CHEMICAL HERITAGE FOUNDATION

YIXIAN ZHENG

The Pew Scholars Program in the Biomedical Sciences

Transcript of an Interview
Conducted by

Andrea R. Maestrejuan

at

Carnegie Institution of Washington
Baltimore, Maryland

on

9, 10, and 11 September 2003

From the Original Collection of the University of California, Los Angeles

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UNIVERSITY OF CALIFORNIA, LOS ANGELES

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Interviewee agrees to participate in a series of University-conducted tape-recorded interviews, commencing on or about September 9, 2003, and tentatively entitled "Interview with Yixian Zheng." This Agreement relates to any and all materials originating from the interviews, namely the tape recordings of the interviews and a written manuscript prepared from the tapes, hereinafter collectively called "the Work."

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Attention: Janice L. Reiff

If to Interviewee:

Yixian Zheng
Department of Embryology
Carnegie Institution of Washington
115 West University Parkway
Baltimore, Maryland 21210

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YIXIAN ZHENG

Born in Chongqing, China

Education

1984	B.S., Biology, Sichuan University, Sichuan, China
1992	Ph.D., Molecular Genetics, Ohio State University, Columbus, Ohio

Professional Experience

University of California, San Francisco, California
1992-1996 Postdoctoral Fellow

Southwestern Agricultural University, Sichuan, China
1984-1987 Lecturer

Johns Hopkins University
1996-2002 Adjunct Assistant Professor, Department of Biology
2000-2002 Adjunct Associate Professor, Department of Biology

Carnegie Institution of Washington, Baltimore, Maryland
1996-present Staff Member, Department of Embryology

Johns Hopkins University School of Medicine
2000-2002 Adjunct Assistant Professor, Department of Molecular Biology and Genetics
2000-2002 Adjunct Associate Professor, Department of Molecular Biology and Genetics

Howard Hughes Medical Institution
2000-present HHMI Investigator

Honors

1997-2001	Pew Scholars Program in the Biomedical Sciences Grant
1997-2006	NIH R01 Research Grants (Awarded by NIGMS)
1999	Women in Cell Biology Award, the American Society for Cell Biology
2000-present	HHMI Investigator, Howard Hughes Medical Institution

Selected Publications

Zheng Y, Jung MK, and Oakley BR. (1991). -tubulin is present in *Drosophila melanogaster* and *Homo sapiens* and is associated with the centrosome. *Cell* 65, 817-823. (cover image)

Zheng Y, Wong ML, Alberts B, and Mitchison TJ. (1995). A-tubulin ring complex from the unfertilized egg of *Xenopus laevis* can nucleate microtubule assembly in vitro. *Nature* 378, 578-5 83. (News and Views: *Nature* 378, 555-556)

Wilson PG, Zheng Y, Oakley CE, Oakley BR, Borisy GG, and Fuller MT. (1997). Differential expression of two -tubulin is oforms during gametogenesis and development in *Drosophila. Developmental Biology* 184, 207-221.

Dictenberg JB, Zimmerman W, Sparks CA, Young A, Vidair C, Zheng Y, Carrington W, Fay FS, Doxsey SJ. (1998). Pericentrin and -Tubulin Form a Protein Complex and Are Organized into A Novel Lattice at the Centrosome. *Journal Cell Biology* 141, 163-174.

Martin O, Gunawardane R., Iwamatsu A, and Zheng Y. (1998). Xgrip109: A -tubulin associated protein with an essential role in TuRC assembly and centrosome function. *Journal of Cell Biology* 141, 675-687.

Moritz M, Zheng Y, Alberts B, and Oegema K. (1998). Recruitment of the -tubulin ring complex to *Drosophila* salt-stripped centrosome scaffolds. *Journal of Cell Biology* 142, 77 5- 786.

Zheng Y, Wong ML, Alberts B, and Mitchison T. (1998). Purification and assay of tubulin ring complex. *Methods in Enzymology* 298, Part B, 218-228.

Field CM, Oegema K., Zheng Y, Mitchison T, and Walczak CE. (1998). Purification of Cytoskeletal Proteins Using Peptide Antibodies. *Methods in Enzymology* 298, Part B, 52 541.

Oegema K, Wiese C, Martin OC, Milligan RA, Iwamatsu A, Mitchison T, and Zheng Y. (1999). Characterization of Two Related *Drosophila* -tubulin Complexes that Differ in Their Ability to Nucleate Microtubules. *Journal of Cell Biology* 144, 721-733.

Wiese C and Zheng Y. (1999). -Tubulin Complexes and Their Interaction with Microtubule Organizing Centers. *Current Opinion in Structural Biology* 9, 250-259

Wilde A and Zheng Y. (1999). Stimulation of Microtubule Aster Formation and Spindle Assembly in *Xenopus* Egg Extracts by the Small GTPase Ran. *Science* 284, 1359-1362. (News Focus: *Science* 284, 1260-1261, 1999) (Commentary: Desai and Hyman, *Current Biology* 9, R704-707, 1999)

Wiese C and Zheng Y. (2000). A New Function for the -tubulin Ring Complex as a Microtubule Minus-end Cap. *Nature Cell Biology* 2, 358-364. (News and Views: *Nature Cell Biology* 2, E93-E96)

Zhang L, Keating T, Wilde, A, Borisy G, and Zheng Y. (2000). The Role of Xgrip210 in Tubulin Ring Complex Assembly and Centrosome Recruitment. *Journal of Cell Biology* 151, 1525–1535.

Gunawardane R, Martin O, Cao K, Zhang L, Dej K, Iwamatsu A, and Zheng Y. (2000). Characterization and Reconstitution of Drosophila -Tubulin Ring Complex Subunits. *Journal of Cell Biology* 151, 1513–1523.

Gunawardane R, Lizarraga S, Wiese C, Wilde A, and Zheng Y. (2000). -Tubulin Complexes and Their Role in Microtubule Nucleation. In *The Centrosome in Cell Replication and*

Early Development. pp 55-73. Academic Press (Book).
Gunawardane RN, Lizarraga SB, Wiese C, Wilde A, and Zheng Y. (2000). -Tubulin Complexes and Their Role in Microtubule Nucleation. *Current Topics in Developmental Biology* 49, 55-73.
Wilde A, Lizarraga S, Zhang L, Wiese C, Gliksman N, Walczak C, and Zheng Y. (2001). Ran stimulates spindle assembly by changing microtubule dynamics and the balance of motor activities. *Nature Cell Biology* 3, 22 1-227. (News and Views: *Nature Cell Biology* 3, E1-E3)
Wiese C, Wilde A, Adam S, Moore M, Merdes A, and Zheng Y. (2001). Role of Importin- in Coupling Ran to Downstream Targets in Microtubule Assembly. *Science* 291, 653-656. (News and Views: Walczak, *Nature Cell Biology* 3, E69-70, 2001)
Gunawardane RN, Zheng Y, Oegema K, Wiese C. (2001). Purification and reconstitution of Drosophila gamma-tubulin complexes. *Methods in Cell Biology* 67, 1-25.
Lizarraga SB, Zheng Y, Wilde AR. (2002). Characterization of the effects of RanGTP on the microtubule cytoskeleton. *Methods in Molecular Biology* 189, 247-260.
Gunawardane R, Martin OC, and Zheng Y. (2003) Characterization of a new TuRC subunit with WD repeats. *Molecular Biology of the Cell* 14, 1017-1026.
Tsai MY, Wiese C, Cao K, Martin OC, Donovan P, Ruderman J, Prigent C, and Zheng Y. (2003) A Ran-signaling pathway mediated by the mitotic kinase Aurora A in spindle assembly. *Nature Cell Biology* 5, 242-248.
Li HY, Wirtz D, and Zheng Y. (2003) A mechanism of coupling RCC1 mobility to RanGTP production on the chromatin in vivo. *Journal of Cell Biology* 160, 635-644.
Li HY, Cao K, and Zheng Y. (2003) Ran in spindle checkpoint: a new function for a versatile GTPase. *Trends in Cell Biology* 13, 553-557.
Cao K, Nakajima R, Meyer HH, and Zheng Y. (2003) The AAA-ATPase Cdc48/p97 regulates spindle disassembly at the end of mitosis. *Cell* 115, 355-367. (Commentary: Cheeseman and Desai, *Current Biology* 14, R70-72, 2004)
Ems-McClung SC, Zheng Y, Walczak CE. (2004) Importin / and Ran-GTP Regulate XCTK2 Microtubule Binding through a Bipartite Nuclear Localization Signal. *Molecular Biology of the Cell* 15, 46-5 7.
Kawaguchi S and Zheng Y. (2004) Characterization of a Drosophila Centrosome Protein CP309 That Shares Homology with Kendrin and CG-NAP. *Molecular Biology of the Cell* 15, 37-45.
Li HY and Zheng Y. (2004) Mitotic phosphorylation of RCC1 is essential for RanGTP gradient production and spindle assembly in mammalian cells. *Genes and Development* 18, 5 12-527.
Cao K and Zheng Y. (2004) The Cdc48/p97-Ufd1-Npl4 Complex: Its Potential Role in Coordinating Cellular Morphogenesis during the M-G1 Transition. *Cell Cycle* 3, 422-424.
Li HY and Zheng Y. (2004) The Production and Localization of GTP-Bound Ran in Mitotic Mammalian Tissue Culture Cells. *Cell Cycle* 3, 993-995.
Ducat DC and Zheng Y. (2004) Aurora kinases in spindle assembly and chromosome segregation. *Experimental Cell Research* 301, 60-67.
Nakajima, R, Tsai, M-Y, and Zheng Y. (2004) Centrosomes and Microtubule Nucleation, *Encyclopedia of Biological Chemistry* 1, 372-376. W. J. Lennarz and M. D. Lane (Ed),

Elsevier Inc.
Zheng Y. (2004) G Protein Control of Microtubule Assembly, *Annual Review of Cell and Developmental Biology* 20, 867-894.
Tsai, M-Y and Zheng Y. (2005) Aurora A Kinase-Coated Beads Function as Microtubule-Organizing Centers and Enhance RanGTP-Induced Spindle Assembly. *Current Biology* 15, 2156-2163.
Vong, QP, Cao K, Li HY, Iglesias PA, and Zheng Y. (2005) Chromosome Alignment and Segregation Regulated by Ubiquitination of Survivin. *Science* 310, 1499-1504. (Perspective: Earnshaw, *Science* 310, 1443-1444)
Tsai M-Y, Wang S, Heidinger JM, Shumaker D, Adam SA, Goldman RD, and Zheng Y. (2006) A Mitotic Lamin B Matrix Induced by RanGTP Required for Spindle Assembly. Science 311, 1887-1893. (Published on line March 16, 2006).

ABSTRACT

Yixian Zheng was born and raised in Chongqing, the Sichuan province of China, the elder (by about nine years) of the family's two daughters. Both of her parents were professors at Chongqing University—her mother in metallurgy and her father in mechanical engineering—her extended family members were, predominantly, farmers and other tradesmen. She went to elementary school on the campus of Chongqing University with dreams of becoming a writer like her father had been before settling into engineering. The end of the Cultural Revolution in the 1970s brought about a radical change in Zheng's education as there was much competition to get into college; ultimately she decided to pursue science and technology instead of writing as a career path.

She entered Sichuan University in Chengdu intent on studying biology, which, at the time, had more of a relationship, in her mind, to forestry and being outdoors. While there, Zheng was very active in extracurricular activities and became interested in cell biology after taking a course with an influential professor, Wenshi Pan. When she had not made a decision on her plans after graduation, Zheng went to work for Southwestern Agricultural University in Chongqing as an instructor for two years. Upon encouragement from her father, who, at the time, was a visiting professor in the United States at the University of Akron in Ohio, Zheng took the Test of English as a Foreign Language (TOEFL) and then applied for admission to Ohio State University's graduate program. After being accepted, she worked in Berl R. Oakley's laboratory and determined that science was her calling; her graduate thesis focused on gamma tubulin and centrosome function. Zheng completed her doctorate and took a postdoctoral position in Bruce Alberts's laboratory at the University of California, San Francisco, where she continued research on centrosome function and purification of the gamma tubulin complex. Zheng and her husband, Max Q.B. Guo, who was also a scientist, then had to deal with the two-body problem; Zheng accepted a position at the Carnegie Institute of Washington in Baltimore, Maryland and her husband came along to finish his postdoctoral research. At the Carnegie Institute, her research on microtubules led to a collaboration with Douglas E. Koshland.

At the end of the interview, Zheng speaks about her greatest strengths in research; the manner in which she sets research priorities; and her future research. Additionally, she discusses issues such as competition in science, generating new research ideas, and the qualities of a good science. Both technology and the choice of her model system have influenced her research, and Zheng explores both factors at length. She also talks about other aspects of being a principal investigator, including her research process, tenure, grants, teaching, and balancing family with career. Lastly, Zheng discusses the impact the Pew Scholars Program in the Biomedical Sciences has had on her work.

UCLA INTERVIEW HISTORY

INTERVIEWER:

Andrea R. Maestrejuan, Interviewer, UCLA Oral History Program. B.S., Biological Sciences, University of California, Irvine; M.A., History, University of California, Riverside; C. Phil., History, UCLA.

TIME AND SETTING OF INTERVIEW:

Place: Zheng's office, Carnegie Institute of Washington.

Dates, length of sessions: September 9, 2003; September 10, 2003; and September 11, 2003.

Total number of recorded hours: 5.0

Persons present during interview: Zheng and Maestrejuan.

CONDUCT OF INTERVIEW:

This interview is one in a series with Pew Scholars in the Biomedical Sciences conducted by the UCLA Oral History Program in conjunction with the Pew Charitable Trusts's Pew Scholars in the Biomedical Sciences Oral History and Archives Project. The project has been designed to document the backgrounds, education, and research of biomedical scientists awarded four-year Pew scholarships since 1988.

To provide an overall framework for project interviews, the director of the UCLA Oral History Program and three UCLA faculty project consultants developed a topic outline. In preparing for this interview, Maestrejuan held a telephone preinterview conversation with Zheng to obtain written background information (curriculum vitae, copies of published articles, etc.) and agree on an interviewing schedule. She also reviewed documentation in Zheng's file at the Pew Scholars Program office in San Francisco, including Zheng's proposal application, letters of recommendation, and reviews by Pew Scholars Program national advisory committee members.

ORIGINAL EDITING:

Carol Squires edited the interview. She checked the verbatim transcript of the interview against the original tape recordings, edited for punctuation, paragraphing, and spelling, and verified proper names. Words and phrases inserted by the editor have been bracketed.

Zheng did not review the transcript. Consequently some names remain unverified.

Carol Squires prepared the table of contents and TechniType Transcripts compiled the guide to proper names.

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INTERVIEWEE: **Yixian Zheng**

INTERVIEWER: **Andrea Maestrejuan**

LOCATION: **Carnegie Institution of Washington**
Baltimore, Maryland

DATE: **9 September 2003**

MAESTREJUAN: Good morning. It's September 9th, 2003, and I'm Andrea Maestrejuan with Yixian Zheng at her office at the Carnegie Institution [of Washington], Department of Embryology, in Baltimore to conduct her oral history interview for the Pew Scholars Program in the Biomedical Sciences. We'll start off at the very beginning and I'll ask you when and where you were born.

ZHENG: I was born in China, Sichuan province. The city I was born in is Chongqing.

MAESTREJUAN: Where is that city?

ZHENG: Let's see. Well, do you know Sichuan province, which is in the southwest part of China? Chongqing is sort of in the middle of Sichuan. I think one thing that most people know is that there are three so-called furnaces, cities that are also called furnaces, one of them is Chongqing. That just means it's extremely hot and humid in the summer because it's surrounded by mountains, and there are two rivers flowing through the city. So you are steamed in the summer.

MAESTREJUAN: Were you raised there as well?

ZHENG: Yes, I grew up there.

MAESTREJUAN: Tell me a little bit about your family background. Were your parents from this part of China?

ZHENG: Yes. Both of my parents [Changqi Zheng, Ruanying Lou] are from Sichuan province. They were actually born and raised in a smaller town next to Chongqing. In those olden days the roads were bad. It's about a five-hour car ride, five-hour train ride, something like that. That city

actually is famous for its liquor. One brand of very famous liquor in China is produced in that city, so every summer if you go to that city, you'll smell those grains that people dry on the street, and that's used for producing this liquor.

Anyway, they grew up there, and they both got their college education and then they both became teachers, or professors as we would say now, in Chongqing University. It's one of the pretty good universities in China. My father [Changqi Zheng] is a mechanical engineer; my mother [Ruanying Lou] is a metallurgist.

MAESTREJUAN: Had they come from families that had a tradition in education or going to college?

ZHENG: No. Well, actually, my father comes from a family with a tradition in education. My father's father had a college education; that was pretty rare in China. He graduated from the same university I graduated from. His father actually was principal of a little school that the father himself established in a very rural part of that city where my father grew up. My father's family has a pretty strong tradition in education, but unfortunately, due to the unstable society during that period, among my father's many brothers and sisters, only my father got a college education. Most of my father's brothers and sisters still live in the countryside. They're farmers. They didn't manage to get any education due to the Cultural Revolution. It was just terrible.

My mother's side, though, both of my grandparents [Zhichen Lou and Mongyun Ruan], they didn't have any. I think my grandfather [Zhichen Lou] probably had an education. He probably finished elementary school. My grandmother [Mongyun Ruan], I would say she's illiterate. She can only recognize a few Chinese characters. My mother was the only one among her many brothers and sisters to get a college education. But I think my grandparents really respect educated people. They really supported my mother to do it. Even though, in those days, the family was so poor, they still just didn't say, "Well, why don't you stay home so you can make money and help the family?" They said, "If you have the ability, go. We'll be okay." So I think that reflects that they do respect education, although they are not particularly that keen themselves.

MAESTREJUAN: What did your mother's parents do for a living?

ZHENG: Well, my grandfather, he has his own shop making—I think—noodles. In China you make noodles, but those are raw. People will buy raw noodles. He's got a shop, and he bought some land in the countryside and he sells grains. He has his own little business. After the Communists took over, he worked in the factory. That's all he did. My grandmother never worked. She helped the home business before the Communists. After that, she essentially just stayed home, raised all the grandkids. My grandmother raised me for about eight years.

MAESTREJUAN: Do you have any siblings?

ZHENG: Yes, I have one sister [Wanlan Zheng].

MAESTREJUAN: Older? Younger?

ZHENG: Younger, much younger, about eight or nine years younger than I am.

MAESTREJUAN: What does she do and where does she live?

ZHENG: That's an interesting thing. My sister is deaf. She was born with congenital heart disease. Then when she was one and a half, she became deaf because the doctors who treated her various health problems had used antibiotics. Now it's banned from use, and actually damages your hearing nerve. So she cannot hear. She's essentially a deaf-mute. Now she's going to Gallaudet [University]. She's getting a college education. That's sort of one of the dreams that she always had. She always felt bad that I, her sister, got educated to the highest level; whereas, if she had stayed in China, in those days, in those years, she probably wouldn't even get a college education. I think now it's changing, but she's thirty. Actually, that's one of the reasons my father immigrated here when he was fifty-seven or fifty-eight. He started to work in a company. And now my sister is going to college.

MAESTREJUAN: Great. Did your parents both get PhD's?

ZHENG: No. Very few people—none, I would say probably—who have not left China to go abroad to get an education got a PhD because it wasn't offered. It was only offered, I think, in '84. During the middle eighties, the PhD-master's program was reestablished. Before that, there was only college education.

MAESTREJUAN: Both of your parents taught at the university level then.

ZHENG: Oh, yes. In China the system is somewhat different. In their generation, you got your bachelor's degree, then you were assigned to different places. My father graduated from Chongqing University, so he was able to stay in the university. I think if you are the best of your class, a few of those [people] got to stay in the university. My mother graduated from a different university, but since they had a relationship, my mother was assigned to Chongqing University.

In China, in those days, you first start as what we call assistant professor, and then you get promoted. Well, I'm not really sure what exact system they have. I think you first start by teaching; you do mostly teaching. Then maybe after many years, you'll be promoted to associate, and then maybe professor. But it's really a long process. In my memory, professors were very, very rare. The whole university probably had just a handful.

After the Cultural Revolution, the system started to become more westernized, so then you got to do some research. Then, the country would have certain committees to decide who could be a professor, [who] can have either a masters student or a PhD student. If you are not good enough, you may not even be a professor that could get either a master's student or a PhD student. My father was able to supervise PhD students. He had a pretty well-known lab in China.

MAESTREJUAN: So his work involved more than just giving lectures?

ZHENG: Oh, yes. He had his own research lab. He had a pretty big research laboratory; it's called a key laboratory in his area in China.

MAESTREJUAN: You said that he was a mechanical engineer?

ZHENG: Yes. He does design and research in gears, in transmissions. It's quite useful in various aspects of industry.

MAESTREJUAN: And your mother. How common was it for a woman to teach at the college level?

ZHENG: It's pretty common, in my recollection. My friends' parents were usually both college professors—I would say assistant professors—during the time I was growing up, assistant or associate professors. So it was not a big deal that your mother would also work and would also make about the same amount of money as your father. I think as a girl growing up in that environment is really good. I never felt I would be different because I was a girl in the professional world. That, I think, is the best thing.

MAESTREJUAN: Was she active in research in metallurgy?

ZHENG: She had her research program, but after she had my sister, it was a huge burden and

they [parents] were both very, very frustrated and stressed out by raising a sick child. My sister was sick all the time, as far back as I can remember. My mother took a lesser role in her career. Also, she felt she was not as good in terms of doing research. I think it's not because she's a woman. I think it's true. I think I also feel that way. My father is stronger in research, but she is much better at studying. She could make As all the way through, but my father had better ability in doing research. I think they made a choice that my mother would be spending more time at home so my father would focus more on his work. Somehow, at least in *my* parents' case, I don't think that's because she was a woman and he was a man. I don't think that's the case. But I can't say for other families.

