CHEMICAL HERITAGE FOUNDATION

LEE W. RILEY

The Pew Scholars Program in the Biomedical Sciences

Transcript of an Interview
Conducted by

Andrea R. Maestrejuan

at

The University of California, Berkeley
Berkeley, California

on

29, 30, and 31 December 1997

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

ACKNOWLEDGEMENT

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REFORMATTING:

Holly Polish, Program Intern, Oral History, Chemical Heritage Foundation. B.A. History, American University.

David J. Caruso, Program Manager, Oral History, Chemical Heritage Foundation. B.A., History of Science, Medicine, and Technology, Johns Hopkins University; PhD., Science and Technology Studies, Cornell University.

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Interviewee agrees to participate in a series of University-conducted tape-recorded interviews, commencing on or about December 29, 1997, and tentatively entitled "Interview with Lee W. Riley". 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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Division of Public Health, Biology and Epidemiology
140 Warren Hall
University of California, Berkeley
Berkeley, California 94720

University and Interviewee have executed this Agreement on the date first written above.

INTERVIEWEE
Signed release form is on file at the Science History Institute

(Signature)

Lee W. Riley
(Typed Name)

Division of Public Health, Biology and Epidemiology

University of
(Address)

California

Berkeley, California 94720

Date 12/29/97

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Pew Scholars in the Biomedical Sciences

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

LEE W. RILEY

1949 Born in Yokohama, Japan, on 15 October

Education

1972 B.A., Philosophy, Stanford University
1978 M.D., University of California, San Francisco

Professional Experience

Columbia-Presbyterian Hospital, New York City, New York
1978-1979 Intern
1979-1981 Resident, Internal Medicine

Centers for Disease Control and Prevention, Atlanta, Georgia
1981-1984 Investigator, Epidemiologic Intelligence Service
1988-1990 Laboratory Project Manager, India Biomedical Support Project, assigned to World Health Organization, New Delhi, India

Stanford University, Palo Alto, California
1984-1988 Postdoctoral Fellow

Weill Cornell Medical College, New York City, New York
1990-1994 Assistant Professor of Medicine
1994-1996 Associate Professor of Medicine

University of California, Berkeley, Berkeley, California
1996-present Professor of Infectious Disease and Epidemiology
1997-present Director, Fogarty International Center Global Health Equity Scholars Program

Honors

1986-1987 Robert Wood Johnson Foundation Grant
1990-1992 Robert Wood Johnson Foundation Grant
1991-1994 Cornell Scholar in Biomedical Science
1992-1996 Pew Scholar in the Biomedical Sciences
1993 Jack Friedman Young Investigator Prize, Michael Wolk Foundation
1993 Michael Wolk Clinical Scholar Award

Selected Publications

Riley, L.W. et al., 1983. Outbreaks of hemorrhagic colitis associated with a rare *E. coli* serotype. *New England Journal of Medicine* 308:681-85.

Riley, L.W. et al., 1983. Evaluation of isolated cases of salmonellosis by plasmid profile analysis: Introduction and transmission of a bacterial clone by a contaminated commercial product. *Journal of Infectious Diseases* 148:12-17.

Riley, L.W. et al., 1984. Importance of host factors in human salmonellosis caused by multiresistant strains. *Journal of Infectious Diseases* 149:878-83.

Riley, L.W. et al., 1984. Significance of hospitals as reservoirs for endemic multiresistant *S. typhimurium* causing infections in urban Brazilian children. *Journal of Infectious Diseases* 150:236-41.

Riley, L.W. et al., 1987. Plasmid-encoded expression of lipopolysaccharide O-antigenic polysaccharide in enteropathogenic *Escherichia coli*. *Infection and Immunity* 55:2052-56.

Riley, L.W. et al., 1989. Epidemiologic patterns of drug-resistant *mycobacterium tuberculosis* infections: A community-based study. American Review of Respiratory Diseases 139:1282-85.

Arruda, S. et al., 1993. Cloning of a *mycobacterium tuberculosis* DNA fragment associated with HeLa cell entry and survival inside human macrophage. *Science* 261:1454-57.

Stoeckle, M. et al., 1993. Catalase-peroxidase gene sequences in isoniazid-sensitive and resistant strains of *M. tuberculosis* from New York City. *Journal of Infectious Diseases* 168:1063-65.

Ferrazoli, L. et al., 1995. Catalase expression, katG, and isoniazid minimal inhibitory concentration of *mycobacterium tuberculosis* isolates from Sao Paolo, Brazil. *Journal of Infectious Diseases* 171:237-40.

Gunzburg, S.T. et al., 1995. Identification of enteropathogenic *Escherichia coli* by a PCR-based detection of the bundle-forming pilus gene. *Journal of Clinical Microbiology* 33:1375-77.

Tornieporth, N.G. et al., 1995. Differentiation of pathogenic *E. coli* in Brazilian children by polymerase chain reaction. *Journal of Clinical Microbiology* 33:1383-84.

Friedman, C.R. et al., 1995. Transmission of multidrug-resistant tuberculosis in a large urban setting. *American Journal of Respiratory Critical Care Medicine* 152:355-59.

Kritski, A.L. et al., 1996. Transmission of tuberculosis to close contacts of patients with multidrug-resistant tuberculosis. *American Journal of Respiratory Critical Care Medicine* 153:331-35.

Friedman, C.R. et al., 1997. Widespread dissemination of a single drug-susceptible strain of *M. tuberculosis*. *Journal of Infectious Diseases* 176:478-84.

Ehrt, S. et al., 1997. A novel antioxidant gene from *M. tuberculosis*. *Journal of Experimental Medicine* 186:1885-96.

ABSTRACT

Lee W. Riley was born Hiroshi Satoyoshi: he spent his first ten years with his mother in Yokohama, Japan, then lived for a short time in a Japanese orphanage before being adopted by the Riley family, at which time he moved to Tachikawa, outside Tokyo, Japan. The family moved to Bangkok, Thailand, in time for Riley to attend high school there. Like his biological parents, his adoptive father was African-American and his mother Japanese; Riley has two sisters who were adopted as well. In Riley's early years his Japanese, schoolteacher grandfather had a great influence on his schooling, encouraging his questioning nature; living in Japan in the aftermath of World War II impacted Riley's perspectives on life, as well as his Buddhist heritage and being multiethnic. Riley attended an international high school in Bangkok, about which he talks at length, and had several influential teachers who stimulated his early interest in physics.

Riley decided not to attend a Japanese university, but Stanford University instead; he wanted to become a physician and practice medicine in Bangkok. Aware during the sixties of the countercultural movement and anxious about the draft at Stanford, Riley found his perceptions of the American presence in Southeast Asia changing. His growing interest in public health led him to spend a year in Japan after college.

Riley chose to enroll the University of California, San Francisco, to pursue his medical degree; during his first year he undertook a clinical rotation in a missionary hospital in Thailand. After deciding to shift from clinical medicine to public health he completed his internship and residency at Columbia University College of Physicians and Surgeons. He found interesting the differences between the types of medical conditions encountered in New York and those encountered in Thailand, and he entered the Epidemiologic Intelligence Service at the Centers for Disease Control and Prevention, where he used enteric pathogen fingerprinting technology to identify strains of Salmonella and identified E. coli 0157:H7 as the cause of an outbreak in Oregon.

Riley then accepted a postdoc in the Gary Schoolnik lab at Stanford to study enteropathogenic E. coli using molecular biology technology. Next he studied tuberculosis (TB) for two years in India and published a paper in Science identifying the invasion gene for TB. He then proceeded to an assistant professorship at Cornell University Medical College, where he worked on devising a technique to identify primary and reactivation TB. Through his understanding of the molecular basis for disease transmission he identified why a high percentage of drug users in New YorkCity had a particular strain of tuberculosis. Riley's interest in approaching biological questions from the standpoint of public health led him to work on developing a Salmonella vaccine for chickens.

From Cornell Riley accepted a position as professor of infectious disease and epidemiology at University of California, Berkeley, and he has since become Director of the Fogarty International Center Global Health Equity Scholars Program at University of California, Berkeley, where he continues to work on TB pathogenesis, drug-resistant Gram-negative bacterial infections, and global health focusing on infectious diseases of urban slums.

During the interview Riley discusses his acquisition of the scientific skills and knowledge necessary to accomplish his research goals; his belief in the need to make science understandable to the public and obstacles to that understanding; the scientific community's response to his dual focus on epidemiology and pathogenesis; his desire to advance on the

strength of his work rather than through self-advertising; and his relationship with other Pew Scholars. He elaborates on his decision to work with Stanley Falkow and Gary Schoolnik at Stanford and explains how he collaborated with Schoolnik to establish the geographic medicine program at Stanford. He concludes his interview by describing how he attempts to balance career and life with his wife, Jesse Frances Furman, and three children.

UCLA INTERVIEW HISTORY

INTERVIEWER:

Andrea R. Maestrejuan, Interviewer, UCLA Oral History Program; B.A., History, University of California, Irvine, 1988; B.S., Biological Sciences, University of California, Irvine, 1988; C.Phil., History, University of California, Riverside.

TIME AND SETTING OF INTERVIEW:

Place: Riley's office, University of California, Berkeley.

Dates, length of sessions: December 29, 1997 (111 minutes); December 30, 1997 (113) ; December 31, 1997 (129).

Total number of recorded hours: 5.9

Persons present during interview: Riley 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.

