with that.

MARVEL: I always worked on that sort of thing. I didn't want to do any research unless I was interested in it myself, and I was interested in useful things more than the others.

GORTLER: At that time you certainly considered yourself to be an organic chemist.

MARVEL: Oh yes, I was an organic chemist until after 1930 when I began to do mostly polymer chemistry. There weren't any polymer chemists around before then. Nobody knew what they were.

GORTLER: You did have some idea of what you wanted to do. I know that you had started to think about triarylmethyls.

MARVEL: Yes, well, of course I'd worked on that.

GORTLER: Yes. What other kinds of things did you want to do at that point?

MARVEL: Well, maybe drug synthesis. I tried to make some things that would be useful. I never got into that very heavily, however. I made a lot of mercury compounds because I had some ideas in that field. In fact, the first independent piece of work I ever did, my senior work, was to make organic mercury compounds, dialkyl mercuries. I became sensitive to mercury and so I had to stop that line of research. If somebody opened a bottle of mercury compound two doors down the hall, I'd get a headache.

GORTLER: That's interesting. During that period, you must have already been aware of Kharasch's work because he was also working on dialkyl mercury.

MARVEL: Yes, I knew of Kharasch's work.

GORTLER: Coming back to the general feeling about Chicago and Kharasch...

MARVEL: Oh, he was a good chemist, although he was very controversial. He was always scrapping with everybody. Kharasch was one of those fellows with whom you couldn't disagree in public. If you disagreed with something he said and asked him a question--gosh, he would be angry with you. He'd just rake you over the coals and make you feel like a horse's ass. If you went to him privately, however, you could argue about anything with him and it was all right. He was a very sensitive man.

Kharasch was a good friend of mine. I liked him and we got along fine.

GORTLER: I see. I know that there were some hard feelings between Illinois and Chicago.

MARVEL: Oh no. I wouldn't say that there were hard feelings. There just wasn't much feeling at all.

PRICE: It was very interesting to talk to Kharasch.

MARVEL: Oh yes.

PRICE: You'd get some good ideas from him. He was a very bright guy.

GORTLER: How did he and Adams get along?

MARVEL: Oh, they'd fight back and forth some, but I think that Adams respected his ability. I don't know whether he respected anybody else's ability or not.

GORTLER: I think that Adams was asked if he'd be interested in becoming the chairman at Chicago.

MARVEL: I suspect that he was. He was offered the job but he didn't want to go. He was also offered a job at Harvard, but he didn't want it.

GORTLER: Did you ever have any offers to work at other places?

MARVEL: I was offered a job at the University of Minnesota. I considered it seriously, but then decided I'd stay where I was. I had a chance to go into industry after the war as research director at Firestone. I almost did but I'm glad that I didn't. I wasn't sure that I could ever get back into the academic world if I got out of it. So, I stayed at Illinois. I was lucky.

GORTLER: When you first started, what were your duties as an instructor?

MARVEL: Oh, I taught a general course in organic chemistry to premeds. I also taught the laboratory courses. At one time or another I taught every course in organic chemistry that Illinois offered. Once established at Illinois, I usually taught the second semester of organic chemistry for chemists and chemical engineers. That was my standard, long-time job.

GORTLER: Did you have any favorite textbooks during that period?

MARVEL: No. We used Norris a good deal as a reference work.*

GORTLER: Norris?

MARVEL: Yes, Jimmy Norris from MIT. I wrote my lectures, however, from my background in research.

GORTLER: Your appointments followed an odd sequence. You were an instructor, then an associate, and then an assistant professor.

MARVEL: That was the rule at Illinois at that time: instructor, associate, assistant professor, associate professor...

GORTLER: You advanced from instructor to full professor in ten years. Was it standard practice to go up the ladder that fast at Illinois?

MARVEL: If you were good it was. (laughter)

GORTLER: I was going to ask whether you knew somebody or whether the department just recognized your abilities.

PRICE: Recognition of your abilities, wasn't it?

MARVEL: I'm sure it was because some people stayed there as associate professors until they retired.

GORTLER: OK. Tell me a little bit about Illinois during the 1920s. A lot of changes occurred.

MARVEL: Well, there were a lot of changes in 1920. In 1915 there had also been a lot of changes because of the shift in the industry. We had a lot of people come in...

GORTLER: A lot of people? What kind of people?

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*James F. Norris, The Principles of Organic Chemistry, 2nd ed. (New York: McGraw-Hill Book Company, Inc., 1922).

MARVEL: Well, I mean, a lot of the faculty went into industry. We got a new man in physical chemistry, Rodebush. We got a new man in organic chemistry, Adams. We got a new man when the head of analytical chemistry left and Beal came. The man who had been head of inorganic chemistry, Balke, left, and Hopkins took over. In chemical engineering, Parr retired and Keyes replaced him. So, there was a big turnover.

PRICE: Four of those men were still there when I arrived at Illinois.

MARVEL: Yes, but that was a new group then.

PRICE: Early twenties.

MARVEL: 1915 and the twenties. The department stabilized after all of that change. In organic we hired a lot of instructors who didn't stay. We only kept those we liked, who we thought were going to do a good job. There was a turnover in instructors for a year or two. We didn't have the system that mandated that a faculty member leave after a certain period of time if he didn't get tenure. Nonetheless, we generally managed. If we didn't think someone was going to do a good job we'd find another job for him. We'd help him move on, make him think that he was going up. We'd stay friends that way.

GORTLER: I see. An interesting approach. So, in 1920 the organic chemists were Noyes and Adams and Marvel.

MARVEL: That's right. Then we brought in others. Benny Souther, wasn't that his name?

PRICE: He wasn't there when I was there, but...

MARVEL: He was there for only a couple of years. He wasn't one that we thought we wanted to keep.

PRICE: Fuson and Shriner came to Illinois.

MARVEL: Yes.

GORTLER: When did they arrive?

PRICE: They were there in '36.

MARVEL: They came about '26, '27, I think. Well, Carothers and Jack Johnson were there. When they left, we got several others and finally we got you and Harold Snyder. You left and Bob Frank arrived.

PRICE: Bob was on the faculty before I left. Eliot Alexander took my place.

MARVEL: Yes. He died very suddenly. We didn't have him very long.

GORTLER: There was a turnover in leadership in the department too, in the mid-1920s.

MARVEL: Well, Adams became department chairman when Noyes retired. He was already the boss, however.

GORTLER: I see. Noyes was slowly pushed out?

MARVEL: Well, he just slowly passed out. I mean, he got old and wasn't so active.

GORTLER: I see. There wasn't a revolt or anything of that sort.

MARVEL: No, no, no. He'd just come to the end of his time.

GORTLER: I see, OK. I have a little note here about something that Stan Tarbell told me. I think that the first time that he went to Illinois, he was looking for Adams but he couldn't find him. You were there and you took him across the street to Farwell's for a cup of coffee.

MARVEL: Yes, that was the standard meeting place.

PRICE: Twice a day.

MARVEL: We never had faculty meetings in organic chemistry while I was there. Rather, we would sit around the coffee table at Farwell's and talk things over.

PRICE: We used matchsticks to determine who would pay for the coffee. Odd man out would pay. When we had a visitor, we always managed to stick him with the bill. We made it look honest. (laughter)

MARVEL: We were pretty good at that.

GORTLER: I see.

MARVEL: Farwell's was the standard hideout. In the morning and in the afternoon we all met there and had a cup of coffee. Lousy coffee.

PRICE: But good company.

GORTLER: Stan said that Farwell's served lousy food; nobody ever ate there.

MARVEL: It's gone now.