MAESTREJUAN: Right. What expectations did your parents have for you, in terms of educational achievement and career?

ZHENG: Pretty high. It's very high. My parents always thought I should always try my best to make the highest grades. I'm afraid I never really made them satisfied. I never really was able to make a lot of As. I always felt kind of happy with B, B+. [laughs] So my parents would always be very, very distressed about me not really trying my best. They would just complain, "You could have easily fixed that mistake. Why didn't you?"

MAESTREJUAN: What were the consequences when you didn't bring home the As?

ZHENG: Oh, my father would lecture me on and on and on about how he was diligent, about how if he made one mistake in his exam, he would just go back, study that problem. He would then remember for years where that problem was, on what page, in what book. I remember it so clearly. He would just go on and on. [laughs] But somehow I just never paid a whole lot of attention. Now whenever I talk to my son [Benjamin Guo], I always tell him, "I have to let you know I wasn't such a great student, even though I lecture you." [mutual laughter]

MAESTREJUAN: When you were growing up, if somebody asked you, "What are you going to be when you grow up?" what would you say?

ZHENG: I always wanted to have a life that was more exciting than my parents' life. I never felt my parents' life was very exciting. My impression—or whatever I could see when I was a child—I saw my parents sitting in front of their desk, writing day in and day out. What's fun in that? I hated it. I had this dream of just going out, just spending a lot of time outdoors and getting to know the world, getting to know all kinds of lives people are leading. I had a really big dream of becoming a writer when I was going through my teenage years, and also even in college. But here I am, not a writer.

MAESTREJUAN: What kind of encouragement did your parents give you to encourage this getting out into the world?

ZHENG: Well, there was very little opportunity. Maybe that's why I had such a strong desire. In those days, China was so closed. There was no such concept as traveling for fun or vacation for fun. You got to travel if you had business that you had to travel for. For me, my only travel was to go from my parents' place to visit my grandparents. That was my travel. I did that every summer, and sometimes in the winter. In terms of my dreams of becoming something that they actually didn't like— a writer, no, no—that's not something they liked. They always said writing is important; it's great to be imaginative, but my father would say, "You don't have the ability to become a first-class writer," which is the only way you can actually make a living. And also, the Chinese environment then was not good for writers anyway. My parents actively discouraged me from becoming a writer, *very* actively.

MAESTREJUAN: What kind of writing were you thinking about?

ZHENG: I wanted to be a novelist.

MAESTREJUAN: Okay. Can you tell me a little bit about growing up in Chongqing? How do you pronounce it again?

ZHENG: Chongqing. Maybe during Chiang Kai-Shek—the government that now is in Taiwan—during that period it was called Chongquing. Now I think it's called Chongqing.

MAESTREJUAN: What was your neighborhood like?

ZHENG: Oh, it was great. I loved it. It's really different. That's one of the biggest differences in universities at the time I grew up. In the universities, all the faculty lived on campus. The campus is usually huge, so you have little villages on the campus that are slated out for workers, for teachers. Then you also have dormitories for students. My parents lived in a little village, and then my school was also operated by the university. In the first about five to seven years, I would walk across the campus to go to the elementary school. And it was really great, safe. We would just walk, and I would always be late. [laughs] You'd get to see all kinds of things on the road. Sometimes you'd get sidetracked because you'd see a little tadpole in the pond, or in this little puddle. It was just really great. It was really safe and you were not afraid of anything. You just wandered around on campus. It was really very well wooded, the whole campus. It's a great environment.

MAESTREJUAN: So the campus itself is pretty much self-contained. It's a city unto itself?

ZHENG: Well, you still need to go out of campus to go shopping and sometimes go to movies. The campus itself has its own movie place; every week there was a movie. I really had very nice memories of that environment. It was great.

MAESTREJUAN: The kids you played with in school or after school, were they all part of the university?

ZHENG: That's right. They were either faculty or workers—supporting members— of the university. And we all went to the same school.

MAESTREJUAN: How were the schools that you went to?

ZHENG: It was really a good school. Yes, it was a huge class—many people—but I think the teachers were pretty high quality, and education was something that was stressed, although it was during the Cultural Revolution. I think the elementary education I went through was pretty solid. I would say the middle school education wasn't good, but that was only for two years, and then we ended the Cultural Revolution. So starting from the last year of middle school through high school, we got back to normal education again. The only bad thing about that period [the Cultural Revolution] was we got to have good math, Chinese, and physics education, but we didn't have history, we didn't have natural sciences, because that was bad. So that was the bad thing; the very bare minimum of education for kids, we got.

MAESTREJUAN: Okay. Where did this idea to become a writer come from?

ZHENG: I don't know. It's probably genetic, actually. My father was a writer. He went into the army first. He dreamed about becoming a writer. He is the one who actually became a writer. He wrote and he published. He even won prizes. Maybe he thought he was not going to be that prolific, or maybe it was too dangerous. He had a bad experience in the army, and he just decided, probably, that being a technical person in a scientific area both provided a stable job and stable social status, as well as satisfied his desire of creating something. I think it's probably genetic. Well, I guess I have to say, my mom always loved reading novels to me. Maybe that had something to do with it, or maybe I thought their life was just too boring. Maybe being a writer, life would be so much more interesting. Then you get to live in different people's lives. Then it's much more interesting.

MAESTREJUAN: How were you trying to get this nascent interest in writing developed?

ZHENG: I didn't really develop it much. In Chinese, in that particular class, you'd always have to write. I've always loved writing. I always kept my diary until after I finished college. In college, I actually wrote. I wrote poems; I started little novels and things like that. I guess because my parents had always actively discouraged me, I really also wasn't very sure. I don't think I'm a very confident person on anything.

MAESTREJUAN: Why is that, do you think?

ZHENG: I don't know. I've never felt confident, and I think because of that, I always try to work very hard. Maybe that has something to do with everything I do. Or maybe I have always had trouble making As, that had something to do with it. I don't know. There was never a time that I felt like, oh, I will be able to definitely nail this.

MAESTREJUAN: How well did you do in school? You mentioned that you never got As, but Bs and B+ are not bad.

ZHENG: Well, I got As, but it was rare. I think for me the best would be A-. And then B+ and Bs were probably more common among my grades. I think it's just basically I didn't have the patience to sit through the details. It was just too boring to me. I could not really sit through to make sure I knew all the little details, and that's what was really needed for me to get those things. I just don't have that kind of stamina to do it, or just not good enough, I don't know.

MAESTREJUAN: What subjects gave you the most problems, and what subjects could you just kind of show up and do okay in?

ZHENG: Well, we had very few subjects before the Cultural Revolution. None of the subjects were hard. It was just that, for none of them, I seemed to have the stamina to really nail the exam. It was just like, I know it. Every exam I'd take, each question, "I know this, this is easy." Somehow, every time I'd finish the exam, I'd always think, "No problem, I nailed it." But when the exam came back, "Oh, shoot. I missed that?" That's the type of thing that always happened to me. It definitely made me less confident. I think the confidence then probably came later in my life where I understood how really being rigorous is going to get you that last mile. And if you actually get that, then you probably will be able to develop some confidence. I don't know. It's an interesting experience as a child that I always found that I knew it, but I couldn't make

straight As.

MAESTREJUAN: Okay. It was clearly important to your parents that you make straight As, but how important was it to you to make straight As?

ZHENG: It wasn't that important. I think that's the reason I never really said to myself, "Okay, well, let's just spend more time." It was never that important. I always felt I'm not too bad. I'm above average. [laughs] I always wondered why my parents were making a fuss. But since they made a fuss, that made me feel, oh, maybe I'm not good enough to make it. I don't know. Or maybe I didn't have a good enough character. I think that's what my father would most criticize me on: character. It's a character problem.

MAESTREJUAN: Well, when you weren't in school, what were you doing?

ZHENG: Actually, most of our time was not in school. It was playing. We just played outside and searched through the woods, and did a lot of things kids do: making little forts, a fortress, and playing all kinds of games. I think we had a better childhood than the kids now in China. They have to study so hard. We never had to study that hard. Education wasn't on the top list of the country, so we actually got to have a lot of free time. Nowadays the kids in China really have very little free time. Even I think my son [Benjamin Guo] has less free time than I had.

MAESTREJUAN: What kind of religious or spiritual beliefs—religious traditions— did you grow up with?

ZHENG: There was none. I think Mao [Tse-Tung], believing in Mao, believing in Communists, replaced religion. To me, it was almost like a religion. I remember when Mao died, I cried for a long time. I thought a great saint or something had passed away.

MAESTREJUAN: And your family didn't have any religious or spiritual beliefs that preceded Mao?

ZHENG: No. I don't think so.

MAESTREJUAN: Is there any kind of spiritual belief or religious traditions that you practice now?

ZHENG: No. If you don't have that, it's kind of hard to get back in.

MAESTREJUAN: Okay. As a historian, we look at the Cultural Revolution in China as a time period that can be defined by some ideological analysis and political analysis. We can look at it at that one level. But what did the Cultural Revolution mean to you?

ZHENG: It's kind of a loaded question.

MAESTREJUAN: Right.

ZHENG: Well, the Cultural Revolution means to me, at the national level, a huge disaster. But you can't just say it was all bad. Based on my experience on probably a personal level, I felt the Cultural Revolution—I don't know if it's Cultural Revolution or if it's Mao or the Communist Party taking over, that whole era—gave this real sense of equality of all kinds of people: women; men; all kinds of professions in the society, farmer, blue collar worker, or professor, or government official. Everybody was equal. I mean, most people made about the same amount of money. So I don't know. It was a very interesting time to grow up in that environment. I know we were deprived of many things, but at the same time, there was this sense of you didn't really have to worry about your retirement, your insurance, or your this and that, your job security. You just lived. I don't know. I think, for me, coming to America made me have the opportunity to compare that kind of environment—that kind of society—with this kind of society. I have to say after sixteen years in America, in this Western culture, I'm not sure this is *the* best for human beings. I don't know. I don't know what the best is. The Cultural Revolution was definitely not the best, and it was definitely not good. But there are certain things about the socialist ideals, I think, that there's some merit to it. I don't know how to pinpoint it.

MAESTREJUAN: At the time, was there a sense that you were being deprived of something growing up?

ZHENG: No. We were all brainwashed. Now, thinking back, we were definitely deprived of literature, of history, of many things that kids now get to do. But then we had very little idea, especially as a child. I think my parents knew, but they wouldn't tell us. They just were quiet. You live whatever you're told to live, so you don't make a fuss.

MAESTREJUAN: As intellectuals in, at least, their society was there much fear.

ZHENG: Yes. There was a lot of fear. That's why they were very quiet; they didn't talk much. They only complained in private about various things they were frustrated with.

MAESTREJUAN: Do you recall any instances where they may have come under scrutiny from the state over what they were teaching or their research?

ZHENG: No, because they were technical people. They were under much less scrutiny than if you were a historian or a writer. Those people were subjected to a lot more torture and various things than people like my parents.

MAESTREJUAN: How much do you think those sentiments of censorship influenced your father's decision about his own writing, and then your decisions about wanting to be a writer?

ZHENG: I never really asked my father. He never gave me a straight answer. My sense is he sensed that it was not going to be very easy to just write what you want to say. For me, my parents never said to me that it's going to be terrible if you write something people don't like, but I think that had a lot to do with it. Definitely being a writer in those days you just had to write what you were told to write. What fun is that? I think the other thing is, my parents felt life being a professor in college probably was more stable and more reliable than life as a writer.

MAESTREJUAN: Okay. So, as an official policy, the Cultural Revolution ends in '76, do you remember? Was that just a window of opportunity opening up, or what did '76 mean?

ZHENG: I remember that. Right after '76 my parents got into motion to transfer me into a much better school, so that's what they did. And it was really very clear. Right after that, colleges would start to take students on a competitive basis, so my parents immediately realized that I *had* to be transferred to a better school so I'd have a better chance to go to college, and that's what they did. I remember that very clearly.

MAESTREJUAN: So you would have been our equivalent of high school at that point?

ZHENG: No. Actually, I was still in middle school. In China, during my time, we had three years of middle school and two years of high school. So I had three years to prepare for college entrance exams.

MAESTREJUAN: How did your curriculum change by going to this new school?

ZHENG: It was the same curriculum. It was just that they had much better teachers.

MAESTREJUAN: Because natural science wasn't being taught in schools, what kind of exposure did you get to anything in the realm of life sciences: biology, chemistry?

ZHENG: I don't remember very clearly. I thought we had dissected frogs or something in high school. That high school was really good. We had definitely a very good chemistry class. The teacher was wonderful. Biology, I can't recall anymore. I don't think we had a biology course, but as I recall, we had some exposure to biology specimens. Maybe I was confused with college, I don't remember.

MAESTREJUAN: You mentioned that your father had many siblings. Did you have much of an extended family that you interacted with? Cousins?

ZHENG: Not really because they lived—like I say—a five-hour train ride away, and they lived in the rural part of that city. But my father's youngest sister had come to help my family take care of my sister for about two or three years, so I had a lot of interaction with her.

MAESTREJUAN: How much did your sister's illness, being the older sister, influence your career decisions, or what you would do with your life?

ZHENG: Well, I don't think it had a whole lot of influence, but I do have to say it's very hard to grow up in the family where one person is sick all the time. The environment is always gloomy. Very, very hard.

MAESTREJUAN: How much responsibility did you have for caring for your younger sister?

ZHENG: Not much, but I think my parents would always tell me that, "This is your responsibility in the future, and she just cannot really make a good living." My parents made it very clear all the time.

MAESTREJUAN: Did you decide to go to college? Was it an option?

ZHENG: It was not an option. You had to go to college; otherwise, you wouldn't get a job. So you had to go to college.

MAESTREJUAN: And you had just mentioned that college entrance had become competitive after '76.

ZHENG: Yes. In my year, it was *really* competitive because we belonged to the Baby Boomers [generation], because that was after the great famine in China in '63. I was born in '63. That was right after the famine, so there were a ton of kids. My grade had fourteen classes, and each class had fifty to sixty students. That's how many there were of us. It was just terrible, a huge number. Essentially, I think, in my school, only one out of a hundred could get into college. And that was the best school. Most schools wouldn't have any students get into college.

MAESTREJUAN: How many students attempted to go to college from your school?

ZHENG: Half of those try to prepare to go to college.

MAESTREJUAN: What happens to the other half? If you didn't get into college, what happens?

ZHENG: That's interesting. I mean like in my class there were two kids who didn't get into college. They just somehow didn't manage to get the exam. They were smart kids. I don't know what happened to them. Maybe girls mature too early. They stayed home. They tried to prepare for exams again for two more years, and after that, their parents managed to find them jobs. That's what happened. You basically stayed home and waited for job opportunities.

MAESTREJUAN: What kind of job opportunities were available for people who didn't go to college, at that time?

ZHENG: Well, it all really depended on what your parents did. If your parents take early retirement from a factory, then you could go fill up that spot. In the university, if my parents decided to retire, then I didn't get to be a professor, but I might be able to get a spot to be a cashier or something like that.

MAESTREJUAN: Why don't you explain a little bit about the entrance exam and what that entailed; what it all meant; and where you could go after you passed the exam.

ZHENG: The entrance exam is different from here. It's just basically the whole country has the same exam questions. It's quite exciting, actually. In my year, there was math, Chinese, political science—that was the worst part, I hated it—and then physics. English is only partial. I think the English score was only counted as 30 percent. What else? I forget. There was something else. I remember six subjects. Basically, you just prepared for them in high school. High school, if you ended up in those best classes or best schools, then the teacher would just drill you like there was no tomorrow. We actually had a very tight schedule: morning, afternoon, and evening. The teachers didn't feel that they could trust kids: that they will study if they're sent home. So we had to go back to the classroom to finish our homework.

That's hard. The last year we had to do that. The first year of the two years, it was a little bit laid back, but still we had nonstop quizzes. Every week we'd be quizzed on some kind of a subject. It was very, very rigorous drilling. I would say it was less of preparing you for knowledge, more of preparing you for exam.

MAESTREJUAN: So high school was basically to prepare you for your college entrance exam.

ZHENG: Oh, yes. It was really gung-ho. Then the entrance exam, in my year—I think it's probably still pretty much the case—was held in this big auditorium. You'd go in and there were a lot of—I don't know how you call them—the examiners would be walking around making sure there would be no cheating, and things like that. I remember seeing some kids faint because they were stressed out for so long, and they would faint. [laughts] It was really bad.

MAESTREJUAN: How did this affect your relationship with friends? It seems like you had to develop camaraderie, but also it would stimulate a sense of competition.

ZHENG: There was definitely a sense of competition, but my classmates, they had very good relationships. Everybody felt like we were not really competing with each other, we were competing with a bigger population. I don't think it really it affected the relationship. It really affected kids playing: You had no time; you had to study. But I guess I wasn't a good kid. I would be reading my novels. I would put my novels in my drawer, so when the teacher or my parents came close, I'd just sit up. That's probably one of the reasons I didn't have a very, very high score to go to a university like Beijing University/Peking University.

MAESTREJUAN: What kind of novels were you reading?

ZHENG: These were times that you actually got to read some Soviet novels that were banned. During the Cultural Revolution, the foreign novels we got to read were from the Soviet Union Communist period. There were some really good novels. I don't think literature-wise I was deprived, because those were really wonderful novels to read. But then we didn't get to read the Russian novels. So those were the times in the three years you actually got to read some Russian novels or some French novels and some English novels. That was just such an eye-opener. I just really put things away.

MAESTREJUAN: Were you reading translations of those works?

ZHENG: Translations, of course, yes. My English wasn't good enough.

MAESTREJUAN: So during the period of the Cultural Revolution, the only kinds of novels were those Chinese novels approved and then the Soviet.

ZHENG: From the Communist period, yes. There are a lot of really good ones.

MAESTREJUAN: Okay. Let me flip the tape over.

[END OF TAPE 1, SIDE 1]

MAESTREJUAN: Then you passed the entrance exam. How well did you pass it?

ZHENG: I didn't pass that well. Actually, it was a big disappointment. I had a big fight with my parents [Changqi Zheng and Ruanying Lou] before the exam. It was silly, you know, teenagers. Somehow, something I did my parents disapproved, and I was really mad, so I just took five yuan and decided I'm just not going to take the exam; I'm just going to escape. It was just too much. I hated it. I hated every minute of it. But then after I ran out, I realized, shoot, I don't even know where to go. We were so isolated as a kid. Every time I'd go visit my grandparents, my uncle would come pick me up. His driver would come pick me up. I don't even know where the train station is. It was so bad. So I realized I couldn't do anything, so I spent a whole day in my mother's [Ruanying Lou's] office. Finally, they figured out I probably was hiding in her office. They got me home, and of course, they lectured me more. Then I got a fever. It was a disaster, and that made my parents even more upset.

I don't if know if now it's still the case. In China there are many universities. They are ranked by their quality. My score was high enough to go to a university that's called a [national]

key university. It's an important university. There are quite a number of them. But I did not get a high enough score to go into a certain subject area. My parents thought computers would be a great area, but I wasn't good enough for that. My parents really wanted me to stay in the same university where they worked. That's also a key university. They would have loved for me to go into computer science. My score was not good enough. Then my father said, "Well, why don't you just do mechanical engineering," because he could then really give me a lot of pointers. I hated it. That would be definitely a no-no. I definitely didn't want to stay in Chongqing University. I didn't want to stay home, because I had a lot of conflicts throughout my teenage years.

I would have loved to maybe go into the literature area, but that was impossible already because you actually made the decision when you went to high school to say, okay, I'm going to go into literature, social science, or science and technology. And at that point, I had already chosen to go into science and technology. There was no way I could go into a social science area. I felt a good compromise would be to go into biology.

It's very strange. I don't think most teenagers know exactly what they want. I loved astronomy. Looking into the sky gave me a lot of imagination, a lot of things you can think about, think about the universe. But my score wasn't high enough to go into astronomy.

MAESTREJUAN: Is this based on a cumulative score?

ZHENG: A cumulative score, yes. My cumulative score just wasn't good enough to go into astronomy or go into computer science, which my parents really would have loved. My dream of biology was probably—not molecular biology like I do now— more like forestry, forestry type where you get to go out sampling a lot. That's what I thought I was getting into, but after going to school, I realized it was not.

MAESTREJUAN: Is there any chance that you could wait a year and take the entrance exam again, or is it just the one shot?

ZHENG: You get to take it as long as you want. A lot of kids actually took it more than once. The ones who didn't get in could try again. I think the success rate of return probably is not that high, because it was terrible for a teenager to feel like they had failed. I don't think it's a good thing. I think it's just hard, because then parents feel like, well, this is your best opportunity to get a job, get an education and get a good job, and if you don't succeed in that, then you have to wait. You have to first be unemployed for a few years, and with all kinds of uncertainty, and no respect. So I think kids were pushed a lot.

MAESTREJUAN: How common was it within your circle of friends to have these kinds of

conflicts with your parents?

ZHENG: It was common, at least in my circle of friends. One of my best friends, she had a lot of conflicts with her parents as well. I think the conflicts that I see in my case were more because I didn't grow up with my parents. I grew up with my grandparents [Zhichen Lou and Mongyun Ruan]. I went back with my parents when I was about eight. So suddenly I was thrown in with two strangers, essentially, to me, and I had to listen to them. They would be lecturing to me.

MAESTREJUAN: So you physically lived with your grandparents until you were eight years old.

ZHENG: Yes. My parents, they had very little free time. I remember very clearly, when I was five my mom came and visited me. She was very nice and talked to me. She was asking me, "Do you know I'm your mom?" I said, "No." She said, "Do you know you have parents?" I said, "No." I just was completely oblivious. If you don't see your parents very much, you don't have such a strong concept of them. And it was historical. That's the situation for a lot of Chinese. You just didn't have that ability to take care of your kids. They lived in dormitories. My parents lived in dormitories. They had to study Mao all the time. They had no time to take care of their kids.

MAESTREJUAN: So you grew up in a very rural area for the first eight years of your life?