In preparing for this interview, Maestrejuan, in consultation with the director of the UCLA Oral History Program and three UCLA faculty project consultants, developed a topic outline to provide an overall interview framework. Maestrejuan then held a telephone pre interview conversation with Riley to obtain extensive written background information (curriculum vitae, copies of published articles, etc.) and agree on a research and interviewing timetable. Maestrejuan further reviewed the documentation in Riley's file at the Pew Scholars Program office in San Francisco, including his proposal application, letters of recommendation, and reviews by Pew Scholars Program national advisory committee members. For general background on the recent history of the biological sciences, Maestrejuan consulted J.D. Watson et al., *The Molecular Biology of the Gene*. 4th ed. 2 vols. Menlo Park, CA: Benjamin/Cummings, 1987; Lubert Stryer, Biochemistry. 3d ed. New York: W.H. Freeman, 1988; H.F. Judson, The Eighth Day of Creation: Makers of the Revolution in Biology. New York: Simon and Schuster, 1979; and recent issues of *Science*, *Nature*, and *Cell*.

The interview is organized chronologically, beginning with Riley's childhood in Japan, and continuing through his graduate work at University of California, San Francisco, his postdoc at Stanford University, and the establishment of his own lab at Cornell University Medical College and later at University of California, Berkeley. Major topics discussed include Riley's education at an international school in Bangkok, Thailand, his early work in a missionary hospital in Thailand, his identification of *E. coli 0157:H7*, his establishment of the

Geographic Medicine Program, and his study of infectious disease in the US and abroad.

ORIGINAL EDITING:

Kathleen McAlister, editorial assistant, 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.

Riley reviewed the transcript. He verified proper names and made minor corrections and additions.

William Van Benschoten, editor, prepared the table of contents and interview history. McAlister assembled the biographical summary. Cecily Hurst compiled the index.

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INTERVIEWEE: **Lee W. Riley**

INTERVIEWER: **Andrea R. Maestrejuan**

LOCATION: **University of California, Berkeley**
Berkeley, California

DATE: **29 December 1997**

MAESTREJUAN: I'm Andrea Maestrejuan with Lee Riley at his office at the University of California, Berkeley, to do his Pew Scholars Program in the Biomedical Sciences oral history interview. We'll start off at the very beginning like we always do and ask you when and where you were born.

RILEY: Okay. I was born October 15, 1949 in Yokohama, Japan.

MAESTREJUAN: Yokohama, okay. I know that you also had mentioned you lived in Tokyo and also Bangkok, Thailand, and you have a very American name, Lee Riley, so can you tell me a little bit about your family background?

RILEY: It's a very long story.

MAESTREJUAN: Okay, well, we've got plenty of tape.

RILEY: Okay. I was born in Yokohama. My father was in the American military, and then my mother is Japanese. My mother was working on an American base, but my father left when I was small, when I was still I guess a baby. So I grew up with my mother in Japan until I was about nine or ten. Then my mother had difficulty, I guess, raising me there. So I was placed in an orphanage for about a year and a half, and then I was adopted into the Riley family. Then the Rileys also were-- My parents-- My mother is Japanese, and my father is African American. My adoptive father [Lee Woodland Riley II] is also African American with a Japanese mother also. So I grew up speaking Japanese until I was about nine or ten, only Japanese, and then when I was allowed to I started going to an American military base school in Tachikawa, which is right outside of Tokyo. I was there until I was about fifteen, and then we moved to Thailand after that, because my father was in the U.S. civil service. My father was in Japan I guess for about twenty years immediately after the occupation, and then he had a transfer of position to Bangkok. So the whole family went to Bangkok, where I went to high school.

MAESTREJUAN: So is Lee Riley your original name?

RILEY: It's my father's name. He's Lee Riley II. I'm Lee Riley III, so my grandfather is Lee Riley I.

MAESTREJUAN: Was that your biological father's name?

RILEY: No, that's the adopted father's.

MAESTREJUAN: And you said you were about ten when you were adopted?

RILEY: Nine or ten.

MAESTREJUAN: Nine or ten. So did you know yourself as a previous name?

RILEY: Yes, I had a Japanese name. Hiroshi Satoyoshi. You want me to spell it?

MAESTREJUAN: No. We can get that later, but yeah, I would definitely need you to spell it because I couldn't get it on my own. And did you have--? How old were you when you were put in the orphanage? Do you have memories of your--

RILEY: I was about eight and a half or so.

MAESTREJUAN: --of your biological mother? So you have memories?

RILEY: Oh, yeah. No, I visited my mother later when I was in college.

MAESTREJUAN: Do you still have contact with her?

RILEY: I've lost contact. This is a little difficult to sort of bring this up because I've never sort of verbalized this in a public domain. But yeah, I remember my mother was working in the

Japanese railroad company, government railroad company, and she lost the position. So it was very difficult for me to- - I had, you know, lots of uncles and aunts, so I was initially placed with my aunt's family for a few months, and then I guess my mother thought it was best for me to be eventually adopted into an American family-- It was difficult. It was right after the war, after the occupation. And there was no real possibility that if I grew up in Japan that I would be able to do what I'm doing now here, so she felt it was best-- Excuse me. [tape recorder off] So, I guess yeah, my mother felt, in discussing with her family, that it was best for me to be sent to the U.S. and to be adopted into an American family. So there was this orphanage which was for people like me, mixed kids.

MAESTREJUAN: Mixed kids.

RILEY: They were all mixed kids. Run by a Catholic mission [Boys Town] right outside of Tokyo.

MAESTREJUAN: Did you experience a lot of discrimination because of your mixed background?

RILEY: No, I actually have a lot-- I mean, of course kids call you all kinds of things. But I guess as I grew older that no matter what you are, people call you whatever you are, so in retrospect I don't think it was any different from if, let's say, I had grown up here. But there was never-- I have lots of fond memories growing up in Japan. You know, the fact that my aunt took care of me—

I also grew up with my grandfather, who was a school-teacher, because my mother was working every day. My grandfather was a typical sort of Japanese teacher. He was a real disciplinarian, very tough. But he, I think, had a lot to do with my interest in science, you know, later on. I didn't know it at the time. But he was very--how would you say--? I guess as a small kid I thought he was really mean, but he was a typical Japanese teacher at that time, you know.

MAESTREJUAN: How would you describe a typical Japanese teacher?

RILEY: Very disciplinarian and demanding and very sort of insistent on perfection. I was a small kid, and I remember coming home from school, kindergarten even, and I was not allowed to go out to play until I completed some set of math problems that I think were really designed for fourth, fifth graders and things like that. But anyway-- So my mother I guess had a discussion with everybody and made that decision to put me in an orphanage, and then about a year and a half later I was adopted into the Rileys.

MAESTREJUAN: In what ways did your grandfather help you develop an interest in science?

RILEY: It wasn't so much science. It wasn't anything I guess he did directly, but yeah he had me do all kinds of things outside of school that were beyond, I guess, what I was expected to do in school. So I guess he instilled sort of discipline in education or being able to-- I mean, I'm only trying to explain what he did before, as an adult, but as a child I didn't know what he was doing. I think it was a way of his to make me able to solve problems by myself, to critically go through problems, you know, and I think that really worked. I mean, I think just very early on he did that, and it certainly helped I think later. It made it easier for me later because I went to elementary school, and I already knew how to do most of the things. So it made my schooling very easy, first few years, until I switched to American schools, because I didn't speak English. So I had difficulty with English for a while, but I quickly picked that up.

MAESTREJUAN: Clearly, it's very difficult for me to hear an accent now.

RILEY: When I get excited the accent comes through, or I drop articles. Japanese doesn't have any articles, so you'll probably hear in my interview dropped articles or a misuse of articles.

MAESTREJUAN: I wouldn't have guessed on the telephone-- Talking to you on a telephone, you wouldn't hear an accent. Maybe it's just my ears; they're not very good.

RILEY: So you thought I was a red-haired, blue-eyed--? [laughs]

MAESTREJUAN: I had no idea. I saw your background, you know, your CV and some other things, and I thought, " I have no idea." Well, I lived in Germany for a year and that's one thing it's interesting to look around in the United States-- Because the Germans would try to guess people's nationalities, the teachers. They would try and guess people's nationalities, and invariably they got the Americans all wrong because none of our last names are-- What is a typical American name? Lee Riley, you know. My last name clearly threw them off. They had no idea, so anyway--

Well, it's interesting that you say that because I interviewed Yasushi Hiromi, who also is Japanese and was born and raised--

RILEY: Uh-huh, I know him.

MAESTREJUAN: He said something very similar in that he learned to solve problems. And given that your grandfather was a schoolteacher, is that like a pedagogical approach, would you say, of kind of the Japanese educational system? Or is it maybe something more of a kind of a social-cultural value that perhaps is part of Japanese society? What is it about problem solving? Because he almost put it the same exact way; he was taught how to solve problems. It didn't matter whether it was a mathematical problem or a writing problem. Can you--? That's hard to articulate sometimes; maybe we could pursue it a little more?

RILEY: Well, I don't know. It may be a-- Well, certainly what's going on now I think is probably different from what was going on back in the fifties, and so it's hard to say whether that's-- It's probably a mixture of both cultural and the pedagogical system that at least existed in the fifties. This was right after the war. My grandfather was obviously in the war, and a lot of the teachers were persecuted during the war. They tended to be anti-war, or were not-- So I don't know if this was something personal with my grandfather.

I didn't know the education system at that time, but certainly it's not like that now. You know, right now it's all rote memorization. I think the whole education system is geared towards trying to get kids into a good university later on so that then they can find a permanent corporate position. You know I'm not sure if they're-- They're criticized for not putting creativity into the system or an opportunity for creativity in their educational system. That's probably true. But back then-- I don't know. I don't know how different it is now as opposed to the fifties. Certainly they didn't have these after school intense prep [preparatory] schools that kids are forced to go through nowadays, maybe because parents did it at home or something. I don't know. My grandfather certainly did it.