PRICE: It's wiped out.

MARVEL: There's some chemistry building on that corner now. They've got their own coffee in the chemistry building today. They still have the coffee sessions, but they have them in that building now.

GORTLER: Do you remember that R. B. Woodward came to Illinois one summer.

PRICE: One summer. He was an instructor for one summer.

MARVEL: He didn't like us and we didn't like him. He thought that he was out with the Indians. He felt that it was much below his dignity to work at Illinois. He didn't like to pay his bills either.

PRICE: I think that was one problem. The other problem was that he was given an eight o'clock class.

MARVEL: He didn't like that.

PRICE: He didn't like that at all. He rarely got there before 8:30 or so. I also remember that he had the office right next to the one that Harold Snyder and I used. Bob liked to smoke cigarettes but he didn't like to buy cigarettes.

MARVEL: He didn't like to spend any money.

PRICE: That's true. He didn't like to spend any money. Anyway, Harold Snyder provided him with cigarettes for quite a while until Harold finally figured out how to stop that. I don't know whether you remember. Harold had two packs of cigarettes--his own and the one that he kept on the desk that had only one cigarette in it. Bob would come in and look at the pack. He didn't quite have the gall to take the last cigarette. So, he'd leave and Harold would use his other pack of cigarettes.

MARVEL: He was a very disagreeable colleague at that time because he was unhappy at Illinois. Additionally, he didn't pay his poker debts.

PRICE: That practice hurt some feelings out there.

MARVEL: Another thing. He wanted to go to an interview once and I loaned him enough money to go. He damn near never paid me back. After he went back East I fussed about it to Adams who fussed to Jimmy Norris.

PRICE: Jimmy probably paid Woodward's debt. Later, when Woodward really established himself, he became a very different guy.

MARVEL: Yes, he grew up.

PRICE: He grew up. At first, however, he was just a kid. He was very young when he got his degree and was just damned arrogant about it. Years later, when his daughter matriculated at Penn, I used to see a lot of Bob Woodward. We got along just great. He had mellowed and I enjoyed his company.

MARVEL: Well, he was a very smart boy. There wasn't any doubt about that.

GORTLER: Yes. He just didn't fit.

MARVEL: He didn't belong out there.

PRICE: It was not the right place for him.

MARVEL: It was way out in the woods, in the sticks, for him.

PRICE: Indian country.

MARVEL: Yes, that's right.

GORTLER: Well, getting back to chemistry during the twenties, who were the people to whom you were talking? Who were the people you were reading? Who do you think were the influential organic chemists?

MARVEL: Oh, the people with whom I worked with most were Whitmore and Lee Smith of Minnesota, Conant, and of course, Gilman.

PRICE: Homer Adkins?

MARVEL: Homer Adkins.

PRICE: From Wisconsin?

MARVEL: Yes. That was the group that we were closest to. We used to trade students with all of these people. We had a good horsetrading setup. We'd give them somebody; they'd give us somebody. We'd tell our students where to go. You can't get away with that nowadays, but you could then.

GORTLER: Did you know Kohler at Harvard?

MARVEL: I knew who Kohler was but I never met him. He didn't go to meetings.

GORTLER: Yes, I know that.

MARVEL: Although I never met Kohler, Adams greatly admired him and so I heard lots about him.

PRICE: He was a great teacher.

MARVEL: He was a great teacher, no doubt about it.

PRICE: His lectures were super.

MARVEL: Excellent. I always heard that about him. If you ever discussed chemistry with a Harvard man and disagreed about something, he'd finally say, "Well, Professor Kohler says it's this way." That, by God, was the end of the argument.

PRICE: You know, Kohler was a friend of Illinois. He sent me out there.

MARVEL: Oh yes, he gave us a lot. He didn't recommend anybody who wasn't good.

PRICE: Roger, who was on the fellowship committee of the National Research Council at the time, saw my name and called Kohler. He asked if Kohler would talk to me about coming to Illinois. Well, Kohler did. He said, "You go." That was the end of it. That's all there was to it. I'd never heard of Roger Adams but I didn't argue with Peter Kohler. He knew what he was doing. He was a good guy.

MARVEL: I knew about him, but I didn't know him personally.

PRICE: I never regretted that decision. His telling me to go to Illinois was one of the best things that happened to me.

MARVEL: Well, I don't think there was ever any school that was better to its students than Illinois was in those days. We knew our students very, very well. There was very close interplay between the faculty and the students. Everybody thought that we had a factory, but we knew more about our students than most faculties did.

GORTLER: When you first joined the faculty, you had undergraduates doing research.

MARVEL: Yes, mainly.

GORTLER: When were you allowed to take graduate students?

MARVEL: Oh, about two or three years after I started. Not only was I allowed, I was forced. Adams got sick one semester and I had to supervise all of his people and all of mine. I had twenty-seven people working with me during that semester. That was a rough semester.

GORTLER: How were the graduate students supported?

MARVEL: Almost all of them were teaching assistants. Initially, we had a few fellows. Only gradually did we attract more and more fellows. I think that every faculty member in chemistry at Illinois started doing research with

assistance from undergraduates and then only gradually shifted to the senior graduate students.

PRICE: When I started, I had seniors for the first couple of years.

PRICE: The first graduate student I ever had was a fellow who wanted to work with Speed. Speed had a full group, however, and he therefore told the student, "You've got to talk to Charlie Price." That was how I got the very first graduate student that I had. That was another very wonderful thing about Illinois--the way the senior faculty helped the young faculty. All of the students wanted to work with the big names, but Roger and Speed were very adept at channeling these fellows to us. By doing that they gave us a very good start. It was very typical of Illinois.

MARVEL: Well, we got along. While I was there, there was never friction among the organic staff. Nobody ever tried to cheat anyone else.

GORTLER: Would graduate students talk to the various faculty members?

MARVEL: They were supposed to do that. Yes. If they made up their minds ahead of time...

PRICE: They came to work with Adams and Marvel, you know.

MARVEL: We had a system. They'd have to talk to all of the other faculty members.

PRICE: Roger and Speed would then push them to us. At some places, you know, everybody's out to grab students.

MARVEL: Well, we had plenty of students and we tried to see that everybody had a chance to develop.

PRICE: They were great teachers.

GORTLER: I think that you've given me the answer to this question. For a long time, Illinois was the largest producer of organic chemists in the U. S. Can you tell me how that program was built? There must have been some decisions made at some point in time.

MARVEL: No. I don't think so. We just attracted them. The boys that we used to get were hungry boys. They were mostly from the small schools and the farms. They wanted a better life than they'd had. That's what got them into chemistry. As a matter of fact, we used to have the best students in the university. We were in Dutch all the time with the faculty committtee on fellowships because we got the major share of them. It must have been because our students had the best

grades. We just had good students, wonderful students.

PRICE: Did that start before Roger Adams assumed control? Had it started with Noyes?

MARVEL: Not that much. Roger was the one who drew them. There's no doubt about that.

GORTLER: But he was really very fresh out of...

MARVEL: When he started at Illinois he'd had two or three years experience.

PRICE: You and Roger both established great rapport with faculty in other places.

MARVEL: Oh yes. We'd trade students.

PRICE: All of the small colleges in the Middle West--Michigan just has all kinds of small colleges--were pipelines to Illinois. Somehow, you and Roger...

MARVEL: We liked the faculty. We liked the kids. We took care of all of them.

PRICE: That's why people kept sending more students to you.

Marvel We took care of them. We liked them.

PRICE: It was amazing how many schools were always sending their best students to Illinois.

MARVEL: Ohio, Wisconsin, Indiana, Iowa, small colleges, all of those places, sent their good students to us.