ZHENG: No. Actually, in the first eight years I grew up in a little town. It was not very rural. It's a small town. It's also very nice. I think those times I spent with my grandparents were also very nice. I think the only thing that was not so good was I had to go [live with] all my relatives. Some of them I was not so familiar with; it's kind of strange. I felt like I didn't really know which was really my home. I was more of a transient. I knew my grandparents' home was where I was always going back to, but then—also part of this hospitality; Chinese relatives always want to—I got to stay with various relatives. Sometimes it was stressful. Sometimes I felt very strange. I don't think that's very good for a child. Even though Chinese tradition is still such that you *can* send your kids back to your parents, I only sent my son [Benjamin Guo]— after a lot of convincing by my parents-in-law—back to China for nine months. But the second day after they went back, I wanted him back. I don't think it's a good thing. It gives kids a feeling that they are transients. There is no real home. You don't feel like you belong.

MAESTREJUAN: Was this happening to your cousins?

ZHENG: Not so. You were asking [about] my parents, whether they felt a lot of pressure from political parties. I think yes. If you were in universities, you were intellectuals, you did have to go through a lot of study, brainwashing. Whereas, my other relatives, they were not intellectuals, so they didn't have those kinds of stress and pressure. During my almost eight years with my grandmother, some of my cousins would come live with my grandmother for half a year, so I saw various cousins. I would live with them for short periods of time. None of them were long-term like me. I was long-term.

MAESTREJUAN: When you got back to living with your parents, your friends probably had similar experiences?

ZHENG: My best friend, who also had problems with her parents, did. Growing up—I talk to a number of friends that I have now—they also had similar experiences.

MAESTREJUAN: What made you stay? You had run away. You had tried to run away.

ZHENG: Well, I couldn't run away because I didn't know where to go. I wanted to go to my grandparents' place, but I had no idea how to get there. Also, five yuan is not enough to get there.

MAESTREJUAN: Did you have any choice of a university at that point?

ZHENG: Yes, you did have a choice of university, but it, to a large extent, also depended on [the] score you made. I didn't have a whole lot of choice. I could choose a few, and I decided to go into biology at Sichuan University. My parents really didn't like it, but after fighting for a whole day, I just sat there while my parents cried for a whole day. Toward the end, they let go. I think after that they pretty much didn't interfere too much.

MAESTREJUAN: And what was wrong with biology to them?

ZHENG: I think they looked down on biology. They just felt, well, biology you just memorize. What's there to do? They didn't know much about biology; they were engineers. The people who got into biology in those days—in *their* day especially— they felt, were mostly people who were not interested in math, not that interested in physics; so they went to biology. They felt like math and physics were the most important things, and if you went into biology, you weren't going to get a good education in those things, which is true. They just didn't know what a biologist would do. They felt it had very little application, which is not true anymore, but in

those days it was kind of true.

MAESTREJUAN: Sichuan University, did it have a good reputation in the life sciences?

ZHENG: No. It was okay. Life sciences, in general, I don't think then there was a huge difference. It was more like a university name. Sichuan University, I would say, is probably between a second and third tier university. Beijing University[Peking University], Tsinghua University, Fudan [University] would be the first tier, and then there are some second tier. Sichuan [University] is sort of in between second and third tier.

MAESTREJUAN: How far away from [Chongqing] was it?

ZHENG: A twelve-hour train ride.

MAESTREJUAN: So you left home.

ZHENG: Yes. I loved it.

MAESTREJUAN: You—it seems to me—came to this conclusion to do biology because of your scores and your interest.

ZHENG: Yes.

MAESTREJUAN: What kind of biology was being taught at that time?

ZHENG: Mostly memorization. Like we had plant biology.

MAESTREJUAN: Taxonomies?

ZHENG: Mostly taxonomies. It was extremely boring. It was so boring. Math we were taught at a pretty low level. And we had some physics; it was also very entry level. As a biologist now, I think we should give kids more emphasis on math and physics. I wasn't that serious about studying in school. It was so boring. So I would just spend a lot of time writing and going

around Chengdu. That's where the university is. I would just go out. I skipped school a lot. I skipped most classes, except some classes where there were good instructors, which actually stimulated me and really interested me. The best instructor was the cell biology instructor [Wenshi Pan]. It was really great. I mean, cell biology made a huge impression on me, and that's the class I never skipped a single one.

MAESTREJUAN: What was it about the instructor and the class that was capturing?

ZHENG: He [Wenshi Pan] was just so dynamic. You could tell he was so interested in what he was teaching, and he thought that it was just the most cool thing. It really infects you. You sit there and you go, "Oh, yes, that is really interesting." Actually, in 2001 I went back to China for a meeting. I met him. He is still the best teacher, and he is now actually retired, but he was hired back to teach by various universities. He was paid to teach by various universities. He's just the type of teacher who knows how to excite young minds with the right amount of information, but make the information really connected and interesting. It was really amazing.

MAESTREJUAN: We can talk about this probably maybe at a better time, but how unusual was that? And is that something that is cultivated.

ZHENG: I think it has a lot to do with the person, the character of the person themselves. I think some people when they talk, they have this intrinsic ability to infect you. Their excitement can infect you. And they are very articulate. I think that has a lot to do with it. And also, of course, the teacher has to be very knowledgeable.

I think the teacher we had, had done a lot of reading. They don't just lecture you in the textbook. They actually give you some new things to make you see the future, instead of, okay, you have to memorize this text.

MAESTREJUAN: How much lab work—research laboratory-type work—were you doing?

ZHENG: We only did about half a year research work. I did it with a professor who came back from U.S. [United States]. I don't think I did well. I chose this, but it didn't interest me. I should have done something in cell biology. I think that would have interested me. Well, I guess I chose that lab because I heard that he had all kinds of cool equipment. [laughs] So I chose that lab. But the project I had, had nothing to do with the cool equipment, so it was kind of boring. Also, at that time, I really wanted to become a writer. I really was thinking about all kinds of ways to escape.

MAESTREJUAN: How successful were you in finding audiences for your work? You said you were writing a lot.

ZHENG: I was very shy. I just shared with my friends. I had two very good friends who were also very good with writing, and we would discuss it. Interesting, neither of them are writers. Maybe one of them will become a writer, I don't know. I haven't had a whole lot of connection with her. One of them, she's now with Aetna [Inc.]. The three of us had tried to see if we could possibly switch into the literature department and failed miserably. Now I start to see why my father was saying that. I don't think I'm talented to really become a prolific novelist. Being a novelist, you have to really have a lot of stories. Whenever I have some time, I still write something. It's more like improving my English. But I do write stories. I'm trying to write stories. I make little stories whenever I can't sleep and I'm tired of reading biology or writing my scientific papers. I'm sitting there, and I'm just very alert, and I will just write. I think I probably wouldn't become a first-class writer. Like my father would say, "Otherwise, you'll have a very hard life. If you can't sell a few novels you can come up with, how can you make a living?" [laughs]

MAESTREJUAN: What opportunities were there to switch fields?

ZHENG: None. Now I think there are more. The years we were in school, there was no opportunity.

MAESTREJUAN: Did you live in a dormitory on campus?

ZHENG: Yes.

MAESTREJUAN: You had mentioned you thought of yourself as maybe going into forestry. What happened to that in the compromise that you had made?

ZHENG: After I got into the school, I realized, oh, I was in genetics. Then I looked at other people who had more opportunity to go out. Their curriculum was even worse. If you were in taxonomy, you had to memorize even more. So I was just like, "There's no way I'm going into that. Too much memorization."

I was very active in school in terms of student activities. I was, for the whole grade, a representative and then became the whole student body representative. Each year we had a show: So the students had a performance. It could be dance, theater, all forms of art, and you would perform for the whole school. Sometimes, in the years we were in school, it wasn't

happening, but sometimes there would even be competitions. That was an extracurriculum activity. I was very active in that. Actually, there was one year we really got very excited. The three of us who wanted to switch to the literature department, we got together and got a show together. It was "[The] Emperor's [New] Clothes." We made it into a musical, dance and musical. [mutual laughter]

MAESTREJUAN: That sounds great.

ZHENG: It was a lot of fun. We couldn't write music, so we basically clipped music from various Western tapes, and then we just made choreography to the music. We won a prize—first prize—for that. Then other universities also adopted it. With that opportunity, we actually got a reward for our effort: The students who were in the animal sciences specialty got to go out to do practical training; they got to go out to sample maybe species distribution. And we got to go with them. It was just so exciting. That was the first time I actually traveled to the wilderness in Sichuan. It was just so beautiful out there.

MAESTREJUAN: Was this more like population genetics studies?

ZHENG: I have no idea, because I didn't pay attention to whatever they were doing. We just tagged along, four of us tagged along. It was more of a vacation for us than study.

MAESTREJUAN: It seems like you were very divided between what you had to get done and what you enjoyed doing.

ZHENG: Yes, I was very confused. That's why I say a lot of teenagers—or maybe it was just me—don't really know what they're best at and what they ought to do, but they know what they would love to do. I still don't know. If my parents had been less adamant about what I ought to do, I don't know if I, indeed, in the end would have started writing; if nobody told me anything—what I should or not do—where I would have ended up. I have no idea. I still don't know if I became a writer, would I even be able to make a living. I have no idea because I haven't had a chance to test it out. That's a very interesting thing about being a parent. Now I'm a parent.

My son is less rebellious. Maybe it's too early for him. He's thirteen. I don't know. Once he starts to become rebellious, what should I do? I think my parents did something that was good, actually, when I was quite confused after I graduated. All my class went to the graduate school exam. I and my best friend were the only two who just decided we didn't want to do it; we'd go to work.

So I went to work. I worked in the [Southwestern] Agricultural University as an instructor for two and a half years. I was really confused about what to do. I was twenty-one when I got a job. I started to say, well, I could write, because I had a lot of free time, and I realized I really didn't know what else to write other than writing those little things. It just hit me, if I haven't really lived and felt life, I really couldn't write. So I was really confused.

Then my father came to my rescue. He just said, "Well, okay. I'm not convincing you to just go into science, but you wanted to see the world, right? Why don't you go study in America?" He was a visiting scholar here, so he helped me to take the TOEFL [Test of English as a Foreign Language]. He was able to send back dollars so I could take the TOEFL exam, and he sent me back the application forms. The reason I went to Ohio State [University/OSU] is because he was a visiting scholar at Akron University [University of Akron], and he just got a bunch of application forms. It was nothing but just convenience. So I just applied.

MAESTREJUAN: To put this into a context, how much do you attribute your conflicts and frustrations about what to do with your life to being a teenager, or just being a young person who has to do this; and how much was this a generational thing of your cohort in China? The Cultural Revolution had ended, opportunities were slowly becoming greater.

ZHENG: I think it was probably a combination of various things. Also personality. As a child, I always got bored with things very easily, and that was hard for me to grow up. Also, I think one thing that really made it more pronounced probably for people like us in our generation was, we were more or less spoiled by our parents, and also by the society in a way that, really, whether you got a job or not, it was not directly related to how good you were on specific things. It was still, more or less, in the time I was in China, that you graduated and then the school assigned you to where you go. How well you did in terms of your profession was not clearly related to how your future will be.

Now it's very clear. I don't know how China is now, but all I know is, it's mostly single kids. I mean, the single kids are hitting the twenty-some age. I don't know how their view of the society is, but I think at least now in China there's an urgency of, if you're not capable—if you don't make your effort—then you may end up having a much worse life.

That wasn't the case while I was growing up, because everybody eventually got a job. How well you did had very little to do with your compensation. Then you had all this time to fuss about what you actually wanted to do. I don't know if that has something to do with it.

I think I learned a lot about life living in this country. I think I've become much more serious about one's career. After I came here, I realized you could end up on the street if you're not serious, if you don't take life seriously, take your job seriously. That was never really instilled in our minds.

MAESTREJUAN: What role did personal satisfaction play in your decisions?

ZHENG: In what?

MAESTREJUAN: Say, rather than take the graduate examination, to just go out and get a teaching job.

ZHENG: The main reason I didn't take the entrance exam for the graduate school was, I really didn't know what I wanted to do. I didn't think it was reasonable just to do it because everybody else was doing it. I felt if I go to teach, at least I will have some time to figure out what I really wanted to do.

MAESTREJUAN: How interested were you in teaching, and particularly teaching as a lecturer in sciences—in genetics and biology courses?

ZHENG: It was okay. I wasn't particularly interested, mainly because, actually, you don't get to teach. You just prepared the labs for the people who were older than you.

So I would never get to teach; I would just prepare all the lab specimens. It was a very little job there. It was extremely boring. Again.

MAESTREJUAN: And this was at the Southwestern Agricultural University, so all the students were interested in some kind of applied life sciences career?

ZHENG: That's right.

MAESTREJUAN: What were you teaching in genetics? How were you teaching genetics at that point?

ZHENG: I never was able to teach because there was an older professor who was actually doing the lecture. So all I did was prepare samples for the students. It was a very elementary level, so I prepared corn samples. I mean, it was just so mundane. If it was a loaded job, I would have had more excitement. I would do it all the time. Every day you went in for an hour; that was enough. And most of the time you were just sitting there. Okay, now what? Read? It was not that interesting. The curriculum was not that exciting then. It was still probably two or three years away from real change, so it was still quite stagnant then.

MAESTREJUAN: Just suppose the counterfactual. If your father hadn't taken this sabbatical and had the opportunity to say, okay, why don't you come to the United States, what would you have done? What were you thinking about?

ZHENG: If I hadn't come here, I probably would have taken the entrance exams to become a graduate student, because it was becoming very clear. That was just mind-numbingly boring. The school was in the countryside; there was no city, not even a little town. In order to go to town, you had to take a bus to go to town. So, to go to a movie, you had to go to town. It was very beautiful, though. It was very beautiful. It was refreshing. It was one hour away from Chongqing University, from my home.

MAESTREJUAN: How common was it for somebody like your father to leave China and take up a sabbatical position outside of the country?

ZHENG: It was very common then. I think now it's less common. It was very common.

MAESTREJUAN: How common was it for an undergraduate like yourself to just go ahead and go to graduate school?

ZHENG: In China?

MAESTREJUAN: Outside of China.

ZHENG: It wasn't common in my school, but it was very common in Beijing University, or in the best universities. A lot of kids came. Not very common in my school.

MAESTREJUAN: What other universities were you looking at besides Ohio State [University]?

ZHENG: I think I applied to Ohio and Akron [University]. I was out of phase because I applied in winter. Ohio State happened to have two slots of TA-ship [teaching assistantship position], and they just took me and another Korean student in the winter. It was a special admission. And it was *very* special because my father just said, "Why don't you just apply and then prepare for your GRE [graduate record examination]?" I didn't even get to take the GRE, they took me. I

guess I had scored really high on my English. Now it's probably not that high, but in those days, it was really a high score. I was over six hundred. That was considered very, very high.

MAESTREJUAN: How much English training had you had?

ZHENG: Well, we had it in high school. In high school we had to take English, and then in universities we took English. But English was never really a main focus. Not like nowadays. English is a main focus in China. I actually learned English mostly myself during the time I was preparing to come here. I read a lot of novels in English, like the *Scarlet Letter*. I read a lot of English novels, and I benefited by being in a university where you could go to the library and borrow a lot of books this thick with dust. So, I read a lot. I took some classes. It was really a lot of fun. Learning a language was just so much fun. I enjoyed it so much. In the beginning, I started listening to VoA, Voice of America. I could only understand "the," "of," but after half a year, I started to understand maybe the announcements. It was just *so* exciting. Yippee! [laughs] Then after coming here, I realized, oh, no, I don't understand anything they're saying.

MAESTREJUAN: What kind of science did you do when you got to Ohio State?

ZHENG: Basically, when I got to Ohio State, it was so like, "Okay, well, I think I can learn; I think I can train myself to do something," but I wasn't sure what to do. I think what really made me interested was Berl [R.] Oakley's science. It was very logical. He did genetic screens. He identified genes that turned out to be what he'd predicted them to be, so his papers made sense to me. Also, I was interested in cell biology when I was in college because of the great teacher [Wenshi Pan] I had, so Berl's research made sense to me. I really understood. I had no trouble understanding. So I decided to go to Berl's lab.

MAESTREJUAN: Did you do rotations?

ZHENG: I did rotations. I did a rotation in Berl's lab. I just did two rotations because I was off schedule. So I did two rotations, and the second rotation was in Berl's lab. That just pretty much made sense to me. But Berl really scared me. He was very rigorous. I think meeting Berl was the best thing that happened to my science. He trained me to be rigorous. I had this problem as a child of just not being able to put my feet down and really look to the bottom of everything. I think being his student made me do that.

MAESTREJUAN: How did he do that?

ZHENG: He spent a lot of time with me, first of all. There was only me and another student, who was much older, who had been there for a long time, so Berl had a lot of time. He would talk to me a lot and then really made sure that I kept all the notes neat, all the figures nice. He himself is pretty much a perfectionist. There were times that I wondered whether I would survive with him. But I survived.

MAESTREJUAN: At this point, did you see yourself as a career scientist?

ZHENG: I was very interested. After being in Berl's lab, I thought science was something I can do, and it could really satisfy me.

MAESTREJUAN: Before, in China, did you have this aspiration?

ZHENG: No. It wasn't clear to me. I just felt a sense of helplessness. My parents ended up being career technology persons in the university. Maybe that was going to be what happens to me, no matter how much I fight. It's fate. Just gave up.

MAESTREJUAN: It's fate, okay. How long was your father's sabbatical? Were your mother and sister here as well?

ZHENG: No. They were in China. My father was here for about a year, and when I came, he went back. I didn't overlap with him.

MAESTREJUAN: You had mentioned that Southwestern Agricultural University was a little rural, but we might describe Columbus [Ohio] as very rural here.

ZHENG: Yes. Columbus is very rural, but Southwestern Agricultural University is more so. Maybe not now, but it was definitely more so. Columbus at least has a town right outside the school that you could buy stuff. Southwestern Agricultural was very rural.

MAESTREJUAN: One last area and we can finish up for the day. How well did you make the transition from university life in China to university life in the United States and kind of the social/cultural transition?

ZHENG: It was very hard. It was really hard. There were times I wasn't sure if I was going to

survive here. The first half-year was the most difficult time because I couldn't understand the lecture. We have to maintain a GPA [grade point average] of B, average B. If we don't maintain that, we won't get a TA-ship. Because my visa wouldn't allow me to work. Then I basically would end up with no income, and then I would have to go back to China. The only thing that drove me was, there was no way I'm going to go back to China without a PhD, to basically show people I failed. I can't do that. There's no way I could do that. So it was hard. There was a period of time I thought I might go crazy, because I was also very lonely. I felt like, oh, God, I can't maintain my GPA. My first semester, or first quarter, I didn't maintain my GPA. It was a huge scare. It was very hard. It was also very cold. Columbus was so cold in winter. The city I grew up, it didn't usually snow, but in Columbus it snowed for months. I mean, it's covered by snow for months. It was really a big adjustment.

MAESTREJUAN: How well did you integrate yourself into graduate student life?

ZHENG: Not very well, because of my language. I just couldn't understand what they were saying. There's no way I could really integrate. After half a year, I started to know some Chinese students, and I became less lonely. Then I met my husband [Max Q. B. Guo] and everything became much better.

MAESTREJUAN: How many Asians and Asian Americans were in the graduate program, or at OSU at that time?

ZHENG: It was a few. I don't remember. It was a small percentage, smaller than probably nowadays in some universities. But it was really great to have that community there because then you could communicate. The worst part, it's that you just can't communicate.

MAESTREJUAN: Okay. Well, I think we're at good point to stop for today. Thanks.

ZHENG: Okay. Thank you.

[END OF TAPE 1, SIDE 2]

[END OF INTERVIEW]

INTERVIEWEE: **Yixian Zheng**

INTERVIEWER: **Andrea Maestrejuan**

LOCATION: **Carnegie Institution of Washington**
Baltimore, Maryland

DATE: **10 September 2003**

MAESTREJUAN: I'm Andrea Maestrejuan with Yixian Zheng to continue with her oral history interview for the Pew Scholars [Program in the Biomedical Sciences] project. We're at her office at the Carnegie Institution of Washington. Actually, this department's [Department of Embryology's] in Baltimore. I'd like to just basically pick up where we left off yesterday and ask you, When did your parents [Changqi Zheng and Ruanying Lou] become convinced that biology or the life sciences was something worth pursuing?

ZHENG: I think they were tired with my insistence on having to go into biology and not wanting to stay with them in mechanical engineering or at the same university [Chongqing University]. They've probably always known I'm very stubborn. I always want to do whatever they didn't want me to do. I think biology wasn't something that was going to kill them. The thought of me in biology was definitely far better than the thought of me doing something not even scientifically related. I think that's probably why they decided, if they keep fighting with me, then I'll stay in the university, and they will have to deal with me—fight with me—all the time if I'm unhappy. I think that's why they just gave up. They just said, "Well, fine."

MAESTREJUAN: What kind of educational opportunities did your sister [Wanlan Zheng] have in China?

ZHENG: She actually was going to elementary school. Let's see. No. She was still very sick when I went to college. She was going through surgery. She was going through a lot of surgery to fix her heart. I think while I was in college she started elementary school, but *her* elementary school was very far away from home. She had to take several transfers of buses to get to the center of Chongqing, the city, from my home. My home was kind of in the suburb of Chongqing, so she had to commute. It was a big ordeal for her, especially [because] she didn't have good health. She had to spend at least an hour one way to get there. I'm not sure if she really learned much because she would be frequently sick and not go to school.

MAESTREJUAN: Well, then, to pick up where we left off. You had decided to go to Ohio State [University] primarily because your father was at Akron University [University of Akron]

and said, "Why don't you come over here for graduate school?" And that's how you ended up in Ohio.

ZHENG: Yes. He sent me the application forms for Ohio [State University] and [University of] Akron, and Ohio just happened to be taking students off season—in the winter—so they took me. I thought, well, why not? So I just went. I don't think there was much planning or thinking going into that.