But I think that what was good is the combination of that background as a sort of fundamental basis and then going to an American educational system which emphasized creativity and individualism. So I had the best of both worlds.

MAESTREJUAN: Was your mother's family--? Your grandfather obviously needed to go to some kind of secondary educational system to become a schoolteacher. Did her family come from a highly educated background, do you know?

RILEY: No, I think they were sort of an ordinary middle-class family, my biological mother. My adopted mother I think is similar. I know she says she has some aristocracy in a distant relative or something but--

MAESTREJUAN: Japanese aristocracy?

RILEY: Yeah, Japanese side. You asked me earlier about whether there was any sort of

discrimination. I think my mother was more discriminated against than me, both my mothers, because they married an American, an African American. I think that Japanese have a very interesting, I think-- I'm not trying to stereotype them, but they're very accommodating when something happens. They'll be very resistant until something happens, but once something does happen, then they're very accommodating. They're very flexible. That's a very unique, I think, aspect of that culture. So as a child I think I was very lucky.

MAESTREJUAN: Was there any friction between either side of the family, the Japanese side or the African American family?

RILEY: Well, I never met the African American family side until I came to the States when I was already starting college. So I guess when we came, no. We didn't feel that sort of thing from the American side. But on the Japanese side, for instance, my adopted mother [Mitsue Okuda Riley], one of her uncles totally ostracized her from the family. But the others accepted the whole thing. I don't know about my biological mother's side because I was small. I don't know the relatives.

I remember going to-- In Japan in the summer--I don't know if they still do it now--the families go and visit their relatives who are somewhere outside of the cities. So I remember going on the train with my grandfather to visit my relatives in other parts of Japan. My mother rarely went to those, so I don't know. I don't know how this whole thing was perceived by other relatives-- I just don't know.

MAESTREJUAN: Did you know your biological father at all?

RILEY: I never met him. I saw pictures. I know he was from Philadelphia, someplace. But I never really tried to find him or anything.

MAESTREJUAN: And you haven't had any contact with him since coming to the United States?

RILEY: No.

MAESTREJUAN: I know you were quite young when you went to the orphanage, but did your mother instill any expectations of what you should do with your life, or even your grandfather, what one should become when one grew up?

RILEY: I don't remember talking about those things. I mean, as a child I didn't know about these things, you know, about discrimination and institutional racism and things of that sort. So I guess I always wanted to be a scientist. I don't remember why or what triggered it. But I remember telling teachers that I wanted to be a scientist.

MAESTREJUAN: What did you think--? I ask this a lot because that's something--not all the time--that sometimes comes up, "Well, I always wanted to be a scientist." Now, what did you think when you were like seven or eight years old about what it was to become a scientist? What did scientists do? Can you remember what you thought you would do?

RILEY: Well, Japan was also going through a lot of transitions at the time, trying to build after the war. So there were a lot of things I remember reading, you know, comic books and things that had to do with the future, what's going to happen in the twenty-first century and things. I was fascinated by the sort of technological promises and development that they were all writing about. So I thought a scientist is-- I wasn't so much interested in biology. I was more interested in the future thing, to be able, I guess, to invent things, you know, to be able to come up with gadgets that help everyday life. I remember discussing with my mother about making a robot that would do all the housework or writing an essay about a device that you put on your feet and you can sort of fly around in, you know, just coming up with these little gadgets, just thinking those things. So those were the kinds of things, I guess.

I was fascinated by just reading comic books and seeing all those pictures of the cities of the future and all these things. Probably the most influential comic book story that I read as a kid was a series called *The Firebird*. It was actually a very famous series done by probably one of the world's best animators, Osamu Tezuka. He did the-- Well, you probably remember *The Astroboy*. Well, he was the creator of that, but he also did this very serious--I think it was like a six-part series--*The Firebird*. It's a fascinating story, but, you know, it's comic. I read that even through college because it's a really great story. That really got me interested in being in the sciences, I guess.

MAESTREJUAN: Did you ever try making your robot or your shoes? How much were you conceiving of these ideas? Did you get interested in jet engines or--?

RILEY: No, no. [laughs] I sort of dropped those things as I got wiser.

MAESTREJUAN: Oh, well, watch what you say. You never know: somebody may come up with that idea.

Then how did you adjust to being put in the orphanage?

RILEY: Well, it was difficult, at first. Most of the kids there didn't even know their parents. You know, they were there-- What they had was there were two places, one in Yokohama, which was for babies that didn't have parents. Then for the older kids, I guess-- I don't know how they organized it, but I think when they started in the first grade, then they were put into this other place which was right outside of Yokohama. Most of those kids came from the first one, transferred from there, so they didn't know their parents. So, you know, my mother would visit me from time to time and go out and continued to--

MAESTREJUAN: How did you understand it at the time as to what was happening and why you were in the orphanage?

RILEY: I guess I was very confused. I didn't completely understand it, but my mother, I guess, had indicated to me that it was necessary because of her job. She definitely lost her position in the railroad company, and she had to look for something. So it was made-- I was made to understand that it was a temporary thing until my mother was able to resettle, but in the meantime this development with the Rileys came up.

MAESTREJUAN: How long were you in the orphanage?

RILEY: About a year and a half. So when the Rileys came-- They had me come over one weekend, and then they started the process to adopt me permanently.

MAESTREJUAN: They were living in Yokahama?

RILEY: They were in Tachikawa, which is right outside of Tokyo. It's an American military base. At that time it was very confusing. When my mother would come and visit me we'd also go and see my-- She would take me to my aunt's place. You know, it was a very, very nice home, and she also underwent tragedy herself. She understood, I guess, the situation. She would also explain to me about what was going on.

MAESTREJUAN: Then did the Rileys explain to you what was happening when they adopted you? How did you understand that next stage, where now you're calling somebody else mother and you have a father now?

RILEY: Right. That was also confusing, because I didn't know what this was all about. I actually-- They even took me to my mother a couple of times in the first year. I think they tried

to explain to me. I don't remember how. But I guess I gradually learned to accept the Rileys-- I mean, they're-- I mean, I really liked them when I first met them, and they eventually-- I took them as my parents. They're still my parents. My father passed away about five years ago, but my mother lives just down on the peninsula.

MAESTREJUAN: Did your father speak Japanese?

RILEY: Yeah. We spoke Japanese at home pretty much. His Japanese was not that great but--

MAESTREJUAN: You could understand him?

RILEY: Yeah. No, I spoke English to him directly, but when everybody was around we usually spoke Japanese.

MAESTREJUAN: When did you pick up English?

RILEY: It's when I started going to an American school, so I was about nine or ten.

MAESTREJUAN: At the orphanage, were they speaking--?

RILEY: They were Japanese. The people who were running it were actually French, French Catholic. So actually they talked French a little bit, but not formally. I remember very fondly this one--I don't know what you call them--priest or father was a Frenchman who was one of the people who ran the place. He would get a group of kids together and teach them French words. That's when I-- It was a Catholic thing, so that's when I first got introduced to church and things like that. Christmases we had to go to the midnight mass, but I wasn't allowed to do the communion. It was funny: I was wanting to do those things. Because the others were, I think, baptized. They grew up in the orphanage. So there were two groups of kids. So it was an interesting-- It was a lot of fun.

MAESTREJUAN: Were you able to identify with the other kids in the orphanage, either because of their cultural, their ethnic background, or perhaps because they as well were a little bit older before they were put into an orphanage and they knew their biological parent?

RILEY: I had a lot of good friends. There were all kinds of ethnic combinations and, you know,

what we tended to do is to form little, small groups. I don't remember how many kids there were. And usually young kids linked up with some older kid as sort of a big brother, little brother kind of thing. I remember everybody had an American name, also. So there was a guy named Michael who was a very good friend. He would always sort of try to be the protector. He taught me how to ride a bike. It was a lot of good memories.

MAESTREJUAN: Did you have an American name?

RILEY: No, I didn't have an American name. Again, these are Christian names; I guess they were given.

MAESTREJUAN: They were Christian names, okay, when they were baptized. Did you have any brothers or sisters, either from your biological parents or from the Rileys?

RILEY: Not from the biological parents, but yeah, from the Rileys I have two sisters. They were also adopted. I guess when I was adopted they were already there. They're younger. They're both girls.

MAESTREJUAN: And are they of Japanese American--?

RILEY: The same. Japanese mother and African American father. But I don't think they know that they were adopted.

MAESTREJUAN: To this day they don't know? So they must have been infants?

RILEY: They were very small, yeah.

MAESTREJUAN: But do they know that you are?

RILEY: No, I don't think they know either. I think my sister in the middle probably knows, but she's not sure.

MAESTREJUAN: That's interesting. And how do you--?

RILEY: That's my mother's thing, I think. She didn't want them to know. It's a Japanese thing, too, as opposed to the American. Americans are more open about those things.

MAESTREJUAN: Do they live here in the States as well?

RILEY: Yeah, they're both on the peninsula. One is in Sunnyvale [California] and the other one is in San Jose [California].

MAESTREJUAN: What do they do?

RILEY: Irene [Riley Evans], the one in the middle, works at Stanford [University] as a blood bank technician, and then Gloria [Riley] is actually in the U.S Army. She was at Fort Ord for awhile. She was also working as a blood chemistry technician.

MAESTREJUAN: Did they go to college as well, then?

RILEY: Yeah, they went to-- Gloria went to SF State [San Francisco State University] and Irene went to a college in Tennessee. I have an aunt there. They were all still staying in Bangkok, and so when I came to college my parents were still in Bangkok. When Irene went to college, my parents were still in Bangkok. She got sent to my aunt's place in Tennessee and went to school there. But then Gloria came when my parents came back to the States. They settled in Sunnyvale because my father was transferred to Lockheed [Corporation]. So we all stayed in the Bay Area. I was in medical school at the time, so that's why we all ended up in Northern California.