GORTLER: Yes, that answers my question about how the program was maintained.

MARVEL: As a matter of fact, as time went on, we got more and more industrial fellowships. By the time you were there, nearly all of the third year people had fellowships.

PRICE: Yet, they all taught when they first arrived.

MARVEL: I thought nearly all of the graduate students ought to teach at least one semester for the experience.

PRICE: It was extra good experience. That's a policy that I adopted when I became chairman at Notre Dame and Penn because I thought it was a very, very good idea. It's one of the reasons why the students were so competent. They learned while teaching.

MARVEL: That's right.

PRICE: You learn two things while teaching. You learn chemistry and how to get along with people.

MARVEL: That's right, you've got to do that.

PRICE: The chemistry department at Illinois implemented another practice, which, though not unique, was nonetheless very important. It insisted that its undergraduates go elsewhere for their graduate studies.

MARVEL: Yes, that's right.

PRICE: You were therefore sending a lot of good students all over the place. That's another reason why you were able to horsetrade for other good students. I thought that was extremely wise policy. Many schools try to keep their best students.

MARVEL: I know that when Eliot Alexander came to Illinois, he fussed about that practice for a while. Eventually, he decided that it wasn't a bad idea.

PRICE: No, it's excellent. That was a very good policy.

MARVEL: A lot of our seniors were better than the first year graduate students that we got. That's why he objected. Eliot found out, however, that they grew up.

PRICE: Yes. Overall, it was very beneficial for the Illinois program.

GORTLER: Yes. Of course you were richer than other places. Faculty at a lot of other places thought that they had to keep their students just to survive. They weren't getting them from elsewhere.

MARVEL: Well, we were horsetrading.

GORTLER: That was smart.

PRICE: We didn't give them away. We were too smart to give them away.

GORTLER: While you were doing your own work did you feel at any time that you were competing with other chemists, that you were in a race?

MARVEL: Yes and no. Well, not seriously. We just went ahead and did our job.

GORTLER: OK. You just worked on the problems that interested you and if other people were...

MARVEL: I never got interested in a problem because it was "hot." I got interested because I thought it was fun.

Furthermore, there were no other people doing polymer research in those days; we were the whole business.

GORTLER: How much time were you able to spend on research?

MARVEL: I can't answer that. At the most, we had two lecture courses. The rest of the time was spent doing research. We generally worked from eight o'clock in the morning until ten o'clock at night, Saturdays and Sundays included.

PRICE: There wasn't too much else to do in Urbana. We did it because we enjoyed it. It was fun.

MARVEL: I usually went fishing on Saturday afternoon. I worked the rest of the time. It was fun.

GORTLER: You must have married relatively late in life.

MARVEL: I married and later married again and raised a family. I didn't have any family until I was forty years old.

GORTLER: Yes, that's what I meant.

PRICE: Your first wife didn't have any children?

MARVEL: No.

GORTLER: I guess it was the second wife about whom I knew. OK. How did you fund your research?

MARVEL: Illinois paid for it. We didn't have...

GORTLER: ...grants in those days.

MARVEL: We didn't have to write proposals and get money out of the government then. Nobody did. In the beginning all of the students were teaching assistants and were paid by the university. Later, we got fellowships.

The first post-doc I ever had was an interesting case. Monsanto wanted to hire a boy from Illinois. Curtis (do you remember him?) was one of the big shots at Monsanto. He called me and asked me about the student. I said, "Oh my, don't hire him. He's no good."

I got a letter from Curtis. He wrote, "That's the first time I ever had a faculty member tell me the truth about a man. How would you like to have a post-doc? Monsanto will pay for it."

PRICE: You saved him a lot of money.

GORTLER: Honesty paid.

MARVEL: You wouldn't dare do that now. The student would sue you.

PRICE: Oh yes, you have to be damn careful these days.

MARVEL: My conversation with Curtis was over the telephone.

PRICE: It might have been over the telephone, but today your call may be recorded. It's ridiculous. You have to be careful. Just don't say anything nice and then they know damn well what you mean.

GORTLER: Let's see, you began to consult with Du Pont in 1928. Had you done any consulting before then?

MARVEL: No.

GORTLER: Adams helped you to get the consulting job?

MARVEL: Well, there's an interesting story behind my getting that job. Du Pont wanted Adams to go to Wilmington every month in order to consult with them. Roger said, "That's too much travel." In those days you had to go by train. He said, "That's too much travel, I won't do it." He and Stine argued about it for some time. Finally, Roger said, "Why don't you hire two of us from Illinois, one to go one month, one the next, and we can exchange ideas at home?"

"Well," Stine said, "Who else do you have?" Roger said, "I think Marvel would do it." Stine didn't know who I was, but he said, "All right."

That's how I got my job.

GORTLER: I guess the relationships worked out all right.

MARVEL: Yes, it did. I'm still going.

PRICE: Roger consulted there for the rest of his life, didn't he?

MARVEL: Pretty nearly did. Toward the end of his life after the war, he didn't do much there.

GORTLER: Tell me about the kind of consulting you've done with Du Pont. Did you start out with the polymer group? You knew Carothers.

MARVEL: I did work with him a lot. In the early days all of my consulting involved organic chemistry. Now, it's practically all polymers.

GORTLER: I see. You were consulting with other groups besides the polymer group.

MARVEL: Yes, all organic chemists were.

GORTLER: And the kinds of problems?

MARVEL: Oh, God, I don't know. I never knew until I got down there what they were going to ask me about. I shifted my focus from Central Research to Textile Fibers, to the plastics group, to the film group, and then to the electrochemical group. At one time I was consulting thirty days a year with various parts of the company. These included Film in Buffalo, Textile Fibers in Camden, Textile Fibers in North Carolina and with the groups in Circleville and in Niagara Falls. I also worked on Dacron, but I can't remember where it's made.

During my last two years at Illinois I did too much work. I decided then just to work with Central Research. Well, now I go every other month (except during the winter) to Central Research. Sometimes, Central Research will loan me to some other part of the Du Pont Company in Wilmington. When CRD does that, some chemists come to me and I spend a half a day with them and one and a half days with Central Research. So, I do yet have contact with Camden and Textile Fibers and so on by means of this arrangement with CRD.

GORTLER: Does your consulting for Du Pont conflict with your work back in Arizona?

MARVEL: I try to avoid anything that will conflict with what I might do here for Du Pont.

GORTLER: That's always been the case?

MARVEL: That's always been the case. Du Pont sometimes paid me to do some research. Additionally, they gave me research help for a long while. One time I had thirteen post-docs working with me in Tucson. Half of them were working with Du Pont money.

I've cut down on my work load. Only three people work with me now, because I just don't want to work that hard.

I've also consulted for the Air Force and the Army for so long that they're pretty good about renewing grants. In fact, the Air Force recently sent me a proposal and wrote, "If you send this back to us, we'll fund it." So, I didn't have to write a proposal.

GORTLER: How very nice.

MARVEL: It was very handy.

PRICE: They practically said, "Do what you want to do. We'll pay for it."

GORTLER: When Du Pont gave you money for post-docs, did they expect you to work on...

MARVEL: No, I worked on whatever I wanted to work on.

GORTLER: OK, fine. I expect that kept you interested. The thirties must have been pretty exciting around here. Can you

describe some of the things that you worked on.

MARVEL: They were interested in Dacron, Nylon, and Neoprene. I learned a lot. Carothers was smart.

GORTLER: You were primarily interested in synthesizing polymers.

MARVEL: Synthesis was always my game. That's all I know.