MAESTREJUAN: Okay. Language differences aside, and that you weren't conversant in English, how well had your education in China prepared you to start work in a graduate program in the United States?

ZHENG: I think the one-year course I took in cell biology probably was one of the best preparations. I think the other courses were okay. Like I said, even though I skipped classes a lot, we did have to take exams. Toward the end, before the exam, you still hacd to really read, and I scored pretty reasonably. I mean, biology, even when I was entering graduate school, was still primarily a memory-based science. As long as you remembered certain basic things, it was not too foreign for me to enter the graduate program. I think the major difficulty was really the language. That was very, very hard.

MAESTREJUAN: What about the hands, working in the lab and learning the tools?

ZHENG: I was not prepared at all. I have to say Berl [R. Oakley] trained me in every aspect. I was not prepared. I never even saw a pipetman before I went to Ohio State, so I had no idea. I had absolutely no idea what is molecular biology, what is the experimental aspect of molecular biology. And you can actually pipet [sic] such minute volume? It was completely new to me.

MAESTREJUAN: How did that compare to, say, other graduate students who were starting the program?

ZHENG: For example, I had a fellow graduate student who came from South Korea [Yisang Yoon]. He got a master's degree in South Korea; and South Korea science, in those days, was already farther advanced than China's. I asked him, "So you've seen this before?" He said, "Of course. I've used them. I did research." [laughs] I realized how dumb I was. It was bad. Yes, he was much better prepared. I guess one reason was that he had a master's degree, and the second reason was that South Korea then probably had more advanced research than the ordinary schools in China. But I bet, like Beijing University, the best universities would have had better equipment to do biology. I think, for example, my husband [Max Q. B. Guo]—he came a little

bit earlier than I did—he actually did plasmid isolation in the brief research period he had in Beijing University. He did some molecular biology, but he's from Beijing University.

MAESTREJUAN: How much thought, up until this point, did you give to model choice?

ZHENG: Model systems. No thought. What I think I was going by is whatever made sense to me, whatever logically made sense to me. And Berl's research really logically made sense to me so I decided to do it. Because I understood it. That's all I did. Again, it was sort of lack of planning, lack of knowing exactly what I want to do.

MAESTREJUAN: What was the environment at the time in the Oakley lab? Had they already published their work on gamma tubulin [ã tubulin]?

ZHENG: They were in the process of cloning it while I was joining the lab. They already finished the genetic screen; they already mapped the gamma tubulin locus, so it was quite exciting. When I read Berl's genetic paper, I was able to completely understand the concept behind suppressor screens, so it was really exciting to think, oh God, they will be able to identify this gene. It would be really exciting to know what it is. Then I think maybe a year or two after I joined the lab, they cloned it, and it turned out to be gamma tubulin.

MAESTREJUAN: Where was your project fitting in? The big paper that came out of your work there wasn't what you originally started off with?

ZHENG: No. I actually had two projects. One was to just do a traditional genetic screen, suppressor-type of screen. Your usual screen, it's not saturated, so you would expect if you go back and screen more, you'll get more. So I did that and nothing really came out in the initial screen. It was boring. I know you notice that I say "boring" a lot. I'm somebody who's really afraid of being bored. I was like, well, that's not very interesting and also not very promising. Then I switched to another project where you actually make a library of small fragments of DNA. Then this DNA you use to transform the *Aspergillus,* which is the model organism Berl uses. Then this small gene, they will do gene homologous recombination to integrate into the gene, and that will cause disruption of that gene. Then using this manipulation that's unique and very nice in *Aspergillus,* you may be able to trap the gene that might be important for mitosis.

I did that for about a year and a half. I was able to actually get some interesting mutations, but what was not foreseen was that actually this short fragment integration wasn't stable. By the time I'd get ready to isolate the gene, they were jumping around. They came out. That was kind of disappointing, but I actually learned a lot. I enjoyed it. I actually started that project by first making a library, and then doing all the transformations, and then doing all the

phenotypic-based screens, and then confirming by Southern [blot hybridization method] that it's integrated. So I learned a bunch of techniques in that process.

Knowing that project is not going anywhere, I just basically—by then I was in the second and a half year, or third year even, in graduate school—decided, well, I need a project that's most likely going to get me something. That's when gamma tubulin was cloned and published. It was very obvious: Yes, this is gamma tubulin. This is a tubulin that came from an organism that's really not even very well known. It's not a very well-known model system, not popular. One very important question is whether it's a conserved molecule. If it's not conserved, it could just be an evolutionary oddity of *Aspergillus.* But really now, after genome sequencing, you go look back at my project and it was nothing. Then it was important. Because the genome wasn't sequenced, it was an important question to address. But I don't view that work as really big. It was just timely, not profound.

MAESTREJUAN: Well, you know, scientific discoveries that we look back upon and wonder about are timely, because the genome hadn't been sequenced, and it didn't even look like it was going to be within a certain amount of time that it would be completed. With these two other projects that one didn't pan out, the other one really didn't pan out but you learned a lot of good techniques, how confident were you that this project would then lead to—

ZHENG: I was pretty confident. I don't know. Maybe it just characterizes somebody who is willing to continue to do research, is that I never really expected something would work. I always thought you try, and you just keep trying. I felt looking for homology is most likely going to work. I thought gamma tubulin was going to be conserved. Because alpha and beta tubulins [α-, β-tubulins] are extremely conserved. Belonging to the same family suggested they would be conserved. The question really was, well, even if you find a conserved gene, it may not have a conserved function. It may not, for example, localize to the centrosome, which is the microtubule nucleating place for animal cells. I guess I really wasn't that concerned. I just felt that it would be a project that would go reasonably fast, and then I could graduate.

MAESTREJUAN: Right. How aware were you as a graduate student that there were these traditional steps a graduate student had to take in order to go on to the next round?

ZHENG: I was very aware of that, very much.

MAESTREJUAN: How concerned were you that you weren't getting that many publications?

ZHENG: I was very concerned. In the end I had one publication. After I published that one paper, I wanted to get another publication, so I did a bunch of other experiments looking at

gamma tubulin regulation and the function of gamma tubulin in tissue culture cells. Now, in retrospect, I actually got a phenotype, I think, but it was not very clear. I've been nagged by that. I've had a child, and I've been in graduate school for a while, so Berl was not in any way feeling like I had to stay to get a second paper. So I thought, okay, fine. I think if Berl really insisted that I should have a second paper, I would have stayed, because I was very worried. I think this also is one reason, probably, that I wasn't able to get a fellowship. The other reason is Bruce [Alberts] left his lab. This is how I think about it. Bruce always was very nice. He said, "Well, don't worry about it. I left the lab, you have difficulty." But in the bottom of my heart, I know that if I had another publication, I probably would still get it, or be at least more competent to get a fellowship. Even though Bruce was not going to be in the lab.

MAESTREJUAN: For you, what was going to be the next step? What were your options as you were completing your PhD work, whether to go on to a postdoc [postdoctoral fellowship] in the United States, to return to China? What kind of possibilities were you considering?

ZHENG: You could go back to China, but then it was not as set up as now. Now, if you have a good publication, like a high-profile paper, it's very well received in China now. I think now, as a graduate student, if you have a good publication, you might be able to get an assistant professor position in one of those very good universities. I don't know. I've never asked. But I've seen people going back now, going straight into a research position where they can really have their students and start to apply for grants, also have some startup money to do research in this country. China is moving toward this country really rapidly. It's really very amazing and really interesting. In fact, I'm going to visit in October. Then it was not set up like that. If then you would go back, you would end up in probably some kind of teaching, and you wouldn't really be able to do much research. No.

MAESTREJUAN: And that's what you wanted to do.

ZHENG: At that point, I felt research actually is like what my parents had said. It still occupies your mind, allows you to use your imagination to really do *new* things so you won't be bored. I agreed with that after that. I was pretty settled. I felt that research would be a life that I would be happy with.

MAESTREJUAN: Were you aware of the irony at that point: That in your teenage years, criticizing your parents, you didn't want to do that?

ZHENG: Yes. I was fully aware of that. I was always thinking, well, maybe this is my father's design that I would, in the end, do whatever he wanted me to do. [laughs] I don't know. I'm still thinking about that now. For him to say, "Why don't you come abroad," it's something, at that

point, definitely not on my agenda. I wasn't even thinking about going to graduate school. What do you mean by going abroad to go to graduate school? But he was able to appeal to the aspect of me that's wanting to explore, wanting to have new things happening in life. I think that definitely attracted me.

MAESTREJUAN: Right. So, did they tell you, "Oh, I told you so"?

ZHENG: No. They never did that.

MAESTREJUAN: Did they tell their grandson, "She caused all this trouble"?

ZHENG: No. I think my parents are more preoccupied. I mean, their life had always fulfilled their responsibilities. I think they were always preoccupied with my sister's sickness. So for me, they just really wanted to make sure that I would do okay so they didn't have to worry about me in the future. Once they felt they've done that, they really didn't have time to pat their shoulder. [laughs] They have no time to do that.

MAESTREJUAN: Okay. Well, many Pew [Scholars Program in the Biomedical Sciences] scholars take the opportunity with a postdoc to learn new techniques or actually move into new areas, and you continue working.

ZHENG: There was a reason for that. When I was in my early graduate school years, I really didn't do enough reading. I came to recognize that in the last year in graduate school. I felt like there was no way that I would survive if I moved into a new area, because I hadn't done much reading in any area other than my own narrow area. So I felt I wouldn't be able to identify a good project. I didn't know what's the best question to ask, what's the most important question to ask.

Secondly, is that question I ask solvable? Are there available tools already, available information already to solve that problem? I wouldn't be able to do that if I switched fields, so I decided to stay. It was the lazy approach. It was the approach that I just sort of felt I had to take; otherwise, I will be probably sinking to the bottom. That's why I did that.

MAESTREJUAN: As a university student in China, how much exposure did you have to the current state of techniques?

ZHENG: None.

MAESTREJUAN: Like the libraries with *Nature?*

ZHENG: Very little. Well, I would say, since I wasn't paying a whole lot of attention in research, I didn't really look into it. I'm sure students who were very keen on research probably had checked in the library. Maybe you could get *Nature* and *Science* that's probably a few months behind. I don't know. I never really paid attention since I wasn't really serious about research until I came here.

MAESTREJUAN: By the time you finished your PhD, what was your intellectual interest in cell biology as an issue to attack?

ZHENG: I felt, intellectually, identification of gamma tubulin as a conserved component offered now an opportunity to begin to understand how the microtubule is nucleated from the centrosome. That, to me, is a good opportunity, and if I continued that, I might be able to answer additional questions that are really burning in my mind for that field, because I really understand that field, microtubule nucleation. It's a narrow field, microtubule nucleation and centrosome function. I felt it's really an important next step somebody has to tackle. I felt in my training what I'm lacking is biochemistry. I did genetics, I did molecular biology, but I did not do any biochemistry. Among all the people I'd looked at, Bruce Alberts' lab was the best biochemistry lab where I felt I could learn.

MAESTREJUAN: How many other positions did you apply for?

ZHENG: I applied to several. I think I, in total, looked into nine labs. All of those labs are on various aspects of microtubule cytoskeleton.

MAESTREJUAN: Did you consider joining the [Timothy J.] Mitchison lab to begin with?

ZHENG: No. Actually, Tim's [Timothy J. Mitchison] lab was one of the nine labs I looked at. When I was interviewing, I don't think Tim gave me an offer. He didn't. Bruce offered me, some other labs offered me, and of all the labs, I felt Bruce's lab was really the best for me. It was some interesting discussion I had with Berl [Oakley]. While I was searching for my postdoc [postdoctoral fellowship], he really talked to me a lot. We had big interaction. He said, "You may want to consider going to a lab where the PI [principal investigator] is more involved." I said, "I'm not sure. If I cannot be independent, I would rather fail when I'm a postdoc." I would rather know that early on, not having to learn that after I get my position as an assistant

professor. I think that's another reason I really decided to go to Bruce's lab. I knew if I went to Bruce's lab I'd have all the freedom I want to decide what projects I do, and then I'd have all the expertise I can ask for help.

MAESTREJUAN: What other labs were you considering?

ZHENG: I applied to Tim's lab, Ron [D.] Vale's lab, Meg [Margaret T.] Fuller's lab, Ron [N. Ronald] Morris's lab, Joel [L.] Rosenbaum, and Larry [Lawrence S. B.] Goldstein. There were two other labs I can't remember right at the minute. Oh, no, three other labs. Actually, I had Don [W.] Cleveland on my list, and in the end I felt it was too many. I crossed that off. There are two more. I can't remember. Oh, I think I did apply to Marc [W.] Kirschner, but his reply was that his lab was full for the next two years, so that's it. And I don't remember the final one.

MAESTREJUAN: Before we move you off to San Francisco, a couple questions about Ohio State. How was Oakley as a mentor?

ZHENG: He's a great mentor, to me especially because I was not very well trained. I was not trained. Period. For experimental biology. To me, he was a great mentor because he really made sure that I was trained properly, that I would do experiments rigorously, interpret the results rigorously, instead of just running wild with taking all kinds of assumptions and things like that. I think that was really very fundamental for me to, in the end, be able to do something on my own. I think without that training, if I just entered any lab without any supervision, I might actually have ended up being very, very disappointed with doing science. With Berl's training, I learned, yes, you might get a negative result, but negative results don't mean that's the end of the road. You can interpret it, you can look at it logically and then think about how to plan the next step. I think those are very, very important trainings for me. Maybe, I don't know, other people may not need that, but I thought it was really important. I really learned how to do it right instead of how to do it but not necessarily right.

MAESTREJUAN: You had mentioned yesterday that his lab was small.

ZHENG: It was quite small.

MAESTREJUAN: The entire time that you were there?

ZHENG: No, it's been small. It's been small throughout the years. He's always had a small lab, about like most people. Most people don't get to have very big labs.

MAESTREJUAN: I also want to go back to the transition between—or just becoming acculturated, if that's the right word—to American culture. What struck you the most about American graduate student life?

ZHENG: Well, what struck me was probably just, in general, American life. It's just so isolated. In China you live in dorms. I lived in this one three-bedroom dorm where I shared a room with my roommate, and then there was a total of six girls together, so you didn't feel loneliness. But here, you live in a room by yourself. Even when you share something with somebody, you still have the room all to yourself. And you have all different schedules. It was really lonely. I think Americans are very used to solitude. Is that the right word? And that was something I really, really was not used to. I was so lonely. I just won't see anybody. I saw people, they were very happy. My American colleagues or American graduate students, they seemed to be happy. It's really noble to go home to your own room all by yourself. Nobody really cared about anybody else's business; whereas, in China everybody cared about everybody's business. [laughs] That was a huge change. In China I always wished that nobody would bother me, but actually, when I came here, I realized I liked people to bother me, because this is too lonely. That was the biggest difference I felt, and that was the biggest thing I felt that I really needed to overcome. But I really probably never overcame that, because then I met my husband [Max Q. B. Guo], we got married, and I wasn't lonely anymore.

MAESTREJUAN: When did you meet your husband?

ZHENG: I met him three months after I came. Then we got married half a year later.

MAESTREJUAN: A whirlwind romance. And he's also from China?

ZHENG: Yes. He came through an exam. He belonged to one of those best students, so he got to come.

MAESTREJUAN: He got As, didn't he?

ZHENG: That's right. He was a straight-A student, the best throughout his career, everything. He was able to come on the scholarship that one rich Hong Kong guy offered. He had set up a program to get the brightest kids to come over to get an education.

MAESTREJUAN: What's his field?

ZHENG: He's in biochemistry. That's how we met.

MAESTREJUAN: We're going to get to some more of that, probably tomorrow. Well, how much, say, tolerance or intolerance did you run into with just trying to fit in.

ZHENG: I don't think that there was any intolerance. I think, in general, this culture is pretty tolerant. I think it's more of inhibition of myself, because I'm afraid of trying to make a conversation, yet I'm not understanding them. It's more of an inhibition on my part. After my language became better and better, I really tried to integrate more and more. I haven't really noticed much intolerance. I think, in general, people are very tolerant.

MAESTREJUAN: You had mentioned yesterday at the very end that your GPA [grade point average] your first semester was questionable.

ZHENG: Yes, that was a scare. What they did is, they got me to take a course, an advanced course for undergrads [undergraduate students] but graduate students can also take, so I made an A in that course. That's how my GPA came back up.

MAESTREJUAN: Okay. Let me turn the tape over.

[END OF TAPE 2, SIDE 1]

MAESTREJUAN: Does that mean you did some teaching?

ZHENG: In the beginning, they always paired me with American TAs [teaching assistants]. The American TA would do mostly teaching. I would prepare; I can grade. I think probably there was some unfairness to the American TA because they probably had to do more.

MAESTREJUAN: In some interviews, foreign-born scholars had commented on how difficult it was to reach undergraduate students sometimes just because, as soon as they opened their mouths, the students would hear this thick accent and react to that.

ZHENG: I never really had to do much teaching, because my co-TA would take up that. I don't think I had much of an experience on that. Later, my language improved and I didn't think it was a big problem. I didn't notice that.

MAESTREJUAN: So you decided on the [Bruce] Alberts lab, and you get there.

ZHENG: And that was the biggest shock.

MAESTREJUAN: How soon when you arrived in his lab—

ZHENG: It was the same day.

MAESTREJUAN: And there was no inkling that he wasn't going to be around?

ZHENG: Before that? No. I had no idea. So I just walked into Bruce's lab. I moved over, I walked into Bruce's lab, and Chris [Christine M.] Field, who was the manager for Bruce's lab, just said, "Yixian, Bruce has decided he's going to leave. He just told everybody in the lab. You'd better talk to Bruce." So I went to talk to Bruce. He said, "Yes," and he was hoping that maybe I could find a different lab to go in. I did try. I looked into Marc [W.] Kirschner's lab again. Tim [Timothy J. Mitchison] said I could go to his lab by then. I also thought about the Jans lab [Lily Y. Jan and Yuh Nung Jan], another lab at UCSF [University of California, San Francisco]. But I really felt Bruce's lab was the best place for me because Tim basically said if I went to his lab, I needed to work on what he wanted to work on. Marc Kirschner said if I went to his lab, I couldn't work on centrosomes. Actually, in the end, he even just decided no, I couldn't go to his lab. I was really depressed. I was really stressed out. I think that's the first time, and probably the last time, I ever cried in my professional career. I felt so backed down. I was like backed into the corner. I didn't know what to do. Bruce [Alberts] was very, very nice. He just said, "Well, just stay. Don't worry about it. We'll figure it out." I think he was really worried whether I would be able to be independent to handle all these things and survive without him there.

MAESTREJUAN: How did you emotionally adjust to coming to terms with some kind of decision?

ZHENG: To stay in Bruce's lab?

MAESTREJUAN: To stay or to leave. How did you get past this point?

ZHENG: I think I passed it very quickly. Right away then all postdocs [postdoctoral fellows] were involved in writing an NIH [National Institutes of Health] grant for the lab. That was really a lot of fun, and that really diverted all my distress. I was so happy because Bruce, I felt like he really trusted all of us. Each of us had a section to write, and he's just such a wonderful editor. He took all of our things and put it together, all different kinds of style. He would just get it all together. It was really great. It was a great experience I had.

MAESTREJUAN: So one of your first things in the lab was to write a grant.

ZHENG: Yes, to write a grant.

MAESTREJUAN: Were there other students in his lab that were going to be staying?

ZHENG: Essentially everybody at that point decided to stay. Also, I think maybe in less than half a year we knew our grant scored so high. Something incredible. Bruce was able to get me the money for four years as a postdoc in his lab. The finances in the lab weren't a problem, so most students decided to stay. The students who rotated and wanted to come actually came and stayed. Two students later on transferred, but that's due to various reasons.

MAESTREJUAN: How then did you learn biochemistry in his lab?

ZHENG: Okay, yes. Bruce had a wonderful—I would say—long-term research associate. His name is Jack Barry. He's a wonderful biochemist. He taught me everything. Basically, I just wanted to do biochemistry, and every technique I want to learn, I'd just say, "Hi, Jack. When are you going to come in? Can you teach me this? Can you teach me that?" He was just *so* patient. He would just walk me through every single phase. It was wonderful.

MAESTREJUAN: What expectations did you have for your gamma tubulin project?

ZHENG: Actually, I went through several projects in Bruce's lab in the first two years. Like what I said, I'm just the type I never feel like you try one thing. I've always felt you need to try a bunch of things, and if one thing works, you consider yourself lucky. So when I went to Bruce's lab, I tried a bunch of projects, and none of them really worked. Or in my view, I just don't think it has a really good perspective. Even though one of the projects I tried, Tim thought it was

something I should follow up. I thought, well, you know, I'm not sure what that would all amount to, so I just didn't follow that up. In the end, I decided probably the gamma tubulin purification would really both fit my initial goal of wanting to do biochemistry and also to understand gamma tubulin as a complex. So that's where I went.

MAESTREJUAN: Okay. Well, I just want to follow up a little bit on that statement you had just made about Tim wanting you to work on a project, and you just didn't think you knew where it was going to go. In a broad sense, what do you feel is the goal of your science? What should the goal of your science be?

ZHENG: What I really would like to understand is how the centrosome is assembled and how gamma tubulin participates in that, how centrosomes nucleate microtubules. That was my main goal. Surrounding those, I tried a bunch of projects, and the project that Tim thought I should follow up on, that project was more characterizing the dynamics of microtubules. It's interesting, but I felt it didn't quite fit what I wanted to do, or I was not sure what that would really lead to because there are also other systems people have used to characterize microtubule dynamics. I'm not sure what this would add to it in terms of a big understanding.

MAESTREJUAN: What kind of pressure were you under? You had just come out of this graduate degree with a very significant paper, but just one paper.