MAESTREJUAN: So are you about eight or nine years older than your sisters?

RILEY: I'm six years older than Irene, and eight years older than Gloria. I told you it was going to be complicated. [laughs]

MAESTREJUAN: Yeah. No, this is really interesting, because I think you give a new definition to a multicultural background.

RILEY: You should see my wife [Jesse Frances Furman] and my kids [Nicolas Riley,

Samantha Riley, Emma Riley]; it makes it even more multicultural.

MAESTREJUAN: Well, we'll get to them, I'm sure. Then I wanted to ask, what was it like to grow up in Japan? How aware were you of the destruction of Japanese society, both economically and socially, as a result of WWII? Did you see, you know, the--? It seems to me that you experienced that devastation quite personally, but how did you experience that?

RILEY: Well, again, as a kid you sort of-- I don't know if what I know now I knew as a kid or because I learned later, reflecting back to that period. But, again, I remember going to a place with my grandfather one day, and I know it now as the May Day. But I didn't know it at the time. We were going to a park in Tokyo, and I remember on the way to the park there were all these people coming towards our direction with their heads bloodied and bandaged, all these people. It turns out it was one of the May Day riots and one of the biggest riots they had in the fifties. It was part of the U.S.-Japanese treaty renewal, and there was a lot of opposition to that and all those people were bloodied. You know, I didn't know at the time, but that-- So there were things like that. And [when I was] even smaller, I guess--I was just beginning to recognize the world--I remember walking with my friends up the street to a fire station, which was in this corner of a main highway. And every once in a while you'll see these tanks, just coming by, coming back from China or Manchuria, coming back bringing all the-- So there was a sense of a war having just taken place, and you know there was-- When people talk about WWI, WWII, I guess that I took it as something that was supposed to happen, like a natural cycle of things. You know, it's a strange thing, but as a kid I thought it was like weather; every few years you have some natural occurrence, and war was one of those things. I think a lot of the kids felt the same way, that there was a possibility of another war. So I think that those kind of sentiments influenced my other views about the world later.

MAESTREJUAN: Which are?

RILEY: Well, you know, I went through many periods. In college I was an anti-war activist. It's corny to say I'm anti-war, but certainly I'm not someone who would advocate militaristic interventions, I guess. I think all the Japanese kids at the time, growing up in the fifties, were sort of influenced by that kind of sentiment. Probably much more than kids growing up here at the time. Here was more of a fear of the nuclear holocaust and the cold war, whereas in Japan-- Maybe it was part of the cold war things, too, but I didn't think—It was real. I mean, I had relatives that came back from war. My uncle, one of my biological uncles, came back from war, and I remember him talking about his experiences in China. You run into people like that all the time, you know.

I can't remember what we were talking about.

MAESTREJUAN: That's okay. That's okay. Because at one point, given your own background, being both Japanese and African American, the Japanese and the Americans were enemies one day and then suddenly all these Americans are occupying Japan and supposedly suddenly we're friends again. How did that--? Did you pick up any attitudes positively or negatively being both Japanese and American? Or were you seen in Japanese cultures as Japanese?

RILEY: Yeah, I really felt more Japanese growing up than American, because I was uncomfortable with Americans, you know, growing up in Japan. Although when I was in the orphanage I remember very fondly, you know, again, Christmas. American GI's would organize Christmas parties for the kids, and we would go to these places and they would give us presents. Everybody in Japan, all the kids that grew up in Japan in the fifties, viewed Americans as being very generous, warm people. It's funny though--I say this now--but you know they were actually very well perceived in Japan as individuals, as individual Americans. They were very genuine in what they were doing, in their generosity. I remember going to a baseball game with Americans coming in. I can't remember what American team it was, but they were playing against the Japanese. All the other kids in the orphanage were supporting the Americans' team, whereas I was sort of rooting for the Japanese team.

MAESTREJUAN: Yeah, and who won?

RILEY: I think the Americans won. So, you know, you sort of realize which sentiments you have by [inaudible]. I guess when I started going to an American school then I felt more American, and I began to move away from things Japanese, even though we were living in Japan. But even now when I go to Japan I feel very relaxed, comfortable, at home.

MAESTREJUAN: Do you know at the time what the status of your citizenship was? I mean, it's become a real big issue now with all of the Americans all over the world.

RILEY: Well, you know the American-- When I was with my mother, biological mother, I didn't have an American citizenship. It wasn't until I was adopted. My adopted parents had to do the paperwork to get me an American citizenship.

MAESTREJUAN: What religious traditions were you raised with?

RILEY: We didn't have any. I mean my mother, my biological mother, didn't practice anything at all.

MAESTREJUAN: Buddhist or--?

RILEY: Yeah, she was Buddhist like most Japanese consider themselves Buddhist or Shinto, but it's not like here. I mean they do everything-- They go to shrines, Shinto shrines, for New Year's, and they might go to Buddhist temples. If they happen to be at a Buddhist temple, they might say some prayers, but it 's not like here where you sort of attend sessions regularly like churches or synagogues. And then my adopted parents-- My father was a Protestant. We never went to church at all. I think when I was a-- I remember when I was in junior high he took us one day to a Sunday School, and we hated it. Ever since then he never took us back, so it was just a one-day thing. He thought maybe we should have religion or something. My mother was actually a Buddhist. She actually did go into--
Do you know the S_ka Gakkai?

MAESTREJUAN: Yes.

RILEY: You know, the Buddhist kind of semi-political movement. She got hooked into that. So she had a little altar at home and she prayed, did the prayers every night and every morning. She did that for many years, but it's not something that she did as I was growing up. It's something that she sort of adopted I think while we were still in Japan, when I was about fourteen or so. She continued to do that in Thailand and met a group of Japanese friends in Bangkok who were members of that organization. She continued to do that, and she still does from time to time, not as religiously as she used to do it. So I didn't grow up with any sort of religious upbringing at all.

MAESTREJUAN: When relatives died or anything, people in biological or adopted families did the Buddhist rituals--

RILEY: Yeah, it was usually the Buddhist thing.

MAESTREJUAN: Were you taught, given that you were kind of the oldest male member or male son, any of those protocols? I have a girlfriend who's married to a Japanese, and he's the only son. They're Buddhist and Presbyterian, but they celebrate both things. She said the protocols were very ritualized, but they try and teach her how to act in these situations because they're still practiced.

RILEY: Well, yeah, of course, it's not a religious practice. It's more of a ritual practice, yeah. I remember going to my grandfather's funeral, and, you know, there's certain things you do. He

was cremated, and when the bones come out you have to pass them with chop sticks one person to another, and then you put them into an urn. So my mother was very superstitious, my adopted mother. [She] would slap our hands if we tried to pass food from chopstick to chopstick at our table, because the only time you do that sort of thing is at these funerals. So you learn about these rituals through these kind of cultural things, but I don't know why you do that in funerals.

MAESTREJUAN: Do you practice any of those kind of cultural rituals to this day?

RILEY: No. I mean, I do all the superstitious things. My mother really influenced me.

MAESTREJUAN: You don't pass--

RILEY: No, I tell my kids not to do that and not to have chopsticks stuck in the middle of the rice bowl. That's also-- You only do that because you have the chopsticks in the ash. So I tell my kids not to do that. And never kill any spiders before ten o'clock in the morning, because it's usually a reincarnation of somebody. That's a Buddhist idea. I do all the Japanese New Year's celebrations, make all the food for the family. They don't like them, but the kids eat them.

MAESTREJUAN: Right. You eat your black bean on--

RILEY: Right, exactly, yeah. Then we always eat noodles before the end of the year. So yeah, those are fun things.

MAESTREJUAN: Okay, so does that go back to kind of a spiritual belief system that you have, or is this a superstition?

RILEY: It's more of a superstition. It's been instilled in me from my mother. [laughs]

MAESTREJUAN: Are you planning on instilling these in your children?

RILEY: It's up to them if they want to do it. No, we're not bringing them up in any sort of religious-- My wife's father was Jewish and her mother was Catholic.

[END OF TAPE 1, SIDE 1]

RILEY: Yeah, you know, we teach them all the different religious things. We celebrate Christmas, not as a religion, but as a time to exchange gifts and, you know, put up a Christmas tree. My kids sing Chanukah songs, and growing up in New York everybody celebrated Jewish holidays. The public schools were off on some of the Jewish holidays, so they really grew up understanding the Jewish practices from New York and continued to observe those things, not as a religion but as fun things.

MAESTREJUAN: As cultural, perhaps?

RILEY: As a culture, yeah. If they want to choose religion later they can do so, but we don't force them. I find it kind of a waste of time to be concerned about religion.

MAESTREJUAN: Yeah. Does that include practicing any kind of spiritual belief in God or gods, in monotheism or--?

RILEY: Yeah, I went through a lot of changes I guess in the way I view those things. That's why I was a philosophy major. I thought about a lot of those things before. I guess my feeling now is probably, if anything, closer to the Buddhist way of looking at the world than anything else. It's more realistic. I don't understand this thing about the sin and the guilt that the Western religions always use as kind of a basis for everything. Whereas with Buddhism it's suffering. There is suffering in the world, and that's real. You see it all around the world. It's very simple: there's suffering in the world. There's something you have to do about it. The Buddhist way--I'm putting it very simplistically--is that there is suffering, so you have to behave and act in a certain way to overcome the suffering. So then it becomes kind of more focused towards the inner self-worth.