GORTLER: There were also people like Flory, I guess, and later Mayo.

MARVEL: Physical polymer chemists.

GORTLER: There were people like Mark who measured the polymers. Mark says that there were the appliers as well--those people who figured out what to do. Did you interact with others?

MARVEL: To a considerable extent, yes. Mayo was a very good friend of mine. Mark was a very good friend. He still is.

PRICE: I saw him two months ago at a meeting in Midland. He's still in good shape.

MARVEL: He's very active. Of course, Flory did his first work with Carothers. Flory wasn't a polymer chemist until he started working for Carothers. That's where he got his start in polymer chemistry. I knew him from that time.

GORTLER: Before he became a polymer chemist was he an organic chemist or a physical chemist?

MARVEL: He was a physical chemist at Ohio State. He later became head of the department at Ohio State before he went to some southern school.

GORTLER: Du Pont was funding Mark at Brooklyn Polytechnic Institute.

MARVEL: Yes. He used to be a consultant for Du Pont.

GORTLER: I don't know why they didn't bring him here in the first place.

MARVEL: Well, I don't know either. Nonetheless, Mark didn't continue to work with Du Pont because he talked too much.

PRICE: I've often wondered how Herman managed to be the courier for the whole industry and still remain a good consultant.

MARVEL: Well, that was one reason why he didn't remain as a consultant for Du Pont. He just talked too damned much. They

liked him and all that, but they didn't want to confide in him too much. I've never had any problems with him, however. I've talked to him about whatever problems I've worked on. Some of them were very secret.

When I started to consult with Du Pont, chemists hesitated to talk to me because they thought that I'd horn in on their patents. They found that I didn't. I soon realized that I was assigned patents about which I'd made suggestions and about which I'd forgotten. Yet they put my name on the patent because I'd made suggestions. I never got any money out of patents anyway.

PRICE: I think that being tightlipped is the secret of being a good consultant.

MARVEL: Don't say anything.

PRICE: Yes. I always tried very hard not to say anything.

MARVEL: If you make a suggestion that's patentable and they want to put your name on the patent, you can't stop them. I never asked them to put my name on the patent.

PRICE: That's why I got along so well as a consultant. I'm sure that's why. They'll open up to you if they know that you're not going to try to steal their ideas.

GORTLER: Have either of you noticed that industry is beginning to cut back on academic consultants?

MARVEL: They've cut back in chemistry more than in anything else. Chemistry is just not as useful to industry as it used to be, Charlie. Organic chemistry, in particular, has suffered a hell of a lot during the last few years. We need some good new ideas.

GORTLER: That's interesting. A few years ago I asked Paul Bartlett that same question and he said, "It will come back, all we need is..."

MARVEL: We need some good new ideas. It's just not as useful as it was.

PRICE: An awful lot of bright people are going from organic chemistry to biochemistry.

MARVEL: Oh yes, that's a big field, and it's going to get bigger.

PRICE: An awful lot of good people are going in that direction.

MARVEL: There's a lot of money going into biochemistry. Du Pont is spending a lot on that. It worries me because I'm afraid they're not getting enough leadership in that field.

Organic chemists can do the work, but they need somebody who thinks biochemically to lead them. I'm afraid they don't have enough good leadership. I fuss about it every time I run into organic chemists doing biochemistry. I tell them "Get more leaders with biochemistry to help you."

Organic chemists tried to go into physics, but they never got any good physicists to work with them. So, they never did very much in physics. Don't you think so? I don't think they have. They did some good things, but never outstanding things. Their work doesn't compare with GE's, for example, in physical organic.

GORTLER: Did you notice any changes in organic chemistry, in general or at Illinois during the thirties? Were changes beginning?

MARVEL: Well, there was beginning to be more physical organic and less synthetic. As time went on, the students themselves were not as much interested in synthesis as they had been. I think that that was a mistake. Maybe I say that, however, because I'm prejudiced.

GORTLER: Was a conscious decision made to begin to hire people with a physical orientation?

MARVEL: Oh yes, to some extent. Everybody thought that you had to be a physical chemist and know the theoretical stuff involved with it. As a matter of fact, polymer chemistry has a very low standing among chemists generally. A polymer chemist, for example, just can't get elected to the National Academy.

GORTLER: Did Illinois ever have another polymer chemist besides you?

MARVEL: No.

GORTLER: You were the only one.

MARVEL: Illinois never found anybody interested in being a polymer chemist there. Nowadays, they have somebody from outside teach polymer chemistry in the summer once in a while. Additionally, several people from Illinois give summer courses in polymer chemistry elsewhere.

GORTLER: I suspect that you were the first chemist who was hired with a physical orientation.

PRICE: Yes, I was.

MARVEL: Pretty close to it. Was Alexander hired before you arrived or afterwards?

PRICE: He followed me. He was my replacement.

MARVEL: Curtin was supposed to be a physical organic chemist, but he didn't do too much with the physical side after he came to Illinois. Nonetheless, physical organic got to be the popular part of organic chemistry.

PRICE: Curtin also came after I left. He was one of my Ph.D. students.

MARVEL: He never did much.

PRICE: Right. He's smart and his work has been good, but it's been pretty...

MARVEL: Sparse. He never lived up to our expectations.

PRICE: I think that Alexander would have been a great man.

MARVEL: Oh, he would have been a ball of fire. He had great enthusiasm.

GORTLER: Do you remember from where you hired him?

MARVEL: Du Pont.

PRICE: That's what I thought. He was at Du Pont for several years.

GORTLER: Jack Roberts talked about continuously fighting with him at Harvard.

MARVEL: Yes, he was at Harvard. That's where he got his Ph.D. Did he get his degree with Cope?

GORTLER: That's what I thought.

PRICE: Maybe he was a post-doc at Harvard? That's what I thought.

MARVEL: He then went to Du Pont. I know that we hired him from the station.

GORTLER: OK. I think now that we should talk a little bit about what happened during the war years. I think that what happened then had a big influence upon what you did later.

MARVEL: Well, it turned me completely to polymer chemistry.

GORTLER: How did you happen to get involved in it?

MARVEL: Well, I was fishing in Canada and got an urgent telephone call to come home in order to work under Adams for the National Defense Research Committee.

GORTLER: When did this happen?

MARVEL: During the fall of '40 wasn't it?

PRICE: Yes.

MARVEL: That's when they set up the National Defense Research Committee and I was made the leader of its synthetic group.

PRICE: Roger was the head of that.

MARVEL: He was the head of the whole chemistry part of the National Defense Research Committee. He reported to Conant, who was head of both the medical part and the chemical part. I was supposed to lead the synthetic work, that is, manage the program and get people to work for us.

GORTLER: You worked with rubber?

MARVEL: No, not yet, not with the National Defense Research Committee in '40. Well, I didn't like that job. It stunk.

GORTLER: What sort of research were they interested in at that time?

MARVEL: Oh, chemical warfare agents and all sorts of chemistry that had to do with war work, like incendiaries. We were also going to get involved with biological things like ricins. The National Defense Research Committee told me to go to New York every Monday or to Washington every Wednesday, and so I went back and forth, back and forth. I got awful damned tired of riding five nights a week on the train. One Wednesday I had just gotten home when they called and said, "You've got to be back here Friday so that you can set up a big program on ricins." Ricins, by the way, are toxic materials made from castor beans.

I said, "All right, I'll be there." Well, I did return there. A program had been set up, personnel were ready, and money was supposed to have been authorized for the work.

Damned, however, if they didn't say, "Well, we don't have any money for the ricins program."