ZHENG: Yes, the paper. The number of papers was a big pressure on me. The biggest pressure on me was that I realized that my fellow postdocs all knew more than I did. I felt like they were so much more knowledgeable, so well-rounded in terms of criticizing other people's research and pulling everything together. That was a tremendous pressure, so I really tried to read a lot more and tried to really ask questions and just tried to make up. I mean, most other postdocs came from more famous universities—in Bruce's lab—so I thought that could be the reason: lack of training. I don't know. I just felt a tremendous pressure that I felt everybody around me knew a lot more and were able to make a better story when they presented anything.

MAESTREJUAN: Well, how well do you think you did in catching up with your fellow postdocs?

ZHENG: I think I did okay towards the end in terms of being able to go to a seminar, understand it, and ask questions. I think I did okay. In the end, I think I caught up on that. But I think my knowledge base is still not as broad as I would like.

MAESTREJUAN: Okay. Let's talk a little bit more about the project that was the hallmark of

your time in the Alberts lab. Again, what was the expectation.

ZHENG: There was no expectation. Nobody knew. There were indications before my time. A postdoc in Bruce's lab and a postdoc in Marc Kirschner's lab, they had shown that gamma tubulin in *Drosophila [melanogaster]*, as well as *Xenopus [laevis]*, existed as a complex. It seemed to behave bigger than it should. So that was new. That was already known. I felt if you can purify it, you might learn what it's associated with and what it looks like.

MAESTREJUAN: Was it like a fishing expedition or were you fairly confident that you had solved something?

ZHENG: No, no. It was not a fishing expedition in this case because I already knew it was in the complex. It's a very, very logical step. You just go purify it. There was nothing imaginative about it. It's a very standard thing.

MAESTREJUAN: And was it that easy?

ZHENG: It wasn't easy. That's the only thing that's different. So I basically spent a whole year trying to use a conventional approach to purify it. I was able to work out a bunch of steps, and in the end, I was able to see some band that was so faint by silver staining, so I already knew it was very minor. The protein is really minor, and that makes purification very difficult. I attribute this all to Tim, because he was the one saying, "Well, why don't you try antibody affinity chromatography?" Then that's where it broke open. That's when I made an antibody. I knew it would IP [immunoprecipitate] because, based on another study by a European group, this antibody will IP and then, since this was a peptide antibody, I could use a peptide to elute it. That's where I was able to do it.

MAESTREJUAN: How much electron microscopy have you done?

ZHENG: I really did very little. Mei Lie Wong did it. She's the author on the paper.

MAESTREJUAN: How was Alberts' lab to work in, considering he wasn't there?

ZHENG: It was a lot of fun. It was really a lot of fun. People were extremely supportive of each other. You didn't mind spending long hours there. The other thing is you could always find somebody up there—morning, evening, midnight. It's a fun place. It's not a workplace, more of

a fun place, I would say. Yes, it was really great.

MAESTREJUAN: How well did you do working independently without an [Berl R.] Oakley kind of mentor?

ZHENG: I think I was able to do that pretty well. I think I'm pretty communicative, and I'm pretty good at getting help. Once I know I'm not good at something, I'm very good at deciding who I should talk to to get advice, and I'm not shy on that. I'm just very outgoing. I think this is probably one of the reasons Bruce [Alberts] decided I could stay in his lab. He felt maybe I wouldn't really completely get lost.

MAESTREJUAN: When it came time to finishing up your postdoc, again what were the possibilities and opportunities?

ZHENG: One thing is that, again, I only had one paper in the three years I was there; so it's again very thin. In my view, even though it's a significant paper, I felt it's really thin. So I wasn't really confident about going on to the job market. I think my husband [Max Q. B. Guo] was more confident that I should go on the job market. We have two-body problem. My husband was doing a postdoc in Mike [J. Michael] Bishop's lab, and he wasn't ready to look for a job. I was actually hoping maybe I would stay longer. Although my time in Bruce's lab could not be extended because the grant ran out—Bruce didn't renew it—so I would have to go do something else. Mike was very nice. Mike Bishop suggested, "Well, you know, I would be supportive of you to be a UCSF fellow , where you become independent but you are still not a faculty. It's a transition so that you can look for a faculty position somewhere else, or just stay at UCSF. I was really interested in that, but my husband felt it wasn't a good thing for my career. He said, "No, you should really do a job search and see what you can get." So I did a job search.

MAESTREJUAN: Just going back a second. How were you both looking for postdoc positions, because you were both graduate students?

ZHENG: I looked first. When I looked, the other consideration I had is I really need to look in centers where my husband can easily find a lab. So UCSF was really a good choice.

MAESTREJUAN: What job opportunities were there when you went to look for independent positions?

ZHENG: There was a few, but not really that many. I applied to thirty, but most of those are

not really suitable for my background and my interest. I was able to get six interviews, and I think I was offered five of them.

MAESTREJUAN: What were your choices?

ZHENG: My choices were here [Carnegie Institution of Washington], Columbia [University] Morningside Campus, the undergraduate campus; Northwestern Medical School [Northwestern University Feinberg School of Medicine]; Worcester Foundation [for Biomedical Research at] UMass [the University of Massachusetts Medical School]; and Rutgers [The State University of New Jersey, Rutgers].

MAESTREJUAN: At what stage was your husband in his postdoc?

ZHENG: We started about the same time, but he switched fields, so it really took him a long time. When I was offered the position, he still felt he was not ready. I told him if I do leave, I would like to come to Carnegie [Institution of Washington], and he felt this was also the best place for me. Then we had a decision to make: Either we separate and one of us take our child, or we stay together. Either I stay at UCSF as a fellow or he come with me and finish up his postdoc. I would be probably happy to just stay at UCSF, but my husband decided he would sacrifice himself.

MAESTREJUAN: That's very nice.

ZHENG: He's a very supportive husband. It's very unusual.

MAESTREJUAN: From your perspective, why was he willing?

ZHENG: He was confident that he would be able to do fine coming here, because he has a fellowship, and he was able to work out that Mike [J. Michael Bishop] said, "It's fine. You can bring the fellowship to go to whichever lab you can find at [Johns] Hopkins [University]." He found a lab at Hopkins, with Chi [V.] Dang, and he continued finishing up his project in Chi Dang's lab. He decided to come. He felt it was more important for me to get this position because it's a really good position, and it doesn't come up every year.

MAESTREJUAN: Why did you choose Carnegie over the others?

ZHENG: The most important thing for me in choosing Carnegie was because it really reminded me of the environment I had at UCSF, which was so great. Essentially, it's very open. You come in here, everybody's lab is open. You can walk into anybody's lab without knocking on the door. It gives me a sense of openness. And I felt the faculty here are all very genuinely interested in science. It has this idea of do whatever, as long as it's interesting. That's what I like. I don't enjoy that you have to always follow a certain route. You can jump out and do something different. I liked that.

MAESTREJUAN: In comparison to UCSF, it's quite small.

ZHENG: Yes, it's very, very small.

MAESTREJUAN: In the case of having to learn new techniques—

ZHENG: That was one concern. At UCSF, you just go upstairs or downstairs, you will find somebody who can tell you something. So coming here, that was one concern. Then you have to go out of your building, or maybe make a phone call. Again, I'm used to making conversation on the phone, just call somebody up I've never known and say, "Hey, I'm who and who. I'm interested in this and this. Do you have time?" In general, I've found people to be extremely helpful, so I didn't think it would be a major problem. If you do feel you need to use some technique, you ought to be able to get it.

MAESTREJUAN: I guess in the remaining time, why don't we talk a little bit about your research program as it developed here. I know from your Pew [Scholars Program in the Biomedical Sciences] application that basically you were going to pick up your project that had resulted in a *Science* paper in [Bruce] Alberts' lab and go about identifying the components of this [gamma tubulin] ring complex [γTuRC]. Along the way—I only have your publications and progress reports—you moved into different areas, and that initial proposal kind of shifted away.

ZHENG: No, basically, we identified all the components. We did that, but that's really not enough for all the people who come to my lab. I don't like to have people work on the same thing or two closely related things. I like to have people start exploring new things, and that's the reason we started to do new things. And that continues in my lab. I guess it again reflects my tendency of getting bored. I always like to do things that are different so it will get me excited. I'm happy to read and really can focus on reading. If I keep thinking about the same problem, even though I read, I don't know what I was reading. It just doesn't register in my brain.

MAESTREJUAN: As an educated lay person reading your work, it made kind of reasonable sense that you had identified this ring complex and that there were five or six proteins that you couldn't identify, so that was going to be the basis of your next grant proposal.

ZHENG: Yes.

MAESTREJUAN: Where was the excitement?

ZHENG: I have to say, this project has been going really slowly. The major difficulty has been the limitation of the assay. We just don't have wonderful assays. I'm not a structural biologist, so I felt really figuring out the structural organization of this complex should be the job of a structural biologist. So we have a collaboration with a structural biologist to try to figure that part out. But like any structural project, it takes time. It also depends on the temperament of the protein. So that hasn't gone really fast, but it's moving, hopefully.

The other aspect of the project that's more suitable for the kind of lab I have is to understand how you regulate this complex in terms of its activity, and how you get this complex to go and bind to the centrosome, because that's where it functions to nucleate microtubules inside the cell in interphase, and probably the mitosis part of the complex is nucleated from the centrosome. That has been what we really would like to know. We have made a lot of effort toward that goal, but it's been difficult. We published, but none of those I would characterize as groundbreaking so far. We found proteins, we found they might be involved, but it's unclear. We don't have the best assay to really nail it, and that still needs a lot of development. We are still working on that, but it will take a long time. Sometimes I wonder whether we can ever understand centrosomes, after we fail and fail and fail. Sometimes I wonder, well, maybe there are certain things inside the cell that are not meant to be understood, or at least not now, when the technology is not quite there yet.

MAESTREJUAN: You're one of the few Pew [Scholars Program in the Biomedical Sciences] scholars who cites research from almost a hundred years ago. You had mentioned in several of your papers, for instance, [Edmund B.] Wilson's *Cell and Heredity* [Wilson, Edmund B. *The Cell in Development and Heredity*. New York: Macmillan, 1925]. This is a 1925, 1900-something first edition. How far has our understanding come?

ZHENG: Of that organelle. We have made a lot of progress, like its duplication, how it goes from one to two doing cell division. We understand some of its regulatory control. And we also have understood—not my work—its role in cell function. For example, now it's clear that it actually has more of an important role in regulating cell division in terms of the last step of cell division, and also maybe after cell division, cell progression. The laser ablation type of experiment carried out by Alexey [L.] Khodjakov was really beautiful work. Then in terms of its

function in microtubulerelated work, we understand that gamma tubulin complex is the key microtubular nucleator from the centrosome. That we understand.

But there's still really a lot to be learned. It's a very complex organelle. How it's made during duplication, how you undergo this orderly duplication is absolutely unknown. I think it's a very exciting organelle, but at the same time, it's one of the most difficult organelles to study. I think one main reason is you only have one, and it's tiny. So you just can't really approach it efficiently from a biochemical point of view. And genetics is difficult in animal cells. I and everybody hoped that it's going to really help one to figure it out, but unfortunately, so far, in our hands, some of the RNAi [RNA interference] we did just didn't seem to do much to the centrosome. So I don't know.

MAESTREJUAN: My goodness. RNAi was the breakthrough last year.

ZHENG: It's made by my colleague Andy [Andrew Z.] Fire. I'm very proud to be next to somebody who's made such a huge contribution.

MAESTREJUAN: Right. But it has not opened the black box.

ZHENG: I think it will help if we identify more and more components, and maybe some of the components can be studied using RNAi. For some of them the RNAi is not useful. But some of them, I feel, should be useful.

MAESTREJUAN: Where do you think the major breakthroughs are going to be?

ZHENG: In the centrosome field?

MAESTREJUAN: Yes, in the centrosome field. Is it going to be conceptualizing new signaling pathways? Is it going to be a conceptual breakthrough, or is it going to be technological?

ZHENG: I think it's going to be technological. If somebody could really work out a very easy assay to study centrosome duplication, centrosome assembly, then that would allow one to really get to the components readily. Or if somebody is able to purify centrosomes in a large quantity and in a really good purity and you identify all the components, then you can go back and study the function of each of those components. So far, it just hasn't been. I have to say, even though we are studying it, I haven't put my whole lab toward making the effort toward that. I think anybody who has a level head wouldn't do that.

MAESTREJUAN: Why is that?

ZHENG: Well, you know, you have to also stay afloat. You can't just get everybody to work on a project that will take you twenty years to crack. Also, people need jobs. People come to your lab. Graduate students need papers to graduate, postdocs [postdoctoral fellows] need papers to get jobs. You can't get one person after another to work on a problem that you know it's probably not going to work. So you can only have each person try a while and then say, "Okay. Now you've done enough time. Go on. Move on to do something that will probably be more productive."

MAESTREJUAN: Okay. What question do I want to ask first? Where did the idea to look at the small GTPase [guanosine triphosphatase], Ran?

ZHENG: It all came from a paper that's published in *JCB [Journal of Cell Biology]* that showed a protein that binds to Ran. It's localized in the centrosome. When that protein is overexpressed, it induces ectopic microtubule asters forming inside the cell. Since we study gamma tubulin, I always read papers that contain those key words. So knowing that, and knowing that a very similar actin cytoskeletal system is regulated by small GTPases, it was really very logical to suspect maybe small GTPase-Ran could be regulating the microtubule cytoskeleton. That's where we began.

MAESTREJUAN: You've also moved into a little bit different area of spindle assembly in mitosis. How drastic a departure was that?

ZHENG: I wouldn't say it's a very drastic departure. I think, essentially, I stayed in the microtubule field all the time. Now we've moved into spindle disassembly. Again, I don't think it's a drastic departure. I think a real drastic departure—I don't know if it's going to work—is what I'm doing now. We are trying to look at evolution.

MAESTREJUAN: In what ways?

ZHENG: I'm doing this as a collaboration with Doug [Douglas E.] Koshland, my colleague. We're hybridizing two different species of yeast to look at the impact on evolution.

MAESTREJUAN: Okay. Let me put in a new tape.

[END OF TAPE 2, SIDE 2]

MAESTREJUAN: We kind of had to insert a break there.

ZHENG: I think this whole thing probably, again, for me at least, comes out of boredom. [mutual laughter] It's interesting. I would say it's not really absolutely boredom, but in some sense I felt like I've been in microtubules—reading about microtubules, studying microtubules, studying cell division—for all these years. All the problems I know are there, and some problems it would be really great to crack, but it's going to take time to crack. Conceptually, I don't think there is anything novel there. There is no huge paradigm we're studying ahead of me. At least I'm not smart enough to think that way. So I kind of felt, oh, it's all the same thing; it's all fill in the details. I was getting sort of not fired up anymore, and that is always dangerous for me because when I feel bored, I just quit. Then I started to read, and I felt, well, what's there left that there probably still could be new things one could think of? Throughout my research career, all I did wasn't that exciting. I want to do something really unknown, start from somewhere that there is a lot of unknown.

One thing that had always attracted me was eukaryotic evolution. If you think about how the eukaryotic differs from the prokaryotic system, it's just amazing. The differences are amazing. Then how nature made that huge leap is a big question in evolution. I've been reading something like that. I thought, you know, I've been doing cell biology for all these years, maybe my background could be suitable to allow me to do something that's completely different. Initially, I thought about maybe one way you could create the evolution of the eukaryotic system is maybe organisms—that's actually not my idea; it's something I read, but I implemented—for example, the Archaea, which is one kingdom that people felt shared a lot of characteristics with eukaryotes but also with bacteria. So maybe if you could fuse Archaea with bacteria, then you might end up getting something. You might drive evolution; you might get somewhere. I was excited about that for a while, but then I realized the system of Archaea study has not been developed very well; so for me, who has no background, it's going to be hard. I also have no background in bacteria study, so I felt, well, let's not be *too* ambitious fusing kingdoms. Let's just step back.

Then I read more about yeast, and I started to realize, actually, in yeast there are a lot of naturally occurring hybrids that people use in beer brewing, and it's actually a hybrid of [*Saccharomyces] cerevisiae*, which is baker's yeast, and another species of *Saccharomyces.* It's called [*Saccharomyces] bayanus.* I thought, well, if we fuse them together, we may get something. Also, if you read plant literature, if you cross two species of plants together, you can see immediate new traits—new features—coming out, and people have been studying that. In fact, Barbara McClintock had had this idea about I think she called it cytoshock [genome shock]. If you bring two cytoplasms together where they have not seen each other for many years—they've been separated—you will create stimulations or certain new traits. You induce

certain new gene expressions or new changes, and that will give you new features.

I thought, well, it's really slow going: studying plants; maybe yeast is good. So I got together with my colleague Doug [Douglas E.] Koshland. We've been doing studies along those lines. But it's slow going, so it's nice to have something that I myself work on and read something that's quite different. I've been reading quite a lot of evolution papers and thinking along those lines. It's quite stimulating and kept me going with doing research.

MAESTREJUAN: Where do you think your greatest contributions are going to come from? Is it intellectually in conceptualizing new directions? You also have a track record for overcoming a lot of technological barriers to learn new techniques.

ZHENG: I never felt I'm a technical person. I'm very good at using techniques to solve a problem that I'm interested in, but I'm not good at creating new techniques. I think my strength is more that I tend to see connections where the connections aren't that obvious to most people. I tend to look at things that are on the borderline that may join two different fields. Ran is one example. In fact, it was really funny. When I was considering Ran, I also was considering another project. I had a new postdoc [postdoctoral fellow] coming in, and I thought, well, I wanted this postdoc to work on something different from gamma tubulin. I tried to seek advice from people in my field. I even told them about these two ideas. I remember very clearly, in general, people liked my other idea, which was much more conventional, much more obvious; whereas, they felt Ran was really kind of an oddball. People have known Ran is involved in so many things; how do you know Ran would be just a direct regulator or indirect regulator? Especially since I've had my own lab, I've been able to look at things and see connections that weren't that obvious.

The spindle disassembly project is a similar thing. My students landed on this complex, and it took me two months to figure out it could be involved in that. This complex has been known for a long time for being involved in membrane function, so we now linked it also to regulating microtubules. So that's spindle disassembly. I think that probably is where I'm reasonably good.

MAESTREJUAN: How do you decide when to pursue a tangent, when to pursue the obvious next experiment, and when to start off in new directions?

ZHENG: I think it's complicated. If a person in my lab already has a good publication that they just need another publication, then in that case, I feet like they should just follow the obvious next thing to do and then finish up their training. I think if it's a new person who just came in, I tend to get them to explore more. Almost all new postdocs I have, I always hope that they will find something different. Most of them end up going back to the same, the more reliable things to do. I wish that science was something that people didn't count on how many papers you

publish— how frequently you published—that they would just look at how important your findings were. If that' were the case, then we could all just follow our own dreams. But that's not the real world.

MAESTREJUAN: What is the real world?

ZHENG: I think I live in a very nice world. It's a real world, but it's nicer than a lot of other people. Being at Carnegie [Institution of Washington], well, first of all, I don't have teaching, so that gives me a lot of extra time to think and to do things myself. Also, there is this sort of intellectual interest, or the tradition of trying to do something different. We all feel we should really take some risk. At least this is the sense that I have, that if I decide I'm going to explore something, and even if I lose my grant for two or three years, I would be okay here. That's my sense, but I don't know if that's really true because I've never tested it. But that's the sense I have. Although I have to say I'm not brave enough to do that.

MAESTREJUAN: I would say many Pew [Scholars Program in the Biomedical Sciences] scholars told stories of the publish or perish model of science. How much pressure do you feel?

ZHENG: I feel a fair amount of pressure. We all have to publish. But I never really felt I have to publish really prolifically. I felt like, along with the lab size—I was fluctuating between six to nine, and this day around seven—if I can publish two papers a year, I'm doing pretty well, but those publications have to be very solid.

MAESTREJUAN: How do you assess your publication record?

ZHENG: In what way?

MAESTREJUAN: Have you been successful?

ZHENG: I think I publish reasonably well, but I wouldn't say I'm very prolific. My number of publication is probably about average, definitely not first-class in terms of the number. But I think the quality I publish, I feel good about it. I feel we publish really solid work, and we publish complete stories, and we also publish novel findings; and that's what I think is important.

MAESTREJUAN: Where do you see your work going in five and then ten years from now?

ZHENG: In five years, I really would like to be able to know some underlying mechanisms of how the spindle really forms, how it really becomes a bipolar orientation from a monopolar orientation. That's one thing I would really like to know. With respect to centrosome assembly, I would really like to be able to learn more about how gamma tubulin is recruited to the centrosome and what regulates that recruitment. That's my five-year goal.

In ten years, I really hope I would be able to make some breakthrough in my evolutionary project. I really hope I would be able to establish some system where you can really study how the cell might evolve—mutate—by combining different species or cross genera, just combining distant organisms and see what the impact of that would be in terms of generating new traits, and also maybe developing some way of actually studying it. And that takes a while, and it might never happen. Maybe next year I'll say, oh, I'm giving up on that.

MAESTREJUAN: Will you still be in cell biology?

ZHENG: Yes, I think I would always be in cell biology. Cell biology is a very broad field. Anything you study requires cell biology. Ultimately, how we function, all is determined at the cellular basis, so cell biology is very important. I think I would still be a cell biologist. Even in the end, if I'm lucky enough to be able to develop something in evolution, in being able to understand certain things in evolution, I think one feature would still be cell biology. It might actually not be microtubules. It might become something different in cell biology.

MAESTREJUAN: I want to talk a little bit about your competition and how competitive your field is. I'll just bring up one example that the story has been told now, but at one time there were a couple of different theories about how microtubule nucleation—a couple of models, not just yours—that is the first turn of the microtubule helix. Then there was another lab who was arguing for a profilament model. You, with your own research, have answered that. In terms of conceptualizing what's happening in microtubule assembly, how different are these competing theories?