I like the American, not the religious views, but the American sort of practical views of the world, where if there is suffering, then you do something about it. So the philosophical basis may be Buddhism, but the action to take is more American. That's the way I think I view the world. I think every individual has a goodness, and that just has to be brought out. I think if you do that then you don't need a religion. I think every individual human being has the potential. I think if you're going to talk about God, then God is already inside every individual. You just have to bring it out. The struggle is to bring that out, and that's what the whole process is about.

MAESTREJUAN: Do you believe in reincarnation?

RILEY: No.

MAESTREJUAN: Okay.

RILEY: Yeah, I haven't thought about these things in a while. So any other parts of childhood or--?

MAESTREJUAN: Yeah, okay, just a big question--and I think it comes from being where we are at this time and place--and that is, how do you identify yourself? I'm sure bringing-- I'd like you to discuss how you discuss identity, cultural identity, with your children, too. Because we live in a state that-- It's being discussed: we can't even write a K [kindergarten] through 12 [twelfth grade] social studies textbook that is agreeable to all. What is it to be a minority or what is it to be "other" or even American? What is it to be American, if there is such a thing? With your multicultural experience, to use too worn a phrase, how do you identify yourself in terms of who you are? Is there some kind of hyphenated term that you use? How do you try and attempt to bring to your children this same kind of issue, being that your wife--? They also come from a Jewish, which is culturally and religiously an identity, and Catholicism, which one can view as culturally and religiously an identity--

RILEY: Well, it's something I struggled with I guess as I was growing up because, you know, on all these forms they force you to fill out one of the boxes. So I usually fill out black or African American as a box, but as I grew older I thought that was not quite correct. I know there's an issue right now as more mixed kids become adults, and there's even a discussion about having another category in the census reports, I guess for the next census, [so that people are] able to check a multiethnic category. I think that's good that at least these discussions are coming up because I think I do believe in a separate identity called multiethnic. There's a lot of us around now, and that should be a distinct category. Tiger Woods was, I think, a very good example. I mean, I think he sort of popularized this, being half Asian also, Thai, and half African American. You need people like that to bring this to attention, because otherwise you're sort of put into a category that you're not really [in].

I remember when I started college--this was in 1968, you know, with all the issues coming up with the Black Power movement and having dormitories specifically for the Hispanics and blacks and Asians, and this is what was going on. I'd be invited to a black student union, but when they looked at me they sort of wondered what I was. I wasn't very comfortable. Then of course there were always people who completely accepted me as African American, but there were others who didn't quite accept me as a true, genuine African American, so I felt uncomfortable. When I'd go to the Asian sides, it's the same thing. Since I spoke fluent Japanese a lot of the Japanese sort of accepted me as one of their own, but there were others whom I didn't quite fit in with. So with my kids-- You can see the pictures. I mean, they could look like anybody.

MAESTREJUAN: I was going to say they look like kids to me.

RILEY: Yeah. I think they're much more aware of this than I am. All their friends are mixed, and to them it doesn't seem to be an issue, at least in Berkeley. If we go to Nebraska or other places, you know, this might become an issue for them. We've always grown up in places where-- New York City, too, same thing. My oldest son Nicolas's class is-- There were kids from all over the world. There were probably more-- It was a public school, but it was more internationally represented than here. So for them it doesn't seem to be a big issue, and I think it's good. I think they'll consider themselves multiethnic, multireligious, and multiethnic.

But I think when we were growing up, when I was growing up-- There were other kids like me, too. I mean, I have friends who were mixed, and many of them-- If one of the parents was African American, they would choose the African American side being in the U.S. But I grew up with my mother, so if anything is emotionally identified, it's Japanese more than anything else. But I think for political reasons, being here, you know, I usually put myself as African American. I think I'm considered African American here at the School of Public Health, officially.

MAESTREJUAN: Why is that do you think?

RILEY: Because I think I had to fill out some forms, and it also helps them with their quotas. They can say they have an African American faculty member. They usually-- I mean, I always do say as a joke, "By having me here they satisfy both quotas, Asian and [African American], with one person." I was always the only one of, you know, any of the residents or Pew Scholars [in the Biomedical Sciences].

MAESTREJUAN: Well, I was going to-- We can bring it up now because you've mentioned this big thing-- Again, I think as a matter of the time that we're living in, affirmative action and Prop[osition] 209 here in the state of California that is moving throughout the U.S. You know, token minorities on faculties is clearly an issue for the University of California. I can say I was a biology major at UC Irvine [University of California, Irvine] and I had one-- In all of my physics, chemistry, and biology classes I had one African American professor. I've never interviewed an African American Pew scholar.

RILEY: There are.

MAESTREJUAN: There aren't many of them.

RILEY: There aren't many, but yeah--there are.

MAESTREJUAN: Well, I guess to start off this big discussion, how do you feel about these issues of affirmative action and being kind of the person who fills two categories, fills two boxes at one time?

RILEY: Certainly for programs like Pew scholars, you know, there shouldn't be any sort of preferential treatment. I think they should be based on science and work, but at the same time my feeling isn't that affirmative action should be done away with. I think everybody has to be consistent. If they're going to do away with affirmative action, they should do away with all forms of affirmative action, including those that traditionally exist for the ones with numerals after their name, right. If you happened to be John Smith III, white, GPA [grade point average] of 3.7, and if you happened to be John Smith, also white with a GPA of 3.7, who is more likely to get into Harvard [University] or Yale [University] or Princeton [University]? There's always that affirmative action that's always existed and will continue to exist. If they're going to insist on doing away with affirmative action for the minorities, they should do away with that sort of thing, too. You can't have both. I think affirmative action is needed to make sure that those things don't happen, that the preferential treatment for the so-called privileged is not maintained. I use the word privileged; it's really another word for affirmative action, for a group of people who can do those things. So, yeah, I think affirmative action is necessary, but for certain types of activities. You can't sacrifice quality. In the long run I think it would do harm by insisting on reducing quality by certain types of preferential treatment. Politically I think it's important to maintain affirmative action, but it can be done in a way that doesn't sacrifice quality, too. You know it's-- When I started college, affirmative action was just beginning to take place. So there was always an issue if you were a minority person on the campus--I was at Stanford [University]. You know, are you there because you came in through the affirmative action program or because you really got there because of your merit? I was valedictorian of my class. I knew, myself, that I got in there without any special treatment. But you never know, so you always feel like you have to prove yourself. In that way it's not helpful, but I think politically it's necessary.

MAESTREJUAN: Do you still feel like you have to prove yourself?

RILEY: No, no. I think what I've done speaks for itself, so I don't feel like I have to-- I feel like I have to prove myself as a scientist, not because of my ethnic background, but just as a scientist.

MAESTREJUAN: Why is it that there are so few African Americans in science?

RILEY: Well clearly, you know, racism is involved, I'm sure. It's not any specific sort of racism but just sort of the way things are built into the whole educational system in the U.S. It's a very complicated thing to say in an interview of this type. Anything I'd say would just be kind of a generalization of my own views. Science is hard right now for anybody to get into. I mean into academic, research science. It's not just-- If you look, how many Americans really come into basic research in academia these days? You know, all of my [postdoctoral] fellows are foreigners. So the standards are different now than it used to be in the fifties and sixties, so the playing field is a lot more difficult, tougher. And then people are expecting to see more minorities in this playing field that's a lot tougher than it used to be. So it's not surprising that we don't see very many. We don't even see white Americans coming in to basic research. So people always ask this question.

Even the standards I think to be able to do these things are different than the way it was. It was a lot easier to do research back in the sixties when the funding was more abundant, and it was during that time when blacks were not provided with opportunities to get into those things. Then as time evolved, when funding opportunities became more difficult, the sort of social obstructions I guess got easier, I mean for the African Americans. But in the meantime, the standards have changed. Now they're asked to compete the same way with a much harder standard, with less preparation time than in the past because they just didn't have the opportunities to play the same game. So I think it's very complicated. That's probably why we don't see as many.

The ones who are in research now have had a long tradition of being able to do research and foster other investigators coming into the field. That kind of history doesn't exist for most African Americans. If you see African Americans in the basic sciences, they've had tradition. They're people whose parents may have been in the sciences or involved in academic institutions of higher learning. Their kids become-- So there just weren't very many in the tradition. And, you know, it takes a whole society and culture to produce good scientists.

There are other things I can say, too, but they're sort of cliche-ish; it's a real cultural emphasis or lack of emphasis, I guess, on the sciences in many minority communities. Even in the schools around here sports is the big thing, and there's very little science being taught, which is a real concern. This is Berkeley. I think a lot of kids grow up worshipping sports heroes and entertainers and not the scientist. You don't need an African American role model; you just need a scientist. My role models were-- Well, I don't know if I had any role models, but I read biographies of people like Albert Einstein or other scientists growing up. It never occurred to me that there weren't any black scientists that I could identify with. It just never occurred to me. There are always African American heroes that you identify with, but not necessarily somebody in science.

MAESTREJUAN: Do you have any African American heroes or role models?

RILEY: I don't know if they were role models. They're someone that I think everybody-- You don't have to be African American to admire them. You know, people like Colin [L.] Powell, and growing up you hear about Ralph [J.] Bunche, Nobel Peace Prizewinner in working--

MAESTREJUAN: I work in a building named after him.

RILEY: There are just many others who are not the traditional heroes like Martin Luther King [Jr.], but sort of individual people that I know who have been role models. I don't know if you know Don [Donald R.] Hopkins, who is in University of Chicago, who was assistant director of CDC [Centers for Disease Control and Prevention] at one time. He was involved in a smallpox eradication campaign and wrote a book that was nominated for a Pulitzer Prize. He's one of my, well, if anything, a true role model who did public health. He's actually influenced me in many ways. When I was at CDC, he was my adviser. So there are many others. My father's friends have encouraged me. I can't think of specific persons.