I then asked angrily, "Why the hell did you ask me to come back in a hurry if you didn't have any money?" I was mad as hell and I said that I wasn't going to work for them any more. I sent in my resignation. Roger didn't like that very much and Conant liked it even less. I said, however, that I was going to quit and I did. I just went down to finish work that I hadn't completed. That was in December, '41. At that time, however, I got a call from, oh, who's the fellow who used to be the Rubber Director? He was at MIT.

PRICE: Bradley Dewey.

MARVEL: That's him. He called me and said, "You've got to get over here and work on this polymer business. You're the

only organic chemist who has a reputation in polymers."

I said, "I'm tired of government work. I'm not going to do it."

He said, "You must."

I said, "Well, give me a contract for one hundred thousand dollars and plenty of men and I'll do it.

The next day he called me and said, "You have it." (laughter).

So, I had to go to work.

PRICE: That's how that rubber program got set up at Illinois.

MARVEL: That's how it started.

I got Charlie Price, Fred Wall, and Herb Laitinen to help me. We set up a big program and did a hell of a lot of good work.

GORTLER: Who were the other guys, Wall and who else?

MARVEL: Herb Laitinen, an analytical man. And Snyder, of course.

PRICE: Was Bob Frank also working on the project?

MARVEL: Yes. Bob Carlin worked with us also. All of those fellows helped. We set up a big program. We had, I guess, about one hundred people working there. We did a lot of good work, I think. I coordinated the program and did a certain amount of research as well.

GORTLER: Essentially, there was a very large group at Illinois.

MARVEL: Oh, there was a very big group. We were working with MIT.

PRICE: Avery Morton was at MIT.

MARVEL: Yes, and Flory and Debye were at Cornell.

PRICE: Minnesota, Kolthoff.

MARVEL: Yes. Kharasch at Chicago and Maron at Case. Industry assisted of course. Companies like Goodyear, Goodrich, Firestone and U. S. Rubber.

All of us in the group worked together in a very friendly, cooperative way. No one held back anything. We were told, "Now don't try to patent anything. Pass along all of your information. Publish what you've got and make it general."

That's what everyone did. They all pitched in. Nobody tried to claim any credit for any part of the work. If anyone had an idea he passed it on, and the recipient in turn passed it on. We'd meet about once a month in order to divide

the work and get the next program going. The group liked to meet in Urbana because I made better old-fashioneds than anybody else! (laughter)

As I said, it was a very cooperative and very, very unselfish program. Everyone helped and things developed surprisingly well.

During the early days of the project I said to Williams, who was coordinator from Bell Telephone, that we would produce rubber within a year. I said, "We're poor chemists if we can't do it."

Within a year we did produce rubber that was workable.

GORTLER: That's remarkable.

MARVEL: We improved it later, but we did make usable rubber within one year.

GORTLER: Did you use pilot plants or did you move your work straight from the lab to commercial-scale production?

MARVEL: We did synthesis, got the products, and sent them to the rubber companies to test.

GORTLER: I see. OK.

MARVEL: The testing was nearly all done by the four rubber companies.

GORTLER: So all the research that you were doing during those war years was primarily...

MARVEL: Synthesis.

GORTLER: Synthesis of rubber.

MARVEL: Rubbery products and other things that needed to go with it.

GORTLER: Was Charlie Overberger a part of the project?

MARVEL: He was a student of mine.

PRICE: Bill Bailey was a student too.

MARVEL: They were both post-docs in that program. We gave a job to Charlie.

PRICE: I did a little work on the mechanism of emulsion polymerization. That's all I did.

MARVEL: Bob Frank did some work on modifiers while Carlin and Norm Rabjohn did research on polymerization.

PRICE: Snyder worked on the end groups and the mercaptans.

MARVEL: We didn't know what the hell the mercaptan was in there for. It was OEI.

PRICE: One essential ingredient.

MARVEL: We didn't know why the hell they wanted it until we found out.

GORTLER: What was the...

PRICE: Laurylmercaptan regulated the molecular weight. It stopped one chain by putting hydrogen on.

GORTLER: OK, and transferred...

PRICE: And the Rs would start a new chain.

MARVEL: We'd get the right molecular weight so they could work with the middle. Nobody knew what it was in there for. You also had to have it to make that sulfate work.

GORTLER: Oh, I see. Somebody just put it in there, but nobody knew what it was doing at the time.

MARVEL: We got the information from Germany. That was a very interesting thing. The Esso people had had a little private conversation with the Germans, and they caught hell later because they cooperated with the Germans. Damn it, we got the lead on how to make synthetic rubber that way.

GORTLER: I see.

PRICE: I don't know whether the Germans knew what that did or not.

MARVEL: I don't know, either.

PRICE: It certainly wasn't known to us.

MARVEL: We didn't know what it was, but it was OEI and we had to find out. Some people thought it had to do with regulating 1,2-1,4 addition. But we found out what it was.

PRICE: It controlled the molecular weight very neatly.

GORTLER: I see, and that was work that you had done. You found that out. You knew what the ingredient was.

MARVEL: We knew what it was. We knew it was OEI. But we didn't know why it was there until we started work.

GORTLER: You were working on gases as well.

MARVEL: We were on the National Defense Research Committee.

PRICE: I worked on two other major items: chemical warfare agents and on the malaria program.

MARVEL: I got into the malaria program later. They wanted somebody to help with the work on synthesis. They asked me to take charge of the synthetic program, that is, to hire people to work on it, but not to tell them what to do. I just contracted the work.

GORTLER: I see. This was after you had started the rubber work.

MARVEL: Yes.

PRICE: We had a lot of good people working on the malaria program. Nelson Leonard worked on it and so did Virgil Boekelheide, out in Oregon.

MARVEL: Oh, that was a good group. It did damned good work.

GORTLER: Had Boekelheide come to Illinois? He went to Rochester.

PRICE: He worked with Lee Smith at Minnesota.

MARVEL: I believe so.

PRICE: And he came down and worked on our antimalarial program.

MARVEL: He was a post-doc with Adams and got into the program that way.

PRICE: He got into malarial work because he needed a deferment.

MARVEL: Yes. Well, my job was also to keep all of those boys at Illinois deferred.

PRICE: Right, and I had to work on that all the time too. By doing so, we kept people there.

MARVEL:
We only lost one man to the Army during that time. He was the one who had gotten disgusted with the work and said, "I'm going in the Army, to hell with it." He didn't want a deferment.

I remember one day that the draft board changed the rules and suddenly all deferments had to go to the appeal boards in the area. All of our fellows were reclassified as 1A, that is, as susceptible to the draft. I got very angry and called Washington. I said, "Do you want us to work or don't you? Go over and see that man and get this fixed up."

The next I heard of the matter, old Justin Lindgren,

who was on the local board, came to me and said "What the hell did you do? The state director called the local board and gave it hell."

One of the members of the local draft board then called me and said, "Will you give us a list of all the people who work out there?"

I said, "Hell, I can't write to you, that's illegal."

He said, "You give it to me at home and I'll take care of it."

We never had any more trouble getting deferments after that.

MARVEL: In fact, the department was working on war-related research one hundred percent of the time.

PRICE: I don't think I had many students there who weren't working on some war work.

MARVEL: Either that or they'd have been drafted into the Army.

PRICE: Orville Bullit was working on that. He came to work with you, didn't he?

MARVEL: Yes, but he wanted to join the armed forces. He thought he ought to do so. I had to talk to him like hell. I said, "It's more important for you to stay here and do chemistry." I finally convinced him. He came from a civic-minded family, however, and so he thought that he ought to serve in the Army.