ZHENG: It's quite different, many degrees different. I'm pretty confident our model is correct, but I do have to say the other model has some very unique features. Really, I think what's going to solve that is going to be structural work. I think if you could really see how gamma tubulin is sitting in the ring, and how gamma tubulin is sitting at the end of microtubules, that will really settle that business. Although we did sort of show gamma tubulin—my work and also Dave [David A.] Agard's work—have shown that gamma tubulins sit flush at the end of microtubules. There're still some doubts, because you sometimes can also see it hangs like that, so it's still very controversial. But if you really can improve that structural work where you can quantify what percentage is sitting end-on, what percentage is sitting like that, and also show that the

gamma tubulin is actually sitting up instead of laying down, I think that would probably help. I think it's going to be more structural work than the work that we will be able to contribute.

MAESTREJUAN: In your field, how high are the stakes that there are these competing theories.

ZHENG: I have to say it's really interesting. I think the centrosome field is really not that competitive because it's just too hard. You spend years and years and years; you may get one paper. And that paper might even be something you are not so excited about. I don't think there is a whole lot of competition mostly because it's just too hard. In fact, I think people in our field have begun to realize that and have become much more supportive of each other. It's so hard if you hold the same standard as some field that moves really fast. And essentially, we cannot publish. So I think people in the same field have been changing the attitude to help so that this field won't die. Otherwise, it will die.

MAESTREJUAN: Because?

ZHENG: Because it's just too hard. If you decide you are making a career in this field, if people have the same standard as the fast-moving fields, then they would expect you to publish the same number of papers, the same quality papers, the same big steps. In the end you would have no publications, and that results in no grants, and you die. That's how I see it. I think people just have to be more understanding from the perspective of the field itself.

MAESTREJUAN: How optimistic are you that this field will continue to get support?

ZHENG: It will. I think it will, but I think it will also take the effort of people in the field to really be supportive of each other to have that happen.

MAESTREJUAN: So would you define your field more as collaborative in nature, or competitive in nature?

ZHENG: It's just really small. I don't think it's competitive in the way I see it. I think in the beginning it was competitive, like when I was purifying gamma tubulin. I was competing with somebody in my field. After many years, we ended up being okay. We are fine. We are still communicating. I think we really have a fine relationship. I think the reason that was being competitive is, it's an obvious thing to do. You just have to get it done. Now, there are so many molecules you could study, so you don't have to all study one molecule. I don't think it's that

competitive. I feel like there is a sense of more people leaving it. This is how I feel. People try to figure out a different way to do it. Maybe it's just trying to figure a different way, from a different angle. I don't know.

MAESTREJUAN: And where do they go to if they leave this field?

ZHENG: They stay in microtubules. They'll stay in microtubules, but you take a view that's further away. I don't know. I may be wrong, but my sense is it's been very difficult. Based on I see what it takes to get your NIH [National Institutes of Health] grant renewed, I felt if we all just be stubborn and stick in here and try to just make something that hasn't worked for many years to work, you probably will have to experience losing your grant. But maybe some other people from another field would have developed something, then they will come in to answer certain questions. I don't know.

MAESTREJUAN: How do you keep yourself moving away from boring science and doing the kind of science that you don't think is boring? And how do you train students to do unboring—to use I think a Volkswagen term, or maybe it's IKEA— unboring science?

ZHENG: Boring or not boring, it's all personal. To me, it's boring or not boring. If there is something new there that you have not already read or somebody has not already said, then that's exciting. And if I'm studying something somebody already predicted, then I think it's really boring. That's why if I have new students come in, I never have them work on something that, oh, people showed this in here, in this system, let's try to see if it works in this system. I just consider that a no-no. I want students to really look at the literature and see what is already known and then they can go from there to something that's unknown, at least to the next interesting question, instead of just saying, well, this is also true in my system. I think that's the minimum.

The best would be a student comes in and says, "Well, I have an idea. You hear me out. This has never been considered." Then we think about it and go after that. That would be the best. But the second best would be, based on your reading, what's the next most important question? Is this question solved? If it's not, let's see if we could do something about it.

MAESTREJUAN: Where do new ideas come from? From these people that don't have a lot of experience, that are new to the lab?

ZHENG: I think it's a combination of interactions. I think postdocs who have been successful with me, in the end when they publish something, it's always something they, as a researcher, had a keen eye to notice the phenomena. If it's just me saying, "Okay, this is a good direction,

let's go after this and you will be okay," it would never have worked. They have to be the one to really not only understand this profoundly and also have the eye to see, oh, this is really interesting. We better follow this up. Or come up with some idea and then we discuss it. I think that's how it's going to work. That's how it always has worked. A person who just basically has no spark in themselves would never work. That's just my experience. I don't necessarily think you have to have somebody coming in with all the bells and whistles all complete, but they do have to have their own in observing, in doing experiments, in thinking. And then you sort of facilitate that along the line.

Most people [who] come to my lab so far are not from the same field, so in the beginning I need to train them, I need to tell them what are the baselines— the boundaries—of this field, and what are interesting questions, what we could try. But once they get a hang of it, eventual observations which lead to a finding usually come from them. Because I'm not the one doing experiments day in and day out. They have to be the one. If they see something exciting, they have to be able to recognize it, and in order to recognize it, they have to have the basic understanding of what they are doing.

MAESTREJUAN: Yesterday you had mentioned it was fate. You were bound and determined not to do what your parents [Changqi Zheng and Ruanying Lou] did, but then you end up coming to the United States and really getting involved in science and deciding to make it your career. Are good scientists born, or are they made? Is it fate or is it serendipity?

ZHENG: Science attracts certain personalities, and that's something I strongly believe. I think it has a feature of attracting people who like to think, like to really think a lot, and like to ask questions, and like to do new things all the time. I think that's what science attracts. I think this is the reason I can settle with it, because it makes me feel every day I go in, I can do something new or I continue with something that will lead me to something that's new. It's not same old, same old every day. I think that's what characterizes science, and probably scientists. I'll bet most scientists probably have the same tendency as I do. You just can't be bored. If you are bored, then you better have a career that will occupy your mind. Otherwise, you'd go crazy.

MAESTREJUAN: I think we've come to a good point to stop for today.

ZHENG: Okay. Good.

[END OF TAPE 3, SIDE 1]

[END OF INTERVIEW]

INTERVIEWEE: **Yixian Zheng**

INTERVIEWER: **Andrea Maestrejuan**

LOCATION: **Carnegie Institution of Washington**
Baltimore, Maryland

DATE: **11 September 2003**

MAESTREJUAN: It's September 11, 2003, and I'm Andrea Maestrejuan with Yixian Zheng for the last session of her Pew Scholars Program in the Biomedical Sciences oral history interview. I wanted to follow up on a couple of questions from things we talked about yesterday. One of them was, you have worked with fungus, flies, frogs, human HeLa cells, *Drosophila,* mouse, and yeast. How important is model organism choice in the work that you do?

ZHENG: It's very important. Certain aspects of a question are easier to address in certain organisms with a certain approach. For example, the recent project that my student has now finished is that she started to use *Xenopus* egg extracts to address the question of whether a very interesting protein complex is involved in regulating spindle disassembly at the end of mitosis, and she was able to establish that function of the protein. Then it's really important to also see if this protein complex has a conserved role, and also whether it indeed functions in vivo. In biology, everybody always worries about, okay, whatever you see using in vitro assays, whether that's really just in vitro artifact, even though *Xenopus* egg extracts have been well received as being something mimicking in vivo function, but the people still worry. So in terms of addressing in vivo function of a protein, she decided to use yeast. That allowed her to do various genetic analyses and basically led to the same kind of results.

MAESTREJUAN: What impact has it had that you have used *Xenopus* as a model, and because of the tetraploidy problem, it looks like that genome—*laevis*— won't be sequenced any time soon.

ZHENG: That's really slowing things down for people like us. If we want to identify a protein using biochemistry, we would like to identify sets proteins by purifying the proteins and subjecting it to microsequencing. Since we don't have a genome backing us, we don't know the sequence of all the proteins. We also have to be lucky that this stretch of peptide we sequence also happens to have a homolog in mammals. Then we would say, okay, maybe from the information in mammals, we can easily design primers to clone the *Xenopus* gene. Oftentimes, we actually are able to generate peptides, but there's no homology anywhere, so you have to use the hard way to clone it if you really, really want to clone it. So it's been a big impediment.

MAESTREJUAN: You certainly aren't the first Pew [Scholars Program in the Biomedical Sciences] scholar to use frogs.

ZHENG: Even though frogs have been very popular in cell cycle research—like what we do—cell division research, and also in development, the population of scientists studying, I think, is not as big compared to other organisms. That's one factor. The other factor is, it's a tetraploid, so that makes sequencing daunting. That's the other reason. I think it's two issues that make it difficult.

MAESTREJUAN: Right. Okay. How do you see the lack of the genome influencing future decisions on what model to use?

ZHENG: Well, I think people like me, who really want to study certain aspects of cell division, would still have to use *Xenopus* egg extracts. Like it did, for example, affect the decision I made in terms of what to do. We've tried to identify protein complexes using *Xenopus* egg extract, and we have basically ended up only focusing on the proteins that have conserved function or have been found in other organisms to study their function in *Xenopus,* their specific function during cell division instead of focusing on proteins that really did not have any homology in other systems. We found that very risky, time-consuming. You can clone the *Xenopus* gene, and then you'll have to take the risk of what if this gene is not really involved in what you are studying. Just we got it by biochemical purification; we didn't get it through function. So it has been limiting. We would just avoid those genes that have not shown up in human sequencing. If it's not showing up, that would not be our first choice.

MAESTREJUAN: Because you have had experience using different model organisms, what benefits does that give you in this new area of research in evolution and comparative evolution?

ZHENG: I think it's really beneficial from a cell biological point of view. You see that the cells, depending on what type of cell you are working with, seem to have evolved. It's a somewhat different way of solving the same problem. So when you think about evolution, your thinking possibly would be less limited. You would think, well, this is a possibility because it happens in other situations. This kind of phenomena evolved in this kind of cell. It could have happened. It could also happen in this other cell if you uncoupled or recoupled certain regulatory circuitry that would happen. I think it's really useful.

MAESTREJUAN: Some people might argue that having experience with all these different models, you end up being a jack of all trades and a master of none. Is there a risk?

ZHENG: No. Well, I don't believe I've mastered all the model organisms. I just basically for a specific biological question, I decide to use a certain model organism, but I've never been model-organism driven. There have always been questions and problems with it. So that's not a problem.

MAESTREJUAN: Also, again to touch on something we talked about yesterday: Early in your career, you were using brute force screenings, you were creating huge cDNA libraries [complementary DNA], how has technology impacted the training of students, and particularly the kinds of skills that graduate students and postdocs [postdoctoral fellows] now learn?

ZHENG: Oh, it's a huge impact. For example, they don't have to sequence anything anymore, and they usually don't make their own libraries anymore. I think now students these days really have to be spending more time in thinking about a problem than trying to weed through all the technical things before they can get to solve a problem. I think that's a big change. I think students come to a lab, whatever they do, they can quickly get to a stage of actually answering a question, instead of having to, okay, let's just clone the gene, let's just sequence it. It's much faster.

MAESTREJUAN: So technology has helped move beyond boring science, would you say?

ZHENG: Yes. I think technology has made things a lot more interesting. You can do things really a lot faster. That also makes it more competitive. [laughs]

MAESTREJUAN: How about hand skills at the bench?

ZHENG: It's still very important. Well, I mean, you still have to be able go from X to Y to Z. You still have to be able to do experiments to show whatever theory you have is correct or incorrect. You will never overcome that, no matter how fast technology advances.

MAESTREJUAN: One area we haven't talked about is funding. I know from your C.V. [curriculum vitae] that you currently have one RO 1?

ZHENG: I have one RO1, yes.

MAESTREJUAN: I'm going to say that that was renewed.

ZHENG: Yes.

MAESTREJUAN: I guess just to talk about the history of your funding, when you arrived at Carnegie [Institution of Washington], what did you have to start up with?

ZHENG: Well, just, our chairman's words, "You'll get what you need." [laughs] That's the Carnegie style. There isn't a set amount, but you tend to get what you need. If what you need is really sound and reasonable, you eventually get what you need.

MAESTREJUAN: To start up?

ZHENG: Yes.

MAESTREJUAN: And then what percentage of your salary is covered by Carnegie and what percent by grants?

ZHENG: Well, now it's irrelevant, because I also have Howard Hughes Medical Institute [Investigator] appointment, so all my salary is covered by Howard Hughes. Carnegie just does not cover my salary nor my grant.

MAESTREJUAN: How easy or difficult was it to get your first RO1?

ZHENG: For me, I wrote it and I got it. It wasn't hard. But I think to actually get your first RO1, you basically have to do well as a postdoc. You have to show as a postdoc you have established an area that wasn't something everybody else was already there, and you can continue along that area, and that's what you have to do. Once you achieve that, I think your first RO1 is really easy. That's how I feel, at least in my field, and my friends. I didn't see anybody have trouble getting RO1's.

MAESTREJUAN: Well, that's good because *Science* has written a few articles about how difficult it is for young investigators to get their first RO1.

ZHENG: I think it really depends on the field. My field, in general, is pretty small. The

microtubule field is pretty small, so during your training, you still have the opportunity to explore new horizons, I think. But I don't know for sure these days. We are talking about seven years ago. I don't know what the situation is now. I think it's probably a lot more difficult because of the budget cuts and the downturn of the economy and everything.

MAESTREJUAN: Right. Well, when you were leaving the [Bruce] Alberts lab, what were the issues involved in taking your project?

ZHENG: There wasn't any issue because Bruce, [Alberts] wasn't there. I never really felt that was a big deal. I think, in my mind, I never paid attention to what else other people might want to do. I was pretty much single-minded looking at this as what I want to do. The way I was purifying γTuRC [gamma-tubulin ring complex], I knew there must be competition, but that rarely crossed my mind. What if somebody else got ahead of me? Those kinds of things didn't cross my mind that much. And in terms of whether I'm going to take this project or not, again, it was the issue of I felt you cannot stay with one project forever; you have to branch out. I think probably, due to my intrinsic tendency of wanting to do something different all the time, made it less of an issue for me. I just didn't think it was a big deal, but I think, in general, it's a pretty big deal when a postdoc leaves their mentor's lab; and usually, I think, mentors give a two-year grace period. Sometimes things become very gray. What if this postdoc did something and that postdoc also did something? They overlapped unknowingly, and then later realized, okay, it's an overlap, and if one leaves for a job, the other one is still in the lab, what do you do? I think it's really complicated. It's a very complicated issue.

I think the best way to approach that—to deal with it—is just to work out certain agreements to say, okay, define the thing you want to do. This is what I want to do; this is what you want to do; let's give each other a certain grace period of time and then after that, there is no limitation. I think the worst thing is, "I'm going to take this whole project, this whole area. Nobody in your lab can touch it." I think that's the worst thing. There have been things like that, things I've heard of, and to me, it's ridiculous. You can never claim a whole field. And preventing your former lab to work on it doesn't mean that other people won't scoop you.

MAESTREJUAN: Right. Have you dealt with this with your own students? Have you had to deal with these issues?

ZHENG: With my two postdocs, yes. Basically, my approach is, "You tell me what you want to work on. You tell me various aspects you want to work on on this project. I'm not going to say I will stop work on spindle assembly in mitosis. It's not possible. Or this whole Ran pathway. I can't say that. But there are definitely areas I can guarantee, if you want to do it, I won't do it." So that's how we work it out. It's the best. The problem resolves, I think. Usually, it's a temporary problem. When people leave, after people start their own labs for a year or two, if they are going to survive, they realize the fight is not the particular project. I mean, that's what *I*

realized. It's really your imagination and creativity that a're going to allow you to survive in being a scientist, not whether your old lab will continue to work on a certain aspect of it or not. That's my view, but people may actually disagree with me.

MAESTREJUAN: So, in the life cycle of a scientist, your students have not become competitors, direct competitors?

ZHENG: Not really. I mean, if they say this is something they want to work on, I don't work on it. It hasn't been a direct competition. I think if you really say, "Okay. This is the protein I want to work on," I don't work on it. That wouldn't be a problem.

MAESTREJUAN: And for yourself, coming out of the [Bruce] Alberts lab and having really an issue?

ZHENG: It wasn't an issue. There was a little bit of an issue, but really, in the end, not much of a deal. There was a postdoc in Bruce's lab who we sort of worked on different things. I purified γTuRC , and she was studying centrosomes, so it wasn't really much of a problem. Bruce said, "Why don't you have her clone some genes so it will push things faster?" So she started to clone some genes of this complex, but in the end she got bogged down to do something she was more interested in doing. It didn't amount to much of a project. Then she went to Dave [David A.] Agard's lab, and there she helped Dave Agard to work on this complex. They took a structural point of view, and that's not my forte. I've been there, done that.

I felt, when you are a postdoc, especially when you are looking at leaving the lab—establishing your own lab—it's really understandable that you're very nervous and you are being more territorial. That's a very understandable phenomenon. But I don't think anyone can ever claim the reason my career didn't take off is because my PI [principal investigator] kept competing with me. That, I would never agree because there's no way you would survive anyway if you're not smart enough—creative enough—to realize, okay, my PI is too interested in this problem and he has a bigger lab; I'm going to have to switch to something else. If it's not your PI, it would be somebody else who is very smart in your field who would roll you over.

I really don't agree with that kind of mumbling, that kind of whining. Science is not, oh, if somebody took this then that's the end of my career. It's never that way. You have to really believe your own ability to identify a new problem, to study it. There are so many interesting problems in biology. Why does it have to be some certain problem there that you have to study so you will have a career. I don't agree.

MAESTREJUAN: Okay. Great. Back to the funding issue. What's the optimal size you want your lab to be, and how many grants does that take?

ZHENG: I've been switching back and forth. Let's just say if I get to have an eight-person lab, then if two of those are very independent, very good, I can manage it. But if I get to have twelve-person lab, then four of them, or even more of them, would have to be more independent, so that you can actually run your lab and you can be productive. I don't think there is an answer to the size that I would feel comfortable. It all depends on how good the people you have are, how independent they are, how much you need to have daily supervision, I think. It's, again, a hard question, because if you are able to recruit people who can apply for their fellowship, then it's less money. But if you aren't able to do that, then it's a whole lot more money. So I don't know. I can't give you an answer.

MAESTREJUAN: In your graduate work, you trained in a lab that was relatively small.

ZHENG: Very small, yes.

MAESTREJUAN: And the [Bruce] Alberts lab?

ZHENG: Was twelve. They started with twelve and ended up with seven. By the time I left it was four or six. I don't remember.

MAESTREJUAN: And the [Timothy J.] Mitchison lab, I would imagine, was large as well.

ZHENG: It was about sixteen.

MAESTREJUAN: Do you aspire to a high-profile, productive lab like Alberts or Mitchison?

ZHENG: Everybody, when they first start their career, they would love to have that. After seven years, I realized what it takes to have that.

MAESTREJUAN: What does it take?

ZHENG: What does it take is that you have to have people who are very good in order to run a big lab. If you don't have people who are self-sufficient, you cannot run a big lab, because if you do that, you will completely be bogged down, or most people in your lab will be floundering.

Maybe what you would do is, then you focus on the ones who are producing and give them a lot of advice and supervision, and the ones who are not producing, you just ignore. And that could be wrong. But then, you still have to support the whole huge lab, so you have to spend a lot of time writing grants and things like that. So I'm not sure.

Yes, of course, if I get to have all these smart people who want to come work with me, then it's worth my time to write a grant to support them so they would develop a novel approach. And it would be exciting for me. I can be a manager. I don't mind being a manager in that case, because I get to hear the exciting ideas and the exciting results. But that's generally not the case, especially since I started my career. I think the explosion of biology has stopped probably at the end of my graduate school, or middle part of my graduate school. From there on, it's just downhill. Fewer and fewer people want to continue this route, and fewer and fewer postdocs are out there.

MAESTREJUAN: Why is that?

ZHENG: Well, it's a pyramid thing, right? In the beginning, when there were very few biology labs, and there's a ton of money, it's great for new students to see this huge great future to go into biology, so it attracted a lot of smart people. And they attracted a lot of smart graduate students and postdocs. Most of them got jobs. So they got jobs, they got money to hire people. But you cannot possibly sustain this expansion. I think it went through the expansion; now it's going like that. I think people from probably even before my generation hit that. Unless you are extremely smart, have really established some unique area that made your name that people want to go work with you, it's possible. It's still possible, but I think it becomes much more difficult. I mean, if you work on some popular area that's currently hyped up, then it's possible you'll get that. Whatever I work on is never really a hyped up area.

MAESTREJUAN: Given that Carnegie Institution here is somewhat attached to the university but not really integrated into the university, how successful have you been in attracting good and capable and smart graduate students and postdocs and technicians?

ZHENG: I think I've been pretty lucky with graduate students, not in number but in quality. I've had three graduate students. All of them are great. Two graduated, they went to Harvard [University], and they're doing well. One is going to graduate next year. She's wonderful, very smart, very bright.

MAESTREJUAN: Where do your graduate students come from?

ZHENG: Biology department. They're generous enough to let us dig into their pool of graduate

students. I think we're going to become even more integrated.

MAESTREJUAN: When you move to your new building?

ZHENG: Well, even now, because they start to allow us to have the first rotation with students, stuff like that. Postdocs, no, I haven't had a great fortune. I don't really know what's the deal here. I think it's a combination of being in Baltimore and also what I'm doing. Baltimore is not a premier place for postdocs.

MAESTREJUAN: Why is that? You would think, with the Hopkins [Johns Hopkins University] being here.

ZHENG: Well, I know. But you have the Bay Area; you have the Boston area, you have San Diego. When I was choosing postdocs, my eyes were mostly for either Boston or the Bay Area. I figure I will only be there for four years, why not find a place where you can feel the excitement. Whereas, here in Baltimore you can hardly feel that, especially at Carnegie. It's so small. Carnegie really attracts a certain type of people to come.