MAESTREJUAN: Okay, well, we'll get going into more of these topics I'm sure, but why don't we pick up and talk a little bit more on how you got to be a scientist. This has been really interesting. Just to go back a little bit, how well-- Or to put it clear in my mind, up through high school you were in Japanese school or schools in Japan?

RILEY: No [I] went through junior [high school] in Japan. I finished eighth grade in Japan, and then we moved to Thailand-- Oh, Japanese school? No, I was in Japanese schools until fifth grade, right. Then I switched to an American school on base in Japan. I was there until I was in eighth grade. Then we moved to Thailand, and I went to an international school in Bangkok. So it was a high school from ninth through twelfth.

MAESTREJUAN: How was the education that you received? It seems fairly discontinuous going from a Japanese system to an American military system.

RILEY: Well, the American military system is not military. It's really no different from American public school. The things I remembered-- Because I didn't speak much English, I had difficulty with some of the things that required English, but the math I thought was very, very easy and I was able to-- I didn't have any problems with math. It took me about a year before I spoke enough English to do the other things. So what happened was I was put into third grade when I went to an American school, so I could pick up the language. I stayed in third grade for a year, and then I skipped fourth and fifth and went into the sixth to catch up once my English got better.

MAESTREJUAN: So in third grade you were a little bit older than the other kids, but in sixth grade back in the mainstream.

RILEY: Yeah. You know, it was not all that different I don't think in terms of the ways things were done. I didn't like-- Well, at that time the Americans would have these--what do you call?--prayer things, which I didn't know. You're supposed to do before the class--

MAESTREJUAN: Prayers in school and the national anthem.

RILEY: At that time they still had it. I think there was-- Right, the national anthem, and they had- - What is that passage?

MAESTREJUAN: The Lord's Prayer?

RILEY: Yeah, the Lord's Prayer. I didn't know how to-- I'd never learned it, so all the kids-- I felt very uncomfortable at that time having to do that. I remember going home, and my father had a copy of the Bible, so I had to sort of flip through the pages to see where it was and then try to memorize it.

MAESTREJUAN: What was his attitude toward this prayer in school?

RILEY: Oh, we never talked about it. I never brought it up in the family. Eventually I learned it, and then I guess after about a year they didn't do it anymore, so it was okay. I certainly felt a lot more comfortable in the American school because there were a lot of kids like me who were mixed also, you know, the Americans. Whereas in Japanese schools I was the only one who looked like me. So until you got to know the people, the kids-- The most difficult part was always the first day of school, because I didn't know them, they didn't know me. But after about two weeks I was like everybody else. Whereas in American schools I didn't have to go through that process.

MAESTREJUAN: Out on the playground or after school were you hanging out and speaking Japanese?

RILEY: In the Japanese school?

MAESTREJUAN: Or in American schools?

RILEY: In American schools. No, I was hanging out and speaking English, yeah, after I got to know the American kids. Yeah, we were hanging out in English.

MAESTREJUAN: Do you remember any particular teachers who tried to identify an interest of yours, whether it be scientific or even like writing?

RILEY: Yeah, there were several I remember. This was when I was in third grade, I think, when we had an essay contest that we had to do after the summer-- In Japan the school year begins in March. So in the summer you get like a month and a half, two months off, so you actually have to do homework during the whole time. When you come back then you have to write about the summer and all these things and turn in your homework notebook. So I wrote an essay, and I won an award in the school, you know, as a publication. The teacher really insisted that I submit the essay to this thing, and so that's when I got interested in writing. When I was in college, I told myself the first thing I'm going to write ever that's going to be published will be Japanese, and I was able to do that. I have an essay in Japanese that appeared in a Japanese magazine.

MAESTREJUAN: What was it about?

RILEY: It was about my view about Japanese-ness. I don't have a copy here, sort of about my experiences. After college I spent a year in Japan, lived there for a year. So it was sort of about my view of what I observed during that period, but I can't remember what I said now.

So anyway, then when I was also I think in second grade, there was one teacher who would always read stories to us after class. She was one of my closest teachers. She would always invite me to her place afterwards. This was when I was in the orphanage, and so it was very special treatment. See, in the orphanage we couldn't go to the local schools nearby, near the orphanage. They wouldn't accept mixed kids, so we had to go all the way to Yokohama, a one-hour commute on the bus every day. That's the only school that would-- It was actually a famous school in sort of a foreign district in Yokohama, but it was a Japanese public school. We were sort of accepted as different to begin with, so it wasn't as bad. But I remember this one teacher-- I can't even remember her name, but she was a very supportive person. That was in Japan.

Then when I switched to an American school there was one teacher--I think I was in seventh grade--Mr. Mohotvic. I still remember him. He was very, very influential in my getting interested in science. He was a geologist, and he would take us to these trips in Japan, you know, to the volcanoes and things for these school overnight trips. Those were really, really fun.

But I think my interest in science really didn't take off until I was in high school in Bangkok.

MAESTREJUAN: Did the Rileys express any kind of expectations of what they wanted their children to become as adults? Should they go to the university? Should they go to college? Should they adopt a profession?

RILEY: You know, certainly they expected that I go to college. My father went to college in Tennessee. My mother didn't. But certainly they expected the kids to go to college.

MAESTREJUAN: Did your mother work outside the home?

RILEY: Not when I was growing up. She was, but not when I was growing up. We talked about a lot of things, as families do, about what you want to be when you grow up. I probably talked about that more with my mother than with my father.

MAESTREJUAN: What did you tell her?

RILEY: I wanted to be a scientist. I didn't know what kind. I didn't know what a scientist was I guess.

MAESTREJUAN: How did they encourage that interest?

RILEY: I remember my father-- I had to do some kind of report, I think, a science report for one assignment. So my father was one day very impressed that I had all these books that I was reading, reference books to do this science project. I think that's when he discovered that I was really interested in science. Then he started sort of doing things. I guess he didn't know until then, and so I remember that distinctly. After that he would buy me books, and I remember getting a telescope once as a present and a microscope. So it was shortly after that that I guess he started encouraging me.

MAESTREJUAN: Did you get chemistry kits?

RILEY: I wanted one, but I never got a chemistry set, no.

MAESTREJUAN: So did you go to your local pharmacy and get the chemicals yourself?

RILEY: Yeah. Yeah, we used to do those things, mix things.

MAESTREJUAN: Did you blow anything up?

RILEY: No, I don't think I did. You know at the time you could mail order these rocket fuel propellants, so we used to get those and make little rockets and shoot them up.

MAESTREJUAN: Did your dad help you with that or was that with--?

RILEY: No. That was with my friends, yeah, just friends. That was actually when I was already in high school. In Bangkok we did that.

MAESTREJUAN: What did your father do in the military?

RILEY: My adopted father was actually in the civil service. He was a contractor for the U.S Air Force. He was in civil service but doing procurement work for the air force.

MAESTREJUAN: What was his college education and background?

RILEY: He went to business school in Memphis, Tennessee, where he grew up. He says, you know-- He's always talked about that. He says if he didn't go to that college he would have never gotten that job in Japan.

MAESTREJUAN: So he was always a civilian working in Japan attached to an American--

RILEY: Right. Yeah, he went there as a civil service person, employee. He moved to Southern California I guess when he was in his twenties with my grandfather [Lee Riley I]. My father was a very entrepreneurial-- I mean, he owned a couple of houses in his twenties already, and his grandfather was also-- I think they had seven kids, and every one of them did very well. So my father was very-- He was a real go-getter I guess even when he was young. Then he saw an advertisement at Norton Air Force Base in Southern California about this position and applied to it. He got it, and then he was sent to Japan eventually and stayed there.

MAESTREJUAN: Was he originally from Tennessee?

RILEY: He's from Tennessee. He was born in Memphis, Tennessee.

MAESTREJUAN: Okay. And then moved to California.

RILEY: To California with my grandfather [Lee Riley I]. They started a grocery store in Fontana.

MAESTREJUAN: Oh, you're kidding! Wow.

RILEY: So yeah, I visited there. In college I used to visit my grandfather all the time.

MAESTREJUAN: In Fontana?

RILEY: Summers.

MAESTREJUAN: That's not exactly a happening place, but--

RILEY: No. No, there wasn't much, but I got to know my grandfather. That was interesting. I have an aunt and uncle who live in Barstow, so I used to go there in college for Christmases because my parents were in Thailand still. I guess when the Vietnam War was starting then he was debating whether to come back to the States or take another position in Bangkok. He decided to take the position in Bangkok.

MAESTREJUAN: Why was that? What was the decision based on?

RILEY: I think he still wanted to stay overseas. It was probably also better for the kids to be in the educational system overseas than to come back to the States to go to school.

MAESTREJUAN: By this time though you had decided to go to college in the U.S.?

RILEY: Yeah. No, it was an international school, so it was about 80 percent Americans. So all the kids came back to the States for school. Either they didn't go to school, or if they came back, they all went to American colleges. So that was just the natural order of things in high school. I didn't know where I wanted to go. I wanted to go to California, because during the summers when we were in Thailand we'd come back every two years here and visit relatives. We always went to see my grandfather or my uncle in Barstow. I knew California. California was the only place I knew, and California is also a very well-known state, you know, in Japan. It's like the state that everybody goes to, the Japanese, so I wanted to go somewhere in California. I applied to a bunch of schools in California, and Stanford gave me a scholarship.

MAESTREJUAN: Did your parents ask their kids how they felt about moving from Japan, where you've just mastered English, and now you're having to move to Thailand were you're going to have to learn to speak Thai?