MARVEL: Well, there was some readjustment to be made, but nothing very major. Our students were already in place and we wanted them to continue to do their work. We also had money.

PRICE: Well, of course, I left you right then.

MARVEL: There was very little transfer. We didn't notice much difference. We just kept working. Our research had a little different emphasis.

GORTLER: Roger was still chairman?

MARVEL: Well, yes. He was running around the country, but he came back. William Rose took care of things while he was gone.

GORTLER: Who took care of the department?

PRICE: William Rose, a biochemist. He was the acting chairman for the last two or three years of the war.

MARVEL: Yes, while Adams was in Washington. Adams also had to go to Germany and Japan for a while before he came back to

us.

GORTLER: You went to Germany after the war?

MARVEL: I was there for a month in late...

PRICE: The war ended in August, 1945.

MARVEL: I was over there from September to October 1945. I was still part of the American Technical Information Committee.

GORTLER: Oh, that's right. I want to come back to that. You went over there just to find out about the rubber program?

MARVEL: Well, to find out about the German industrial research program. I was on the rubber team that found out how the Germans did redox polymerization. It's a faster process. They were trying to make a continuous process. We adapted it to a lower temperature polymerization. We could do it in only about seven hours. This reduced the time of polymerization a lot.

PRICE: At lower temperature...

MARVEL: At zero degrees we got the same time cycle that we'd had before, at seventy degrees; and we made a much better rubber. It wore better. It's the synthetic rubber that we use today. What do they call it? It was GRS then; it's something else now.

PRICE: SBR.

MARVEL: SBR, yes. That's the rubber that's used even today for practically all passenger tires.

GORTLER: Supporting research after the war was quite a different thing.

MARVEL: Almost all research after the war was government-sponsored. We had to write proposals to get funding. I got some funding from the National Science Foundation, but most has been from the Army and the Air Force.

GORTLER: You were on one of the review boards. You had something to do with the NSF for a while.

MARVEL: Yes, for the first review board that I was on.

GORTLER: How did you happen to get on that review board?

MARVEL: Walter Kirner was the director. He and I were good friends. We had run the department of chemistry at Illinois during the first war. When he became director of the review board therefore, he wanted me to go and help him. He had gone

to Harvard, gotten his degree there, and was teaching when Adams and I decided that Kirner was the man we wanted for that position on the review board.

PRICE: The Illinois connection at work.

GORTLER: Absolutely amazing.

PRICE: Kirner was a good man.

MARVEL: Very good.

GORTLER: So you served on that review panel for a while.

MARVEL: Two years, I think. Two or three years, I've forgotton.

GORTLER: Almost all of your work was on polymers after the war.

MARVEL: Practically all. I worked on the rubber program from 1940 to 1945. I worked for the Air Force from '45 until about seven or eight years ago. I quit that. I had worked on high temperature stable polymers for them. PBI was my last study.

GORTLER: That's...

MARVEL: Polybenzimidazole. Celanese is now manufacturing about a million pounds of the stuff per year. It's just coming into production--while the patents are running out.

GORTLER: Do you think that they were waiting?

MARVEL: They were waiting for the opportunity to produce it. When the asbestos problem arose, they saw an opportunity to sell their stuff in place of asbestos. That's what brought it to the market. It's constructive stuff. There wouldn't have been any deaths in that airplane accident that occurred recently had PBI been used. It doesn't burn except in forty percent oxygen. Additionally, when you heat it, it doesn't give off smoke. It chars without smoking and doesn't produce any toxic fumes.

GORTLER: I see.

MARVEL: It's as comfortable as cotton.

PRICE: What does it cost?

MARVEL: Oh, about twenty dollars per pound. I don't know exactly what it would cost now, but that's what they were figuring originally.

GORTLER: How did you happen to think of putting together

those rings like that? That's a clever idea.

MARVEL: Well, we'd been working on heat-stable polymers, and the Air Force had funded a program at Monsanto to find out what synthetics would suit high temperatures better than any others. Imidazole would take a high temperature without any change better than any other carbon chemical. So I decided I'd heat the polymers and see. Making this nonflammable material was an accident. We didn't know that it was going to do that. It won't burn except in forty percent oxygen. As you know, there are rarely cases where you have that.

GORTLER: You converted completely to polymer chemistry after the war, not doing much real organic, you know, classical organic chemistry after the war. Did you realize...

PRICE: Well, you can't call it "not real organic chemistry."

GORTLER: I was going to say "classical organic chemistry." I don't want to get into trouble.

PRICE: It's real organic chemistry.

MARVEL: It's regular organic chemistry.

GORTLER: The description you just gave me of how the polybenzimidazole polymer came about obviously indicates that it came out of the organic chemistry. You understood that.

MARVEL: It's synthetic organic chemistry even though you make polymers.

PRICE: Polymers instead of monomers.

GORTLER: I thought maybe that converting your research activity almost totally to polymer chemistry was a way of insuring your students of jobs in the future.

MARVEL: Well, I wasn't necessarily worried about that. I did what I liked to do.

GORTLER: I see. OK.

MARVEL: You have about seven chances in ten, if you're in organic chemistry and go to work in industry, that you're going to work on polymers.

GORTLER: Right, OK.

MARVEL: It helps.

GORTLER: Let's see, Curtin arrived at Illinois about '49 or so--maybe in the early fifties.

PRICE: Dave Curtin came to Illinois in the late forties, I guess.

MARVEL: About the time you left, whenever that was.

PRICE: A year or two after that.

GORTLER: He had been your student, where, at Notre Dame?

PRICE: At Illinois.

GORTLER: Oh, he was your student at Illinois.

PRICE: He had a post-doc at Columbia?

MARVEL: I can't remember.

GORTLER: He was on the faculty at Columbia, I know that.

MARVEL: We then brought him to Illinois.

GORTLER: Right. And he'd made a bit of a splash there with some interesting work that he'd done. Then J. C. Martin came...

MARVEL: Yes, he was a post-doc from Harvard and stayed. Applequist and Reinhart also arrived at about that time.

PRICE: They're both still there, I guess. Is J. C. Martin still there?

MARVEL: He's going to be head of the department next year. He follows Gutowsky, who's retiring in August. Actually, it's not settled yet, at least not the latest I've heard about it. Yet, I don't think there's any doubt about it.

GORTLER: Let's see, I'm trying to remember whether Reinhart was the one who did the Grignard work with Kharasch?

MARVEL: No, that's not the one.

GORTLER: He has a son, I think, who may be at Columbia.

MARVEL: The Reinhart we had came from Yale. He was a natural products man.

GORTLER: OK. The one I was thinking of was in inorganic. In '61 you left Illinois.

MARVEL: I retired.

GORTLER: Were you at retirement age for Illinois?

MARVEL: Yes, I was within a year of the absolute required retirement. I could retire at sixty-five and I had to retire

at sixty-eight. When I was sixty-seven and down in Tucson on winter vacation, the University of Arizona offered me a job. I said, "Well, I'll think about it." I went home and found forty inches of snow in my driveway. (laughter)

PRICE: A powerful argument, wasn't it?

MARVEL: The first of March, forty inches of snow.

GORTLER: Did you teach at Arizona?

MARVEL: I did the first semester I was there, but I didn't teach after that.

GORTLER: You didn't take graduate students. You just took post-docs?

MARVEL: That's right, post-docs.

GORTLER: Essentially, you did research.

MARVEL: I could have gotten graduate students, but they were needed by the other faculty. I had money for post-docs. Why should I compete with them for graduate students? As a result, they didn't say, "Look at that old son-of-a-bitch going around here stealing my students." We got along fine.

GORTLER: You contributed to the department by stimulating research.