MAESTREJUAN: Okay. So, rotations, Carnegie is now just becoming part of—

ZHENG: It's more integrated. Before, for the first rotation the students were only limited to biology. Then the last three they are allowed to go out. Now they are allowing them to go right from the beginning. I think also the faculty here are contributing more and more to graduate teaching. That probably helps as well.

MAESTREJUAN: Before this change, how were you able to get graduate students attracted to your work?

ZHENG: I don't know. Basically, you get to present to students, and then they read your things. Probably most of them are much more sophisticated than I was, but at least they have to read your stuff, they have to say, "Well, this makes sense to me. It's kind of interesting." But there are so many interesting lines out there, so it's competitive. In fact, I want to be able to recruit one or two students in my lab this year. I didn't get anyone to do their first rotation in my lab. I'm kind of nervous. You really need new people.

MAESTREJUAN: How good are the Hopkins graduate students in the biology department?

ZHENG: I have to say, in the seven years I've been here, they are just quality. I was very lucky. The first student I had turned out to be great. The second was great. The third is even greater.

MAESTREJUAN: Do you get any students interested in your work from the medical campus?

ZHENG: Not really. Nobody contacted me. It would be nice if I could get into their pool, but they would never allow it.

MAESTREJUAN: Why is that?

ZHENG: Well, it's all competitive. I mean, we all compete for the limited pool. When you have cultivated a pool, you want to guard it.

MAESTREJUAN: Okay. How well have you been able to attract good and competent technicians?

ZHENG: I have been lucky again. I heard that a technician was really good, was long-term. She worked with another staff member here who left to go to Mayo Clinic [Mayo Foundation for Medical Education and Research]. She actually worked for two years and was a staff associate. Those are temporary positions here. Then when I joined, she came to my lab, so she's been with me as long as I've been here. I tend to hire sort of short-term--not exactly short-term--I hired another technician for three years. She then went back to China. Now I hired another technician. She turned out to be really good as well. After probably three or four years, she'll go back to China. I think I have not really had a great luck in terms of getting the right-out-of-college type of students. A few people tried. One really good one basically left after half a year to graduate school, so that wasn't very useful. For those students you tend to get about a year or two years' worth. If you get them for two years, you should really consider yourself lucky. But in those two or one years, they need to be trained for half a year, so it's less stable. That's where a lot of people get technicians from.

MAESTREJUAN: How competitive is the pool of technicians here in Baltimore, would you say?

ZHENG: I don't think it's easy to get a very good technician. It's actually very hard to get a very good technician. You can always find people to work, but a really good responsible one is very

hard to find, or well trained, basically knows all the techniques and is very reliable—dependable—wouldn't say, well, I can't come. It's just very hard, and I've been very lucky.

MAESTREJUAN: What's the balance you need in your lab to get the work done between technicians, grad students, and postdocs?

ZHENG: I think it's because I don't have a big lab, and also, Carnegie is set up in such a way that technical help is really greatly minimized, like the really mundane, like ordering of really very commonly used stuff is not a technician's job. It's ordered by the department; restriction enzymes, plastic ware, a lot of other daily-use materials are ordered by the department, so technicians really get into a lot of experiments. In that case then, I would say I really only need one and a half technicians. Yes, one and a half. One is kind of hard. One and a half is good.

MAESTREJUAN: Funding. You seem to have been fairly successful. Carnegie Institution of Washington is clearly an endowment, Howard Hughes [Medical Institute/HHMI] is an endowment, Pew Scholars [Program in the Biomedical Sciences] is an endowment. I don't know how the Carnegie endowment is doing, but I know that the Pew Charitable Trusts and the Howard Hughes Medical Institute have taken a big hit in the last couple of years, and both have been downscaling.

ZHENG: Carnegie has been doing fine.

MAESTREJUAN: Are you an assistant professor with the Howard Hughes?

ZHENG: I'm an assistant investigator, yes.

MAESTREJUAN: How confident are you that you'll be able to maintain your appointment with them?

ZHENG: I think I should be able to get renewed once. I'm pretty confident that my next renewal, I should get it, because in the five years I've been appointed, we've made some really exciting findings along the line that I started. We not only really forded the pathway that we figured out at the beginning of Howard Hughes, we really figured out several steps down from the beginning. That's when I was appointed. Not only that, we actually branched out into a new direction of another very exciting area. So I'm not worried about that.

My concern is more for myself. I feel like even though we have been studying things

that are exciting, I often ask myself, if I'm not here—if somebody else can do it—then it's not that exciting. I'm not satisfied with my whole performance in terms of a scientist. I feel I haven't really done anything that's truly original. And that's something more of my concern. I like what I'm doing. I enjoy figuring out those things. I think it's still important. But I always have this feeling, if I'm not here, somebody else is going to get it done. I don't know. Maybe it's just me. I tend to be easily bored. I think maybe it's a manifestation of I'm kind of getting bored. I know I was definitely getting bored, and I don't know whether the reason is because I feel like I haven't done anything *that* important. I don't know.

MAESTREJUAN: What's the criteria of doing something important?

ZHENG: Something that if you don't do it, it probably wouldn't be that obvious. Other people probably wouldn't have done it. I don't know. I mean, it's hard. Any idea once it's starting to be talked about. I don't know. It's also possible it's midlife crisis. That's another possibility.

MAESTREJUAN: Are you having a midlife crisis?

ZHENG: I think I already passed that. I think the last two years was very, very hard. It was just, "What am I doing?" "Why I'm doing all of this?" I think I already passed that.

MAESTREJUAN: How did you work out of that?

ZHENG: I think one way was to really start the evolutionary project. I'm reading in evolution and really trying to get my mind away from various things you can never solve but into certain things that are quite interesting intellectually. I think evolution is intellectually an interesting question. The main thing that attracted me is, I think, there isn't any clear idea yet what at all happened, why we suddenly have such a diversity. People all have their own ideas, and none of those ideas are proven. Nobody has a really good way to study it. I think that, to me, is really interesting and exciting.

MAESTREJUAN: Okay. How many RO1's do you think you would need to maintain the lab at the level that you want to maintain it?

ZHENG: I really only need one. Yes. Well, Carnegie has a size limit. We're allowed to have about eight, plus or minus two.

MAESTREJUAN: And why is there a size limit?

ZHENG: I think this is the ideals of this institution where they really encourage the PI to be a scientist, not become a manager. Most PI's here—probably everybody—does research themselves, have their pet projects to work on. I think that probably is the most important reason.

MAESTREJUAN: Do you have something here like tenure?

ZHENG: No. We don't have tenure. I don't have tenure with Carnegie, I don't have tenure with the Biology [Department], I don't have tenure with HHMI, or Hughes Medical Institute. I think, yes, I knew that when I was making my choices. I felt really comfortable seven years ago when I was deciding where I was going to go. I think the last two years, there were times I was thinking, well, maybe I have made a wrong choice, maybe I should go to a place where I *could* get tenure. Then if I really ran out of my excitement in doing research, I'd still have a job. Now it's less of a problem because now I think if I'm bored with science, I probably wouldn't want to stay in science without doing research because it would bore me. So I probably would do something else anyway. It doesn't matter. I've sort of come to terms with it.

MAESTREJUAN: What difference does it make, with the kind and the type of science that you do, when money comes either from public sources of funding, like the National Institutes of Health/NIH, or private sources of funding, like the HHMI [Howard Hughes Medical Institute] or Pew [Scholars Program in the Biomedical Sciences]?

ZHENG: Oh, HHMI, Pew [Scholars Program in the Biomedical Sciences] are very important for me, because I tend to do different things. With NIH [National Institutes of Health] , if you don't make progress in whatever you propose you want to do, you'll go down. You won't get funding. So I think the initial thing to get Pew [Scholars Program in the Biomedical Sciences grant] was really important for me to get moving to Ran. That allowed me to hire that postdoc to come in and work on some project that's different. [Howard] Hughes [Medical Institute Investigator award] definitely also allowed me to really think about it. I think getting Hughes, and probably not just getting Hughes, being at Carnegie getting Hughes, all made me think, well, I've been getting money from these endowments. All of them have this idea of having you do something different. I think maybe that was also one reason that made me unsettled with what I've been doing. I feel like I haven't done something truly original, although I've been lucky enough to get all this foundation money. So I think maybe that was also a driving force to make me *really* want to do something different.

MAESTREJUAN: Okay. Yesterday you discussed a little bit about the problems of your field

and the kinds of projects it takes to be productive, that they're long-term projects, and you felt like there may be some danger in this field because there're so few people and it's so difficult that people then move out of the field, that it will disappear. What's the impact if the current situation doesn't allow for long-term projects?

ZHENG: I think what people have been doing. Iit's just like me, what I have been doing. The impact, you mean?

MAESTREJUAN: Well, besides the extinction quotient.

ZHENG: Well, the impact would be, for example, for me—I can't say for other people—I know when we worked out one assay, an assay that was worked out by other people, we were able to take this assay and then do biochemistry. We made three steps, but after that it was hard, and my postdoc tried very hard. I know he had made a lot of effort. I know he would need a paper. He's from Japan and he wants to go back to Japan. He needs a paper. Basically, after a year and a half, I said, "Okay. Let's just take a tentative approach to be sure that you are going to get a paper." So we sort of just decided, instead of following that purification, which probably will take somebody five years, could be still with no paper, or could be you could get something more exciting. We decided, okay, you'll back down to be more paper-oriented. So now he has a paper. But that assay, that purification, is just staying there. Nobody else is touching it. I tend to have postdocs work on completely different projects because I don't want them to have tension among each other. It's uncomfortable. Essentially, I'll have to wait for somebody who has this kind of attitude or this kind of ability to do protein purification—hardcore protein purification and really difficult protein purification—and is willing to give it a try. I don't know when it is going to come.

At the same time, I realize I still need to get papers, still need to make reasonable progress. Even if it's not groundbreaking, it needs to be progress, so I just have other people work on something that's more obvious. At least you'll get a paper even if you don't make a groundbreaking discovery. But you could still make a fundamental discovery for that area. That's what I've been trying to do. You just manage. You push it and then step back and do something else, get a paper, and then you go back and push it again. Or you go to a different direction to push it. And that's what people have been doing. Maybe that's really what science should be. You can't just be so narrow minded to only go on one road; you have to go from different directions.

MAESTREJUAN: Okay. Let me flip the tape over.

[END OF TAPE 4, SIDE 1]

MAESTREJUAN: Do you think the funding environment and the kind of reward system that's set up in the peer review of publications and of grants plays a role in shaping the kinds of scientific research programs that are developed? For instance, does the American system tend to fund this kind of science? Or that you do what you need to do to stay afloat, I think is the term you used yesterday, and you publish papers even though they may not be groundbreaking, and that long-term projects, by necessity, are riskier projects. I guess another way of looking at this, and maybe that's the question I want to ask is, are there such things as national styles of science?

ZHENG: No, I don't think so. For funding in the national level, you've got to have some criteria to give people funding. If somebody does not produce anything in five, ten years, how can a reviewer decide whether this person is doing something really difficult and it's just hard. We should keep funding this person? Or, this person's doing something really stupid. That approach is never going to work. I just believe this is the only way. It's up to the wits of the researchers to figure out how they are going to make their career. They either take a higher risk or lower risk, or push, wait, and go push different directions.

I think the funding is fine, but I think it is important to have private foundations fund more risky projects. I think those candidates were mostly chosen by the person, not the project. Like [Howard] Hughes [Medical Institute] always says, they fund the person, they don't fund the project. I think that's more or less what Pew [Scholars Program in the Biomedical Sciences] does as well. They are not funding the project; they are mostly looking at the person and what they have done. Are they most likely to be creative and to do something original than others? If yes, we take them. But for the national level—and that was the bread and butter of the science–I think you can't take that approach. You have to take the approach where you allow a diverse group of people to take their own ingenuity, to divine their own way of approaching a problem. It can be sometimes mundane, but you need that mundane incremental knowledge as well. So I think it has to take a combination. I think National Institutes of Health [NIH] funding is fine. I think they are doing the right thing. Otherwise, how can you determine? You can't determine. And also, you can't really downplay the incremental problems. Sometimes incremental problems—many of those—add to a big problem.

MAESTREJUAN: Okay. Do you have any teaching responsibilities here?

ZHENG: Very little. It depends. This is one thing, a great advantage I have, and also a great sort of source of my own feeling of being sufficient, because I feel like I have all these advantages. If I can't do something that's really great, I would feel very ashamed. I don't have to teach much, very little. I think it's possible I can get involved in teaching more graduate courses, but so far, I've been only teaching one every other year, and that's just three periods of lecturing and the rest of the time just hearing students talk.

MAESTREJUAN: Obviously, you came directly to the Carnegie, so you didn't have much teaching experience before that; but what would you say are the advantages and disadvantages to not having any teaching responsibilities?

ZHENG: I think your own seminar talks probably wouldn't be as good if you didn't have to teach undergrads and graduates, because teaching undergrads and graduate students allows you to look your problem from far away and think at a much lower level to really lead people into your field. I've seen people who taught undergrads really give great talks. You get it. It's just so easy-going, easy coming out. No matter how deep, how complicated, they lead you through. You feel it has so much clarity. I think I would really benefit if I had to teach undergrads.

And the disadvantages. You really have to be extremely well organized, and I'm terribly disorganized. So I think I would be in moral distress if I had to teach undergrads and graduate students. I just don't have a very strong organizational skills. People who have a strong organization skills probably will survive better than people who don't.

MAESTREJUAN: Okay. We've talked briefly on and off about your pressures from your personal life and your professional life, if you want to choose to divide it up that way. I'd like to talk a little bit more, and just to get the chronology down, you met your husband [Max Q. B. Guo] in graduate school?

ZHENG: Yes.

MAESTREJUAN: And when did you have your child?

ZHENG: I had him at the end of my third year in graduate school. That's when I knew I was going to have a paper, I knew I could graduate.

MAESTREJUAN: Was that factored into the decision to have a child?

ZHENG: Oh, yes. I would never have had a child if I didn't know I would get a paper. It's just impossible.

MAESTREJUAN: Because the paper meant—?

ZHENG: The paper meant you are likely to graduate, so then you can say, "Okay. Now let's put

this extra burden in and I can probably still stay afloat." I still think graduate school is the best time to have a baby. My student is having a baby. I told her the best time, if you want to have a career, no matter what career you want to get in, I think it's best to have a kid when you are young where, even though you do not necessarily have a whole lot of money but you have so much energy. I worked nonstop. I'd get probably about six hours sleep. I never really felt that tired. It was nothing. Now, I don't think I could do it. After I started this job, I don't think I could do it.

MAESTREJUAN: What about the postdoc [postdoctoral fellowship] years?

ZHENG: I think it's very hard. When you are a graduate student, your concern is to graduate. If you learn techniques, you graduate, you're okay. If not, you have to develop something profound. When you're a postdoc, you really need to develop something profound. You need to work independently, and you need to read a lot and think a lot. Your immediate future is to look for a job. Grad students, no. That's why I think graduate student is the best time. I think postdoc is the worst time. Being a faculty is better than postdoc, because at least after being as a faculty, you make a little bit more money. Then you can really arrange things better. Postdocs don't make as much money as PIs [principal investigators].

MAESTREJUAN: And you have one child?

ZHENG: I have only one, and that has something to do with that. I have a career and my husband had a career. We were both very busy, and his job situation was not settled for many, many years.

MAESTREJUAN: You had mentioned briefly in the first session that he chose to put his career second to yours in the decision to accept the position at Carnegie [Institution of Washington] and he'd go on the job market. How has that worked out for him now, after finishing his postdoc?

ZHENG: I think he is happy now. He wasn't happy for many years. He felt maybe he had made a mistake to come here, to leave Mike [J. Michael] Bishop's lab. But now he's pretty happy, because after his effort—he put in a lot of effort—he finally managed to get a job at Hopkins [Johns Hopkins University]. He was a faculty at Hopkins School of Medicine for two years, and it's his decision that that's not for him, after two years. He at least got to his goal. He got an idea of what it is to run your lab and do research, and he decided that's not really for him. He decided to go to NIH [National Institutes of Health] to be a program director.

MAESTREJUAN: So he's still in the field.

ZHENG: He's still in science, but he's no longer at the bench. He's not a bench scientist anymore. He's not running his lab.

MAESTREJUAN: So his workday involves a commute?

ZHENG: Well, yes. The first year we moved here, he was at Hopkins, he didn't have to commute. But the next three years he was at NCI [National Cancer Institute]. He learned how to do microarrays. Those are the early days of microarray. He learned that technique. So he commuted for three years, and then he came back for two years at Hopkins and he didn't commute. Now he's started to commute for a whole year already. He has to commute now. But it's much easier of a commute because his job as a grant administrator is really regular hours. So that makes it bearable, tolerable, to commute.

MAESTREJUAN: When he was trying to figure out what he really wanted to do, what impact did that have on your future here at Carnegie?

ZHENG: Well, he never let anything affect my career. He's just a very selfless person. He never wanted to have his problems affect my career in any way. I think the only thing that sort of affected me is I felt guilty all the time. I felt terrible all the time. I felt because of my being not very flexible. Because the one option he wanted to consider is that he will stay at UCSF [University of California, San Francisco/UCSF] and he will take care of our son [Benjamin Guo] and I will come here first, and he'll spend a year or two maybe hoping to find a job here. I just didn't like that option because I didn't want to be separated from my child, and I didn't think he would really make much progress if he ended up having to take care of our son by himself. I think it's easier if you have two to take care of one child. I didn't like that idea. I said, "If you want to do that, I will take the staff associate or UCSF fellow position." He thought that definitely was a no-no for me, so in the end he came. I've always felt very guilty about that.

MAESTREJUAN: How well have you been able to divide child care and household chores?

ZHENG: It's really equal. He's been a great husband. I mean, I used to have this illusion that American cultural way, the husband and wife are really equal. But actually, after being here for many years, I see actually women still tend to do more work at home, and there's still this unequalness in families. I think in a Chinese family this is probably even more so, but my husband is just really great. He always did his share, sometimes more than his share, when I get busy.

MAESTREJUAN: And how well do you balance your roles as scientist, mother, and wife? How well do you think you balance?

ZHENG: Well, I definitely sacrifice my role as a wife, but I don't think I sacrifice my role as a mom. At least I try my best. Maybe I'm just thinking this way to make me feel more comfortable, to feel good about things. It would be good to see how my son feels when he grows up. But the way I felt is, yes, being a good mom doesn't mean that you could sit home with your son, that's good enough being a good mom. I think being a good mom is really teaching your son to be exposed to interesting things in life. I think my son has always been exposed to my colleagues, because I always bring him to the lab. He grew up in the lab, and he always got a lot of attention every time he came to the lab. Not here. I mean when I was a postdoc. He would be drawing; he would be talking to people. This is the other thing I really felt very grateful about the group I was with. They loved him. He would just have everybody to talk to. Everybody loved his drawings, and they would ask for his drawings. He loved drawing. He's a very good artist. He'd be drawing there. I'd throw him a pile of pencils or pen, and he'd be drawing. Sometimes he will draw on the board in our area. We are all completely open, several labs are all together, and the lunch area is open. I think he has an interesting time. Also I take him to meetings. Yes, sometimes it's boring. He had to wait out while I'm in the meeting.

He just happens to be a child that's very easy to deal with. Throw him a book, throw him a pile of pencils and paper, he's happy. That makes life easier for me as well. I don't know. I think I balanced out in certain ways. Looking at him now, I think he's fine. Probably among his peers, he's traveled a lot more than most kids, because I take him to all the meetings I go to. Whenever possible I take him with me, and then I take two or three days and we'll tour a little bit.

MAESTREJUAN: Is he going to pursue his career in science?

ZHENG: Oh, he enjoys science. Sometimes I would just show him simple phenomenon.

MAESTREJUAN: What if he came to you and said, "I want to be a novelist."

ZHENG: That would be okay. I think he's a very level-headed person. He's not like me. He really is much more level-headed, much easier to deal with. He is in piano. This is the other investment I did. Even though I have been very busy, I've always taken him so he's been having very serious piano training at Peabody [The Peabody Institute of the Johns Hopkins University]. He's been doing that for seven years, as long as I've been here. Every week he has two lessons, one private and one group. Group is theory and private is skills, playing. I always have been the

one doing that. And also since the program he's in requires parental input, I always sat down and practiced with him, every day one hour for five years. After that, he grew older; he is more rebellious; I quit. I don't sit with him because he would be unhappy. But before that, I sat down with him. I was also very tough, he had to practice. I was really tough.

So I think you can manage. It depends on how you define a good mother. If you define a good mother as attending to every single detail of your child, then I'm not a good mom. But if you define a good mom as affording your child to do things that will really have a long-term impact on your child, I think I'm a reasonable mom. So I don't know. I definitely have not spent enough time compared with eight-hour job moms. There's no time I can ever claim that. But if I'm not with him, my husband is with him. We have not been spending much time with each other, but we always make sure that somebody is spending time with him. So I think it's possible to manage if you have a very strong relationship with your spouse and you don't really have to be together to really keep that going, it would work.

MAESTREJUAN: When he brings home B+ and A- in math and English, how do you react?

ZHENG: We are really a lot more relaxed than my parents [Changqi Zheng and Ruanying Lou]. My husband had always felt, "Aw, math, you can learn that later." He always felt piano or art is something you really want to instill into your kid. And my son happens to be very artsy. He's a very good artist. He really draws well. We haven't really done much in terms of training him in drawing. He's very natural. But piano is something we really paid a lot of attention. We really made sure he put time in there because those are the skills if you don't develop early, it's going to be very hard to do that later, because your brain is not as plastic when you grow older. What did you ask me?

MAESTREJUAN: Just if you got on his case about bringing home B+ and A-.

ZHENG: Oh, yes. I think he sometimes gets B+ or B. I don't think he ever got B-. Well, okay. That's another thing that was kind of interesting. After we came here, when we were deciding where to send him to school, we made a conscious decision that, since we are Chinese, we are very restrictive in terms of training—less creative in terms of training—so we wanted him to go to an environment where creativity, imagination is encouraged greatly and not a really mundane kind of training. So we send him to Mark School [New Mark of Excellence School], which is an independent school which claims that they have progressive education. They really encourage in kids an interest in learning, not really knowledge. He went there.