RILEY: No. We didn't have to speak Thai. It was again kind of a-- I sort of regretted that later, but it was kind of an isolated community of Americans and, you know, English-speaking school. So there was very little encounter with the Thais. Although when I was in college, every summer I went back to Thailand, and that's when I actually started learning Thai. But when I was in high school-- I don't know. It was an American thing, so it was not a thing to do, to actually learn Thai.

MAESTREJUAN: Where did you live in Bangkok?

RILEY: We lived about five miles from where the school was but closer to where my father worked.

MAESTREJUAN: Was that also like a little American--?

RILEY: Yeah, there were a lot of American's in the area. There were Thais, too, but they were very wealthy Thai neighborhoods. It was not a typical residential area. It wasn't really until college that I really realized that I was in Thailand. It was strange.

MAESTREJUAN: Meaning?

RILEY: That I really got to know good Thai friends and got to learn the language and really

understand Thailand. In fact that's why I decided to go to medical school eventually, because I wanted to go back to Thailand. But certainly that wasn't the feeling that I had when I was still in high school.

MAESTREJUAN: Were you aware that this was a developing country?

RILEY: Well, you could tell. I mean, even in the four years that I was there and every summer I visited, there was just constant change going on. I remember staying in a hotel on this one road when we first got there as a family, and there were cows, water buffalos, going down the highway. Whereas you just don't see those [now] , really. You know, even three or four years after that you don't see those things. It was a great time to be there, I think, from '64 to '68, before Thailand got popular and before AIDS [acquired immunodeficiency syndrome] and all those things.

When I was in high school in Bangkok I had a group of friends. It was really funny: last week, right before Christmas, I get an e-mail from my best friend [Andrew Roman] from high school that we've lost touch for over thirty years, and he said he's been trying to look for me. It was a group of us called the Aardvarks, which was like this bunch of nerds. There were about five of us.

MAESTREJUAN: Nerds?

RILEY: Yeah, we called ourselves the Aardvarks. We were all in things like the science club and getting together. But you know we're all Americans, so after Bangkok we all sort of scattered all over the world, I guess, and we just sort of lost contact. So this guy Andy contacted another guy, Vince [Vincent B.] Bennett [Jr.], and then Vince Bennett found me through another friend who is now in Bangkok, Kim [Pau Yu]. We're still looking for the fifth [member of the group, Robert Bowen], but it was really interesting. So everybody was sort of filling each other's gaps in memory from these moments. Both Andy and Vince thought I was going to be a physicist. They mentioned in the e-mail last week that they always thought I was going to end up in a university as a physicist, and I told them they were wrong. They were partly right that I ended up being a scientist in a university. I'm a professor. But it was interesting how people perceived you even back then. I didn't know that that's the way they perceived me. It's interesting to have other people tell what they thought about you back then. It was really neat. We were really close friends, and we just lost touch. Now, suddenly, we're contacting, trying to have a reunion.

[END OF TAPE 1, SIDE 2]

MAESTREJUAN: So what was this Aardvark club, and how did you think of such a name?

RILEY: I can't remember how the name came. One of the people came up with a name, and I don't know the origin of it. It was just known as the Aardvarks. We were all members of the science club called Student Science Society. Roman was the one who actually coined the term Student Science Society. We actually had our own journal and it was a really good-- Yeah, we had these big field trips all over the country.

MAESTREJUAN: How big was this international school?

RILEY: It was about eight hundred, eight hundred people.

MAESTREJUAN: Wow. Now, were these all Americans or were they foreigners?

RILEY: No, it was about 75-80 percent Americans and then others, foreigners from all over the world.

MAESTREJUAN: And did any Thais--?

RILEY: There were some Thais, yeah, but they tended to be from very wealthy families. I remember one girl who was the daughter of the ambassador to Russia or the Soviet Union and, you know, people of that sort. But, you know, it was a great school. I remember having all kinds of friends from all over the world. One friend [Kim Pao Yu], who actually is Chinese Thai but is now an American citizen, is now back in Bangkok, but he's like one of the closest friends I have and was the best man at my wedding here. He grew up in Thailand but from a Chinese family. I have another friend [Chai-Meng Cheng] who is Chinese who's from Taiwan who is now in Chicago and has his own computer company, but he and I became sort of good friends because his mother was a math teacher. So when we were stuck with math problems, we would always just go up to his mother and she would help us. So we were both really good in math because of his mother. Yeah, there were opportunities that you would just never have if I went to high school here.

MAESTREJUAN: Yeah, like for instance?

RILEY: Just being able to relate to people from all over the world. You know, they're not just immigrants. They're really there. I remember having a very bad crush on a girl from Israel. And,

you know, it was the Six Day War. We would talk about those things. That was a very American-type school. It had all the American stuff there. We had a junior-senior prom, but instead of going to a-- I don't know what they do here, but we would rent out these hotel lobbies, you know.

MAESTREJUAN: Oh yeah, well that sounds-- And did you play football or baseball or soccer?

RILEY: No, I didn't do any sports. No, I don't think I did any sports. I mean, I did it as part of the required P.E. [physical education] stuff. We were also into Explorers. Part of the Aardvark group was also into Explorers. It was the Explorers groups started by an American military guy, and we'd go all over the country, you know, officially certified by the American Explorers Organization. It was fun. We'd go to Lake Kwai, where the film *Bridge on the River Kwai* was made, and swim across the river. You know, these things are in retrospect things that when we were doing them were just like a kids thing to do. So it was nothing special, but I wish my kids could do that, what I did. You know, I think that would be great.

MAESTREJUAN: Was the expectation at this high school that these students would go on to college?

RILEY: Yeah, a large percentage. I don't know the exact percentage, but a large percentage of them did go to-- Yeah, a lot of people went to college. And all the members of the Aardvark went someplace.

MAESTREJUAN: Was the curriculum technically or scientifically oriented or did it have an emphasis on one particular curriculum, like a technical--?

RILEY: It really varied. I remember after starting college-- Compared to my friends in college who went to high school here, there's some things that were very strong in the international school and other things that were really weak. Biology was really weak, and I remember [I was] not quite prepared in college in biology, because the textbook was really old. Whereas physics was really strong, and I actually wanted to be a physicist when I started college. I had a very good teacher, physics teacher [Mr. Moses], who was actually Indian. But I remember I really wanted to be a physicist, and I was really prepared. I took the advanced physics courses when I started college. I remember math was also very strong. There was an American teacher, Mr. [Phillip] Bachen, who was also one of the very influential teachers that I had in high school. You know, he would sit with students afterwards and just talk about all kinds of things, and he would listen. He taught the calculus class, so I was already prepared in that. But biology was really weak, and even though I had a very good biology teacher, the textbook was really not

very good. Chemistry I think was the standard.

MAESTREJUAN: What about this interest and ability in writing? Where was this during high school?

RILEY: My English teacher, yeah, Mrs. [Caroline] Saluja. She was actually from Massachusetts, but she married an Indian businessman in Thailand. She was really insistent on creative writing, writing, and that got me interested in-- Well, being a philosophy major helped also, because that's all you did. You had to do a lot of writing. I didn't do philosophy because I wanted to do the writing, but that discipline happened to emphasize writing.

MAESTREJUAN: Were your teachers trying to encourage you to go in one direction or another?

RILEY: I think everybody expected me to do some science later. I was president of the Student Science Society a couple of years and had to organize all these-- We had a science fair. It was one of the biggest events of the year. So, yeah, I think that the teachers had an expectation that I would go into science. I never even thought myself, or neither did anybody else, that I would do biology, though, later. Or medicine.

MAESTREJUAN: So did you like have the best and biggest science project experiment?

RILEY: Yeah, I won grand prize I think one year.

MAESTREJUAN: Do you remember what your project was?

RILEY: Yeah it was-- One of my friends on his e-mail reminded me. It was totally-- I just sort of made it up out of my head. There was no experimenting. It was called "The Conception of Life in Nine Planets," or eight planets. So knowing what we knew at the time about the environment on these planets, I tried to figure out what kind of life forms would exist in those places, and I would make drawings based on what I thought. And that won the grand prize. They had some idea how much oxygen was in there. It was mostly methane, like on Jupiter. Then what would you expect the life form to look like?

MAESTREJUAN: Wow. Now, where did this idea come from? Can you remember that?

RILEY: Yeah, it was in Japan when I was in junior high. I had a very good friend who was also into science. It was a real close buddy, Karl Mehring. We would always just talk about planets. We were really into planets.

MAESTREJUAN: And life forms on other planets?

RILEY: Yeah, you know, just imagining what kind of life forms it would be. Then when I moved to Thailand I thought, "Why don't I just make this into a science fair project?" So I actually read a lot of books to learn about what they knew at the time about planets and put this together. So yeah, it was--

On the weekend we would always go down to Yokohama on the train to go caddying on the golf course. That's how we earned some money to do things.

MAESTREJUAN: So there were a few little athletic tendencies in you?

RILEY: No, it was more to just travel around. I guess I was already interested in traveling around at that time. Karl's mother was also Japanese, and so we had a lot of things to share.

MAESTREJUAN: What was it about physics that you found interesting that you wanted to be a physicist?

RILEY: I don't know. I think that the teachers probably just-- It was just really interesting. I don't know what-- I guess if I was going to make a robot and things, I had to be a physicist.

MAESTREJUAN: Okay. So you're still thinking about these things?

RILEY: Yeah, I was still thinking about--

MAESTREJUAN: And you're still reading these cartoons and the comic strips?

RILEY: I still have them. I read them to my kids now.

MAESTREJUAN: They were in English or Japanese?