MARVEL: I did that and as a result the new chemistry building is now called the Carl S. Marvel Chemistry Building. I'm announcing it unofficially. It will be officially announced this coming March.

PRICE: Do they have the Marvel Lectureship down there in Arizona?

MARVEL: That's in Urbana. We have the Marvel Symposium at Arizona every other year. They use it for advertising; it works very well.

PRICE: Good publicity at the right time for the university.

GORTLER: This is a tough question because I only got your bibliography yesterday and couldn't go over a lot of your papers. Nonetheless, what do you think your most important contributions have been?

MARVEL: Training students.

GORTLER: Training the students. OK. I got that impression from some other things.

MARVEL: I don't think there's any doubt about that. Of the

products we've made, I think polybenzimidazole has been the most important industrial development. Celanese is making a million pounds of the stuff per year. It will be, I think, a useful contribution to the industry. I also found a solvent once that helped the Du Pont Co. That was useful--although just the product of good solid organic chemistry, I would say.

GORTLER: The work you did on hydrogen bonding earlier on.

MARVEL: Well, it's interesting. Nobody believed it when we started, but it does help a lot for solubility for mixes.

GORTLER: How did that come about?

MARVEL: Well, a company over in Bloomington wanted a refrigeration system that didn't involve ammonia water, because that requires too much pressure. So, we started to look for organic combinations. We got increased solubility in a number of cases that involved hydrogen bonding effects. I think that was really the first evidence that hydrogen on carbon, ammonia, and things like that would bond with organic materials and give extra solubility.

The water hydrogen bonding was well known, but the other stuff wasn't. Nobody had preached it. I talked to Rodebush, who had been one of the hydrogen bonders. He thought I was crazy, but it turned out that I wasn't. Methylene chloride, for example, bonds with the ethers. Polyethylene glycol ether gives you a good, if not an excellent, combination. It's just as good as ammonia and water, except that it's corrosive as the devil. We never could get a machine that would hold it. We got HCl and it oxidized. The HCl chewed up the machine.

GORTLER: I would have thought that would have been less corrosive than the water-ammonia system.

MARVEL: It's worse. We never could find a way to reduce the corrosion.

GORTLER: Although you've obviously been very committed to your work, you've also been involved with other activities. Remind me to refer to your ACS work. Let's talk a bit about your hunting, fishing, and bird watching.

MARVEL: I did a lot of hunting in Illinois, mostly for rabbit and quail. I never hunted big game. I used to go fishing for about a week in June and for the month of August. I went to Minnesota or Northern Wisconsin or Canada until I got a little too old to take the wear and tear.

GORTLER: You've been a very avid bird watcher.

MARVEL: I've been an avid bird watcher since 1940. Wherever I go I try to do a little bird watching.

PRICE: I heard it differently--that you'd go somewhere if they'd promise to let you do some bird watching.

MARVEL: Well, I wouldn't give a talk unless they promised that I could. I've made few trips, however, for the bird watching alone. The only time I ever did so was when Phil Walters and I went to south Texas.

GORTLER: Did you ever go to Jamaica Bay in New York City?

MARVEL: I've been there, yes.

GORTLER: A favorite place of ours.
Let's consider now your work in the ACS. When did you get really involved in it?

MARVEL: Well, Illinois was always very active in the ACS and I was involved in local matters. I was a councillor. When I ran for president the first time, I ran against Midgley. I knew I wouldn't be elected because Midgley was certain to be elected. He was. I was asked to run again and I thought it was safe to run again and yet avoid being elected. Usually, you have to run three times before you get elected. I, however, was elected on my second try. I got caught.

PRICE: I agree with your political analysis, Speed. I ran twice and didn't get elected. I thought I'd better not take a chance again!

MARVEL: Well, I thought that I could run twice and not be elected, but I was elected the second time.

GORTLER: Did being president consume much of your time? It was during the war years, too.

MARVEL: No, it didn't, because we didn't have any meetings that year. Charlie Parsons ran the society.

PRICE: Charlie Parsons.

GORTLER: He was the executive director?

MARVEL: Yes, he ran the ACS for a long time, as a dictator. He did a good job.

PRICE: He did a good job.

MARVEL: A lot of people got angry with him, but I thought that he made my job very easy. I didn't have to worry much about it. He did a pretty good job.
During my first term of service I functioned as president a little longer because Midgley died in office and I took over as president from November '44 to the end of the year.

PRICE: You had to take over for him.

MARVEL: Yes, I took over for Midgley when he died. I didn't waste much time during my first tour of service as president. I suppose I spent more time on ACS work when I was chairman of the building committee. I had to do a lot of work then. I also had to do a lot of work on a committee for the IUPAC to collect money to get Beilstein and Gmelin back into publication after the war.

PRICE: You were in charge of the committee that supervised the building of the ACS building in Washington?

MARVEL: Yes.

PRICE: Ralph Connor was chairman of the board then? He stuck you with that job, did he?

MARVEL: I tried to get out of it but I didn't.

GORTLER: You were involved also with Universal Oil Products.

MARVEL: Well, Midgley made the original contact. I was the chairman when it was completed and given to the ACS.

GORTLER: OK.

MARVEL: I didn't have much to do with that. Charlie Parsons did most of that.

GORTLER: Some years later they just sold all of that.

MARVEL: They sold that. They didn't think that it was beneficial for the society to hold on to that. They put the money that they got for it in trust.

GORTLER: You've gotten most of the awards that are given to chemists in this country. These include the Nichols, the Gibbs, the Priestley, and the Perkin. Have any of them been particularly satisfying?

MARVEL: They are all nice things to have. I'm saving all of my gold medals so that when I get old I can sell them and use that money to buy myself whiskey. (laughter)

GORTLER: You commented a little while ago about the problems of organic chemistry today. Where do you think science in general and chemistry as a whole are headed?

MARVEL: Oh, I think we'll come back. We're not doing as much as we ought. I think that the part of chemistry that deals with the life sciences is going to have a big boom. Chemistry of plant products and plant physiology is going to be a very important field, especially the part that deals with gene transfer stuff. If I were starting as a chemist today

I'd start there. It has the kind of problems and prospects that organic chemistry had when I started. Its practitioners still don't know what they're doing (although they think that they do). There's lots of good experimental work to be done. It's bound to be a big field.

Human biochemistry is pretty well understood but plant chemistry isn't. A plant at room temperature and atmospheric pressure can take carbon dioxide and water and build up carbohydrates. Why in the hell can't we? We ought to be able to do so, but we can't. We have to have pressure and temperature and all of that stuff to do it. We ought to be able to find out how to get our enzymes to work at room temperature and atmospheric pressure. Yes, we ought to be able to do it.

GORTLER: Can you picture organic synthesis being done by pouring the stuff in at the top and having it filter through a column of enzymes?

MARVEL: Well, I don't know how they're going to do it.

GORTLER: That's the general...

MARVEL: There's no reason why a human shouldn't be able to do it at atmospheric pressure and atmospheric temperature just like plants do. We ought to be able to do that.

GORTLER: Any advice for young people today, aside from going into these hot fields?

MARVEL: Do the stuff that's fun. If it isn't fun for you, don't be a chemist!

GORTLER: It worked for you.

MARVEL: It has to work. In fact, I've talked quite a few people out of chemistry, because it really wasn't enough fun for them. If it's fun, it's all right. You're having a good time. And I think in general that chemists have more fun with their profession than most people do. Don't you, Charlie?

PRICE: I think that's true. I certainly feel that way myself.