And I think there are some consequences. I don't think that school is as rigorous in terms of drilling students for basic principles: ideas and basic skills, math or basic things. So his standardized test, I would say his math is probably A-, sometimes B+. And we know why, because he just didn't have enough time to practice on it, and we never paid attention.

Sometimes I worry if we have made a right choice, but in the end, we decided we will keep him there because he made his friends. He feels very comfortable there for his type of personality, so my husband now starts to give him more basic training in math. That's how we are doing it. We're not really trying to give him much pressure. I never check his homework. It's very good. He always does decent work. And they don't have exams. That school does not have exams until high school. So there's no way for us even to know how well he's doing, other than the standardized test if we want to know; well, they send it back once every year.

MAESTREJUAN: This is a private school?

ZHENG: Yes, it's a private school.

MAESTREJUAN: Where will he go for high school?

ZHENG: It's also.

MAESTREJUAN: Okay.

ZHENG: It's a very beautiful suburban setting. It's really nice. It's a rural setting, a suburban setting, surrounded by mountains. It's very nice. I wanted to go to school there.

MAESTREJUAN: On a little bit different topic—maybe it's actually parallel—what is the gender makeup in your lab? How many men and how many women?

ZHENG: I don't think that really has much bearing in terms of what my choice is. I have no choice. Everybody who is reasonable comes. It's very interesting, in the beginning, my lab was mostly women. Well, actually, I had all women for two years until a boy showed up, and then he got teased all the time. [laughs] They were just making fun of him.

MAESTREJUAN: What do you think accounts for why you attracted women?

ZHENG: I think it was probably because I was a woman. I think I tend to get women scientists because they [unclear] consider me. I think it has something to do with it. Now it's less obvious. I mean, I have probably half and half. Yes, about half and half.

MAESTREJUAN: When you had this discussion with one of your students about when's the best time to have a child, was that a male or a female?

ZHENG: It was a female.

MAESTREJUAN: Do you ever get males asking you?

ZHENG: No. Well, I just had one case where they are considering starting a family. All my students have been female, and the other two aren't married.

MAESTREJUAN: What difference do you think it makes on the kinds of research projects that you do? Are women and men attracted to different kinds of projects?

ZHENG: I don't think so. Not in biology. I don't know. It looks to me maybe guys are more attracted to math and physics, but biology, I think people tend to do similar things in biology. Maybe evolutionary biology there is some gender bias. I don't know.

MAESTREJUAN: What difference does it make in how you train a student if they're male or female? And do women and men learn science differently?

ZHENG: I can't tell because I haven't had a male graduate student. I can't tell. Maybe they're more stubborn. I don't know.

MAESTREJUAN: There've been a lot of reports done in *Science,* and particularly since the MIT [Massachusetts Institute of Technology] study, that shows that at the graduate level it's about fifty-fifty, and at the postdoc it becomes slightly skewed; but by the time you look at the senior tenured members of faculty, it's primarily male. What do you think accounts for that?

ZHENG: I think what really accounts for that is that, once you have a child, it takes a lot of effort to keep going. It takes a lot of support from your spouse to keep going. Your spouse not only really has to be supportive at home to share the load, but also has to be supportive in encouraging you, to say, "Well, don't worry. We're doing fine. I want you to have a good career. I think you're doing great. I'm proud of you." I think that's what it takes. I mean, if my husband had not encouraged me all these years, I would have quit at any point in my career. There are times I feel like why am I working so hard, and also very frustrated when something doesn't

work and when things are just not going as well as you wanted. Then I don't spend enough time with my husband and my child. You need encouragement. I don't know about American women, but Chinese women, even though I come from a family where my parents expected a lot of me, the culture has been that you don't have to have a career; who said you have to have a career? Boys are instilled very early on that they need to have a career. I don't know if that's the case in this country. Maybe that's even so in this country. So for women to survive, to really keep going, you really have to have the right kind of environment, unless you are just an extraordinary woman who does not need any encouragement, who's just superwoman, who can work sixteen hours a day without feeling very tired. It must be those kinds of women that survived in those old Dark Ages, became famous. I don't know.

MAESTREJUAN: Does science select for a certain personality type or certain personal life choices?

ZHENG: Probably. Probably. I mean, for women, you just really have to choose certain things and give up certain things if you want to have a career. I don't even think it's science; it's any career. You just have to choose: What's more important, what's less important. And science probably selects the type of woman who is less—I would say—bothered by not being the ideal mother, being the ideal wife. I don't know.

MAESTREJUAN: Since, at least at this point in time, we can't change the biological roles that women have to bear the children and men don't, is this structure of science that we have—that it's okay to be a graduate student, but it's going to be more difficult to become tenured for a woman—is this something that's static? And what impact does it have on science if there're more graduate students that are women but there're very few senior members of science that are women?

ZHENG: Well, it's been going on like this for many, many years and science is still moving forward. I don't think it'd be having some profound impact from the science perspective. But sociologically, I think it's just going to keep putting women in this role: When there is time to make a career decision, you put your family life ahead of your career. In many cases, it's a personal choice, but those personal choices are based on society's influence as women grow up from a girl. I think if you feel you're always going to be taking a lesser role compared to your husband in the family in terms of career but more a role in homemaking, if you were already instilled like that, that will be what you decide to do when it comes time that you have to make certain sacrifices. You would most likely sacrifice your career. But I don't really think it's going to impact the progress of science as a whole.

MAESTREJUAN: How important is it to have women scientists at all?

ZHENG: I don't think it's how important it is to have *women* scientists, it's how important to have *good* scientists. I think that's important. I think by and large we have such a huge population of scientists. I could be criticized and the women's name could be bad, but I just don't feel it's a science issue. I more feel it's a sociological issue. It's a social science issue, not a science and technology issue. So far I don't see how women doing biology would be substantially different from men doing biology. There's no data saying women would contribute in biology in a fundamentally different way that's fundamentally important. There's no data on that. That's why I'm not convinced this is an issue about how important it is to biological research; it's more how important it is for women's quality of life, for women's satisfaction of their lives.

MAESTREJUAN: Then the other issue would be, what's the ethnic makeup of your lab?

ZHENG: In the beginning, it's essentially one person from a country: My graduate students, one is from Peru, the other is from Sri Lanka; my postdocs, one is from England, the other is from Germany; my technicians, one is from China, the other one is from America. So it was one from each country. Now I have a student from China. Mostly Asian now. It's not by choice. There're just not that many people out there. Europeans tend to go to New York, the Bay Area. Asians, it's a big pool that you can still recruit. Now I have one from Taiwan, two from Japan, one from Hong Kong— that's my postdoc—and I have one technician from China, one student from China.

MAESTREJUAN: So you're pretty much a multinational lab.

ZHENG: Yes, very multinational.

MAESTREJUAN: How does that reflect, do you think, in your other experiences in your other labs and labs that you know about?

ZHENG: In my graduate lab it was pretty multinational. My fellow graduate student was from Korea, and then later Berl [R. Oakley] had one student from Lebanon. The other one was American, and the rest were American, but the rest were the postdocs. My boss's wife was from England. Bruce's [Alberts] lab was a little bit more homogeneous. There were two Europeans and me from China; the rest were Americans.

MAESTREJUAN: That's interesting. What do you think accounts for that, because I would assume he would want to have more people in his lab.

ZHENG: What accounts for that I think is just competition. Bruce has a very big name; he has a very big lab. It's a great training place. I don't know if you pay attention to this. If you go to university—the best universities—you still see a predominance of Americans. Then you go down a tier, you start to see some Europeans. Then you go down further, you start to see some Asians.

MAESTREJUAN: Okay. And what accounts for this hierarchy.

ZHENG: What accounts for that hierarchy, is very natural, because in Asia, really, the best biology training is still from Japan. Japan is a tiny country. China, it's going to become really good, but it's been so many years [that] China's biological research was just lagging behind, so of course they can't produce nearly as many high quality people. My bet is that China is going to take over Japan in terms of producing really good high-quality researchers in probably four or five years. I think that's the reason.

Also there is a language barrier. If I have a choice of equally good candidates, I would choose somebody who can speak English very well—communicate very well—instead of somebody who really has difficulty communicating. It's just only natural. I don't think there is any prejudice, but I believe all scientists who run labs, they take one approach: merit based. They would never do anything different because it's only detrimental to their own progress, to their own survival. You have to do it in the merit-based way.

MAESTREJUAN: I may be begging an answer here, but how important is it to maintain cultural diversity in a lab?

ZHENG: I don't think it's that important. Again, I think it's more important to maintain a highly active research group, maintain high quality, than diversity. That's definitely not on my agenda. I'm not up to maintaining diversity, but I would love to be able to maintain a group where communication is highly available and where people talk to each other and there is no communications barrier. If I had a choice, I would love to recruit the highest—the best quality—people who can communicate in English fluently, and that's definitely not what I have, but I just don't have a choice.

MAESTREJUAN: I want to backtrack a little bit. I did want to ask if your son is bilingual.

ZHENG: He is but his Chinese is not as good as I would like to have. He can understand, but he cannot write. He can't read very well, either. I would like him to be bilingual. Among all the

things I want him to do, I decided maybe we can take cuts in Chinese so he can do more time on piano. It's again a choice. Maybe it's the wrong choice, but he enjoys it.

MAESTREJUAN: Has he spent much time with his grandparents in China?

ZHENG: Oh, actually, his grandma is living with us. My mother-in-law has been with us for the past three years. It's just that he doesn't have the time. He has to practice piano, his homework, various activities.

MAESTREJUAN: Your sister [Wanlan Zheng] is now living in—

ZHENG: In D.C. [District of Columbia]

MAESTREJUAN: And what about your parents?

ZHENG: They are in Dayton, Ohio. My father [Changqi Zheng], like I said, he was really good; he was the best in his field. It's a battlefield in gear engineering, but he is the best. There's no doubt. That's why he was able to get a job in his late fifties, with broken English.

MAESTREJUAN: And is he in academics?

ZHENG: No. He was in a company, he was managing their gear [engineering]. He was there for ten years helping them out, and he's retired now.

MAESTREJUAN: *Science* has done a couple of articles since the Wen Ho Lee case, or the Los Alamos [National Laboratory] case, and that Asian Americans have felt a growing antagonism toward Asian faces in science, and a lot of this was focused in labs that did defense research. But it's also brought together a new consciousness about Asian stereotypes, personality stereotypes, and their ability to move beyond just being assistant researchers and into administrative posts.

ZHENG: Yes. I think it's definitely still there.

MAESTREJUAN: How accurate is this stereotype of the Asian personality of being self-

effacing and low-key and maybe less competitive or less aggressive in a competitive lab environment?

ZHENG: Okay. I think the first part is right. I think that actually reflects more of Asian culture. It's low-key and make sure you do your own things well. Don't bother about other people, what they are doing, just take care of your own business, be a good citizen. That's very much an Asian tradition of value that we were taught for generations. It's kind of hard to change. But I don't necessarily agree that Asians are less competitive. I think there is equal competitiveness. It's just the approach toward competition.

MAESTREJUAN: And has there been a price to be paid for that? Using your own career as an example, would you say you have faced some kind of discrimination because of these stereotypes.

ZHENG: No, I haven't. I don't think the stereotype has affected my type of career. But I have a feeling if people like me one day decided, "You know what, I want to develop my skill in administration. I want to become a dean; I want to become president of a university." I think then you will start to feel that. I think at this stage of career, I don't see that. I think it's a very, very good culture.

MAESTREJUAN: Well, with your own students and postdocs, how aware are you when you see somebody fitting the stereotype, whether it's male or female, of that.

ZHENG: Well, you can't really change that. I think it, to a large extent, depends on the personality. I mean, I'm Asian. I have all these traditional values. But I happen to be somebody very outgoing. I think everywhere I went, I was told, "You're not behaving like a Chinese." I like to talk. I like to yap. Anybody can make a conversation with me. I don't hide anything. I'm very straightforward and I just say whatever I think. That was hard for me in China, but it was great here. I love it here. It's a personality issue as well. One thing, I think, as a PI you could do it; as an advisor, you could do this. They encourage that. But I don't think you can really ever change it. It also comes with whether a technical person is good with their communication skills as well. So I think it's a combination of the cultural value and the communication skills that made this kind of outlook of Asians, in general; that created the stereotype. I think you can only guide people and say, "Well, you need to ask more questions. You need to be more interactive. You need to go out and talk to people more, discuss things more." But it may not really in the end have a profound change on a person. That's how I feel.

MAESTREJUAN: Okay. Let me pop in a new tape.

[END OF TAPE 4, SIDE 2]

MAESTREJUAN: Also, because China has experienced such a great brain drain: that 50 percent of their graduate students go to do postdocs outside of China and very few of them return, that the Chinese Academy of Science is starting to make reforms, how conscious are you that you're part of this Chinese brain drain? Then a second question would be, what would it take for you to consider returning to China?

ZHENG: I'm very aware of this brain drain. I think it's all regulated by the market. I think because of this brain drain it created pressure for the Chinese government to make these changes, which have been great for Chinese science development. Yes, only 50 percent went back, but that has been a huge help for our country. I went back in 2001; I went back in 1998. I've seen these dramatic changes in scientific research. And I'm going back again this October. I'm going to visit some institutions there. I think all this so-called brain drain has ended up being a positive on China. I think it's a great thing, and there shouldn't be any regulations to stop it. I think any regulation you do, it would be only detrimental. As a society, China should just create to be more open and have more open competition for jobs. I think that's what is happening. Now you go to the best institutions, most of those PIs [principal investigators] were trained abroad. A lot of them are publishing in international journals. That was nonexistent even probably five years ago. So I think it's a great thing.

For me, personally, I think I wouldn't fit very well in that environment. I'm just not very good at relationship building. I enjoy this culture, this society, mostly because it's very simple. You do your job. That's all. That's all that's needed. But in China, no, you not only have to do your job; you also have to be good with interpersonal relationships. It's just very tiring to me. I'm just too direct and straightforward. I think I would easily offend a lot of people, and that wouldn't be good. That would not be good for me to really try to make a career.

MAESTREJUAN: Well, how concerned should nations, countries, states be about losing scientists? How important is this issue?

ZHENG: Instead of being concerned with that, the states and countries should think why. Can we do something to promote the retention? That's what China did over the many years. They create positions now to make it attractive for people to go back. And a lot of people are going back. I think if this trend continues, there will be more and more people going back. Just like Taiwan. I think twenty years ago most Taiwan scientists stayed here, but now a lot of them go back. I think, in the end, the earth is going to be so internationalized in many professions, so it's going to be less of a concern.

MAESTREJUAN: Okay. The United States also—well, it's calmed down a bit, but for a while there—was concerned with a reverse brain drain. A prominent UCSF [University of California, San Francisco] faculty member left the United States to take a position in England because of regulations on certain technologies. How concerned are you?

ZHENG: I think that's a problem. I think the U.S. [United States] really needs to be careful about these kind of policies. In this period, due to terrorist attacks, they are limiting visas of scientists to come to do research. I think what it will hurt is what if the very best, like Albert Einstein, happened to be weeded out. I think that would be a huge loss to this country. I think this country really needs to be careful not to take extremes of doing certain things because of certain threats. I think it has to be balanced. I think that's what the Academy [National Academy of Science] is trying to do. They were trying to give the government advice on *not* taking extremes. Most scientists coming to this country are not terrorists; they have nothing to do with that. But now there are certain times when a person obtaining a visa to come to do research would have to wait for a year. It's ridiculous.

MAESTREJUAN: What's your own citizen status?

ZHENG: I'm an American citizen.

MAESTREJUAN: So there's no concern. What about regulation of certain technologies? For instance, cloning or stem cell research. How concerned are you that this kind of regulation will impede the progress of science in the United States?

ZHENG: That's a very tough question. I think I take a more left kind of view. I think as long it is medically beneficial and it's not creating a big ethical issue, I think it should be allowed. Maybe China went too far, but I think America tends to be much more conservative compared to Europe. I think America should be at least as progressive as the European countries, although, even in Europe, probably there are differences. At Hughes meetings [Howard Hughes Medical Institute annual meeting] they tend to discuss this issue. Since I don't do this kind of research, I spend much less time even thinking about it. I'm lucky. I don't have to worry about any of those regulations.

MAESTREJUAN: How important is it to you to have some kind of medical applicability or therapeutic applicability to your work?

ZHENG: Not important. That's a plus. I think it's really much more fun to do research following your heart than doing research following the trends. How it has to be medically

oriented, so I have to figure out how am I going to make my connection. I think it's better to have a connection naturally than to go seek connections. I'm very fortunate by being here [Carnegie Institution of Washington].

MAESTREJUAN: Right. You're one of the few Pew [Scholars Program in the Biomedical Sciences] scholars whose application did not make some reference to any [medical or therapeutic applicability].

ZHENG: That's true. I never really bothered with it. Sometimes you do put one or two sentences in and say, "Well, it's related to cancer." It's really marginal.

MAESTREJUAN: When do you see the need to do that?

ZHENG: When you apply for a grant. You want to put one or two sentences in the section that says to describe the significance to human health or to advancing knowledge in understanding human health.

MAESTREJUAN: How much of that is a game that everybody plays, and how much of that is that some granting agencies, it is important to them?

ZHENG: Depending on the granting agency. I sat on the prostate cancer grant—the panel—for three years. For that particular panel, it's really important. You have to have a *real* application potential or your research has to directly relate to prostate cancer; otherwise, you are not going to be funded. Sometimes this was just for certain grants. Like an NIH [National Institutes of Health] grant, I think if you don't put it in there, they won't say we're going to cut your grant in half. I don't think so.

MAESTREJUAN: How confident are you that because you aren't interested in this—

ZHENG: I'm interested in that, but I just don't think it's right to just try to make that connection so you will get funding. I think it's much better if you just think how it might be connected in the scientific point of view. So far, I haven't. If I had an MD, I think it would be much easier for me to go seek links. I don't have an MD, it's really hard to do that, and I haven't done that. Bruce [Alberts], my postdoc [postdoctoral fellowship] mentor, is very much into that we should really try to do medically oriented research. There is a huge interest there, and also there are a lot of interesting things that you can discover. I completely agree with that. But it also takes a person with the right background. I don't think I have that kind of background, and I don't have a

collaborator around that I could really talk with. Particularly, what I study is very basic. It's really talking about a basic process, and that's probably made it a little bit even more limited.

MAESTREJUAN: Okay. What's the relationship between the basic researcher and the more applied researcher?

ZHENG: A basic researcher probably tends to think about a problem without thinking about the clinical manifestation. I think an applied researcher probably would more think about, okay, what is the disease? What is the mechanism of disease? I think that would be a difference. That's why I really think those MD/PhD programs are wonderful. Because then you have the kind of background which will encourage you to make those connections. You are also a basic researcher. I think those are really ideal training.

MAESTREJUAN: One thing I do to help prepare for an interview is I scan the patent database.

ZHENG: I don't have any.

MAESTREJUAN: You don't have any patents, and also nobody has used any of your work to support their claims for a patent, which is unusual, because most Pew [Scholars Program in the Biomedical Sciences] scholars, somebody has cited their papers or something to support their claims. I guess I'll just ask then, how much encouragement do you receive here at the Carnegie Institution [of Washington] to look for commercial value in your work?

ZHENG: None. [laughs] It's never on the agenda.

MAESTREJUAN: There's not a technology transfer office here?

ZHENG: Well, there is. Carnegie actually is known for its strength in developing new technologies, like the P element was developed here for *Drosophila* research, which really revolutionized *Drosophila* genetics, made many things possible. RNAi [RNA interference] was developed here, and also the same person, Andy [Andrew Z.] Fire, who developed RNAi also developed the transformation protocol, the *C elegans* [*Caenorhabditis elegans]*, which has been really very useful. Oh, and we have Nina [V.] Fedoroff, who developed plant transformation [transposable elements], and she has a patent. Carnegie is known for that, but it's really never a requirement. It's a byproduct more so. Researchers here are driven by an interest in a problem, and in order to solve that problem, they develop the technology. That's the style here. So it was never a problem.

MAESTREJUAN: But they do have an office for technology transfer.

ZHENG: Yes, they have one.

MAESTREJUAN: What about MTAs/material transfer agreements? Have you had any experience where you've needed a reagent, or a clone and have not been able to, or before you can send out any materials.

ZHENG: Oh, I have never had any problem with that. We cloned a bunch of genes which are all normal in gamma tubulin research. I went to our director and said, "Do you want to patent this." He said, "No, no, no. Not necessary." That's fine. I'm fine with that. I have no problem.

MAESTREJUAN: How important is it for scientific progress that monopolies and rewards are given to certain technologies—basically given patents? How important are patents for promoting scientific progress?

ZHENG: I think it's very important, but since I never really think along those lines, I don't have much input.

MAESTREJUAN: Okay, great. That was the last area I wanted to talk about. My last question will be, before I turn it over to you, is what does it mean to be a Pew [Scholars Program in the Biomedical Sciences] scholar?

ZHENG: Well, it's a great privilege to have had great retreats and to have known a lot of people—wonderful scientists—at an equal stage of their career. I think it's really a great boost in your early stage of career to have gotten this award, where it really is just telling you, "All your effort is noted. You're doing the right thing, and you should keep working and keep going with it." That's sort of on one side. On the other side, the money has been great and has offered me the opportunity to get into new areas.

MAESTREJUAN: Okay. What would you like to add to the record that we haven't covered?

ZHENG: I think we covered quite a bit of things. I think you have been very comprehensive.

MAESTREJUAN: Okay. Well, we appreciate you taking your time out of your schedule to do this interview. It's been my pleasure.

ZHENG: I appreciate your time. Thank you.

MAESTREJUAN: Thank you.

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[END OF INTERVIEW]

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