MARVEL: I think that a good chemist has fun at his work. He doesn't work; he plays. Oh, it's serious play, but still, it's a pleasure to do. You don't feel like you're being put upon to go to work.

PRICE: It's great to get paid for doing something that you want to do. It's very handy.

MARVEL: That's right.

GORTLER: I've come to the end of my list of questions. what

have I forgotten? Are there other things about which you have not written that you think would be useful for us to discuss?

MARVEL: Well, I think most of what might interest you is in the autobiography that I put together.* It's being published in Japan now.

GORTLER: I know. I wanted to get your mother's name, and your sisters' names.

MARVEL: All right. My mother was Mary Lucy Wasson. Hers was a Danish name. The original Wasson went to Scotland with King Canute. That name came down through Scotland and Ireland; it's Scotch-Irish. Marvel is a name that comes from Normandy. The Marvells went to England in 1092. Between 1670 and 1720, John Marvell came to America. On the way over he got the "l" knocked out of him, so Marvel now has only one "l" over here. In England it had two "l's".

PRICE: Well, there was a fellow named Marvel who worked for you, didn't he?

MARVEL: No, he didn't, but I knew him.

GORTLER: And your sisters were?

MARVEL: Edith was the oldest one. She was older than I was. Marie was the one nearest in age to me and Gertrude was the youngest. The first two never married. The third one married Tom Reilly.

PRICE: Any still alive?

MARVEL: My sisters are all dead. I have two children, John Thomas and Mary Catharine.

PRICE: She's called Mollie.

MARVEL: And John's called Jack. He's got three boys, Scott, Chris and Randy.

PRICE: What's Mollie doing these days?

MARVEL: She's buying for Hudson.

PRICE: She's very successful.

MARVEL: Very successful and very proud. Last December her part of the store sold a million dollars worth of goods in Detroit. That was something.

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* Copy in Marvel oral history file, Center for History of Chemistry.

PRICE: Is she married?

MARVEL: No. No, she's not married.

PRICE: Very successful.

GORTLER: And your son's a chemist.

PRICE: He got his degree at MIT, didn't he, with Cope?

MARVEL: No, with Buchi. He is the general manager and chemical director of the agricultural products division of Monsanto in St. Louis.

GORTLER: Did you ever urge him to be a chemist or did he just gravitate to that profession naturally?

MARVEL: He wanted to show that he could be a better chemist than I was. He's done pretty well at it.

GORTLER: You're a hard act to follow.

MARVEL: Well, he started college at De Pauw, Indiana, a religious school. That didn't fit his background very well however, because our family's not very religious. He was doing poorly there, getting Cs and Ds. He left De Pauw during the middle of his sophomore year and came home. I said, "What do you want to do anyway? You're not doing well over there."

PRICE: So, because he got Cs and Ds you thought that you might have to exert a little influence to get him into Illinois, Speed?

MARVEL: I said, "I think I can get you in, but if you don't do well, you will eventually get kicked out." So, I called the dean.

"Oh, no," the dean said, "he can't get in."

I said, "Let him in. If he doesn't do well, then throw him out. I'll never say a word of complaint to you."

"All right," he said, "We'll take a chance."

Son-of-a-gun, he's a straight A student since!

GORTLER: He needed a challenge.

PRICE: Doing what he wanted.

MARVEL: Well, he knew that he had to work.

GORTLER: Charlie, anything else that you want to say?

PRICE: It's been a very interesting morning for me, being here with you, Speed.

GORTLER: Well, thank you very much.

MARVEL: I hope it gives you what you want.

PRICE: I hope you always will know how appreciative I am of all that you've done for me. I wasn't a student of yours, but I learned a lot from you.

MARVEL: I learned a lot from you too. You did a lot of the mechanism of polymerization. You've got to give Mark credit for a lot of that, but you really did it.

PRICE: I've often been a little annoyed at how others got credit for many of the things that I did. I didn't pin catchy names on my discoveries. I think that accounts for my lack of recognition. If you don't invent a new name, you don't get any credit for your discovery.

MARVEL: I haven't had any reactions or anything else credited to me. I just worked.

PRICE: Well, you made a lot of contributions. I was very interested in your response when Leon asked you to tell him your major contribution. You said that it was your students. By golly, that's one of the great things that you've done for chemistry.

MARVEL: I think so, yes. I think that has been the main thing. I've interested people in chemistry and gotten them to like it.

GORTLER: That becomes an enormous legacy because it spreads.

PRICE: Yes, even though I wasn't a student of his, he had a lot of influence on me. I imagine, in addition, that he influenced a lot of young faculty members, in addition to the ones who were his own students.

MARVEL: While here at Tucson, I've also had a lot of influence. They've given me more credit, I think, than I deserve; but I'll take it! (laughter)

GORTLER: What about the mechanistic work that was done in polymerization? Do you think that helped you a lot?

MARVEL: Oh, it helped in some ways. I'm still just a plain synthetic chemist, however. I'm afraid that I don't have any theory in me.

PRICE: You have an instinct for chemistry that is unbelievable. I can remember, when I was at Illinois, that you could smell a compound and tell its functional group.

MARVEL: I don't do that any more.

GORTLER: Apparently, you developed a fantastic sense of

smell.

MARVEL: I could smell compounds and tell pretty nearly what they were. My nose was a good infrared machine.

GORTLER: That's admirable.

PRICE: He has such a tremendous instinct for organic chemistry and a wonderful instinct for how to handle human beings. Having those two things together is fantastic.

MARVEL: You know, I think my son has inherited some of that get-along with people.

PRICE: Jack is a great kid.

MARVEL: That's why he's done better at Monsanto than I ever thought he would do. He's a good chemist and he's excellent with people. He's got a lot of older men working for him who think he's wonderful. That's a good sign. They're not jealous of a young squirt coming in and directing them.

PRICE: You know, Speed, I had an interesting experience when I went to Notre Dame. I was the youngest man in the department and head of the department, and they didn't know it until the administration told them...

MARVEL: That you were coming.

PRICE: That's the kind of place a Catholic institution was, you know. The priest over there decided I was going to be head, and he just told them that fact.

GORTLER: You didn't have an interview or something with the department?

PRICE: Yes, I did, but they thought I was just going to come in as a faculty member--until they were told that I was coming in as head of the department.

GORTLER: Who preceeded you as head of the department?

PRICE: Andy Boyle.

GORTLER: There was another fellow there who had quite a reputation.

PRICE: Father Nieuwland. He had died before I got there. I never met him.

MARVEL: He was a very interesting old man, very interesting. I remember when he gave a talk at the ACS in Ohio. He was talking about his work on boron trifluoride gas. "Oh," he said, "It's wonderful. It's just like Casareets--it works while you sleep!" In those days Casareets was a pill that you

took for a cathartic when you needed it.

PRICE: Apparently he was a great guy.

MARVEL: A very human being.

PRICE: I'm sure that the background I got at Illinois came in very handy when I had to solve those problems. It worked out well. They accepted it.

MARVEL: Well, the only thing I think in general is, go and hire a department head who's anxious to be head, just so he's good.

GORTLER: I have just one more question to ask. Are you going to file your papers in some place or have you left letters at Illinois?

MARVEL: I haven't any file anywhere, even though the National Academy has some stuff. I never kept a record of my activities, so I don't have any personal files to pass along.

GORTLER: I think that if you have letters and things, you should consider leaving them with the University of Illinois or some place like that.

MARVEL: I never tried to keep them so I don't know. I think that I have most of the correspondence of the last twenty years in my files at Tucson. I don't have any of the earlier files, however. At most I may have three or four early letters lying around.

GORTLER: Well, thank you very, very much for this interview.

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