RILEY: They were in Japanese. I translate them simultaneously as I read it. My daughter, the older daughter [Samantha Riley], is going to a Japanese school on weekends. She's going to learn Japanese.

MAESTREJUAN: You do speak Japanese at home? Did we talk about this?

RILEY: No, my wife doesn't speak any Japanese, so it's difficult. But they know-- I mean, Samantha knows a lot of words in Japanese, and she can read the *hiragana*. But I don't know. I think it was just basically the combination of this physics teacher in high school and this math teacher. Physics and math, you know, I really liked both of them.

MAESTREJUAN: So what did you see yourself doing then? You know, if you became a physicist, what did you think you'd be doing in college and then after you finished--?

RILEY: I thought I was going to be in college, something, a physics teacher and doing things.

MAESTREJUAN: So when it came time to start thinking about-- In your junior year when you have to start taking the SAT's [scholastic aptitude tests] and things like that, how were you going about thinking about conceptualizing your future and what you wanted to do and where you needed to go to fulfill those kind of dreams?

RILEY: Well, I was particularly interested in particle physics when I was in high school. I remember there was a book that I checked out of the library, and I got really fascinated. It was a book-- I still remember it was a paperback book. It was a 1963 publication. You know, for me that was like one of the newest books that I had at the time. It was all about-- It's called *Fundamental Particles* [Kazuhiko Nishijima, 1963] , the book. It was about mesons and muons and things, and I got really fascinated. That's what I wanted to pursue. So that's why I applied to Stanford [University], because Stanford had the linear accelerator where they did those things. That's really the main reason why I wanted to go to Stanford. I didn't know if I was going to be accepted, but you know--

MAESTREJUAN: Did you apply to any other schools?

RILEY: Yeah, in California I did. I didn't apply to Berkeley though, but I applied to UCLA, I

think, and other smaller--one of the Claremont Colleges. So they were all sciences. Caltech [California Institute of Technology] I applied to. But, you know, the linear accelerator was what really attracted me. So one of the first things I did when I came to Stanford was to visit the linear accelerator.

MAESTREJUAN: Yeah. Okay. Did you get accepted at Caltech?

RILEY: No. I didn't get accepted to Caltech. I got into UCLA and Stanford and then the Claremont Colleges. I don't know if I had already heard from them. I can't remember. But when Stanford gave me the scholarship, I think I withdrew from the others.

MAESTREJUAN: Okay, one last question and we can probably wrap up. How was it that you made the transition from wanting to be a physicist to majoring in philosophy?

RILEY: This was in the late sixties, early seventies, right, and so the Vietnam War was going on. Oh no, this is actually-- Yeah. Yeah, late sixties: '68-'72.

MAESTREJUAN: You entered college in '67?

RILEY: No, I started in '68. So I remember even the first week at Stanford there were all these political forces trying to influence students in one way or another. It was a very traumatic time, I think, for a lot of students, you know, facing the draft for the males, and the demonstrations at Berkeley and at Stanford, too. I guess it was also a period where people wanted to do something, quote, "meaningful." So I think nowadays people sort of look back upon that period as being very simplistic or kind of foolish or overly idealistic, but it was really genuine. I mean people really wanted to do something meaningful. So during the summers when I went back to Thailand-- I was teaching English during those summers, and I got to see a lot of Thailand, you know, the real Thailand that I didn't see when I was living there as a high school kid. I really wanted to come back to Thailand and do something, but I also started learning about Buddhism in Thailand. You know, I said physics was not the way to sort of really learn about meaning in life, and so I wanted to do something that made you think about things more. So I decided to major in philosophy. I took some philosophy courses, and I really enjoyed it and-- So it was more of a—

I guess I looked at the college period as not so much a preparation for some career but as a time to really use that time to really learn about something, about life. Where in your life do you have four years where you can really do what you want to do? You know, you can't find that time any other time in your life. So that was important, and that's what I decided to do. But then in the subsequent years, by the time I think I was in my junior year when I went to

Thailand the third time, you know I realized I couldn't do much as a philosopher either in Thailand. [laughs] So that's when I decided to go to medical school and became a little more practical. But again, the reason I wanted to go to medical school is I wanted to do something meaningful. The reason was that I wanted to go to Thailand to do something in medicine in Thailand, to do something there. So that was the motivation. I never thought I'd end up doing basic research later, but that was the beginning of a-- You know, the reason for my going into medicine.

MAESTREJUAN: Okay, and what did it mean to do something meaningful at this point? To do something meaningful, what did it mean to you?

RILEY: I don't know. I think that whatever that meant at that time sort of changed, I'm sure many times, but I think I wanted to discover myself, I guess, and what the meaning of life was. At the time it was very important. There was a war going on, and my father was part of the process. And a certain feeling of guilt, you know, my friends going off, getting drafted, and I had a high number, so I didn't get drafted.

My best friend [Kwon Ping Ho], who was actually Thai, came to Stanford also. He was a year behind me. He got very quickly involved in anti-war activities on campus, and he got expelled. Because he wasn't an American he got deported back to Thailand. He comes from a very wealthy Chinese Thai family. His father was ambassador to Thailand. When Singapore broke away from Malaysia, his father became ambassador from Singapore to Thailand. And his father was a big businessman who grew up in Taiwan. [He] was also a kind of a very fiery radical in Taiwan when he was young. But anyway, Kwon Ping got sent back, and he got drafted into their army in Singapore.

They had a compulsory draft system. And you know, this was everything that I guess was against his beliefs. But, anyway, I lost touch. I couldn't communicate with him because the military would open the letters. His mother is actually a well-known translator, American or English language novels into Chinese. So I would write to his mother, and his mother would communicate with him. So it was-- I think it was 1977 when I was in Thailand as a medical student doing an elective.

I picked up a copy of *Newsweek*, and there was a picture of my friend in the paper. It turns out he was arrested in Singapore, because after he got out of the army he joined the *Far Eastern Economic Review*, the journal, and he wrote an article that the Singapore government considered to be a military secret. It wasn't. It was in the *New York Times*. So they arrested him and tortured him and did all kinds of things. It was all written in this *Newsweek* or *Time* magazine. I saw him several years later, but he went through a lot of changes himself. It all started from our Stanford days, and I didn't go through that. And, you know, there was a certain sense of guilt.

So I wanted to do something I think that meant something, I guess, but I wasn't as crazy

as some people or not as brave, maybe. I think I wanted to do it at my own pace. Going to Bangkok, I mean, you see things that you just would never see in the U.S. That's when I first learned about kids selling Chiclets all over the streets. You learn about-- You discover things you just didn't know about. You know, you come to ignore those things. In college it was-- Maybe we were just very easily affected, but that was really important. I think those four years were probably the most seminal four years of my life.

MAESTREJUAN: Okay, well, I think we've reached a good point to stop today, so thank you very much.

[END OF TAPE 2, SIDE 1]

[END OF INTERVIEW]

INTERVIEWEE: **Lee W. Riley**

INTERVIEWER: **Andrea R. Maestrejuan**

LOCATION: **University of California, Berkeley**
Berkeley, California

DATE: **30 December 1997**

MAESTREJUAN: I wanted to follow up with some questions from yesterday's session, and one was, had you given any thought to returning to Japan for college or, after you'd graduated high school--? To return to Japan and pick up your life or university education there?

RILEY: No, not really, because I think by the time I was going through high school, I was already sort of slated to go to the States, and I never really-- I wanted to go back to Japan for personal reasons, but not to go to a university. I think probably even now Japanese university education is not the most enlightening system, and that was recognized even back then.

MAESTREJUAN: So how aware were you of the differences between, say, going to the States for an education versus going to Japan for an education versus perhaps even choosing a European university?

RILEY: No, I never even considered-- I was just set to go back to the U.S. I certainly knew that at least in Japan you work very hard through high school, but once you start college then it's a party for four years, because after the four years you have to then start working. So most Japanese students look upon their college years as a time to have their last freedom. Of course, there are many serious students who go to universities. There are good universities, but it's not the most optimal system.

MAESTREJUAN: How aware were you living in Thailand that the United States, particularly California, was being pretty much split apart by these counter-culture movements, the anti-war movement, the Vietnam protests? And how concerned were you to come to the United States being a seventeen- or eighteen-year-old in prime fighting condition?

RILEY: We were aware of all the anti-war movements and all the sort of counter-culture movements going on in the media even in Thailand. Also there were a lot of influences because there were a lot of Americans in Bangkok. Many of them came to Bangkok, you know, as counter-culture people to sort of hang around on the beaches, and so we saw them. The so-

called hippies were already in Thailand, not just from the States but from Europe and other places. So we were quite aware of what was going on, but it didn't affect me in any way. I mean, I didn't even think about it in terms of how that's going to influence me coming to California. In fact, I was looking forward to seeing it more. Yeah, even-- I mean, our high school was very American, so even the so-called counter-culture movements-- There were counter-culture types even in our school. You know, there were drugs I think going on in the school. So I don't think it was that different from the typical situation that was going on in the States in high school. Many of the kids, you know, the military kids, were there for short terms, usually two years or so. So there were a lot of exchanges of these students coming from the States, and so whenever that happened they also brought the current culture in the States. Music, dance, and everything was there.

MAESTREJUAN: You had mentioned yesterday that you got a high draft number, so it wasn't that much of a concern. But how much did you ponder what you would do if you did get--? I'm sure this happens a lot to Pew Scholars [in the Biomedical Sciences] in this time period, that they considered what they were doing. I find it a bit ironic that you come to the United States when several of them were considering leaving the United States. So how did you deal with this issue of registering for the draft and what you would do if you were called upon?

RILEY: Well, this was-- I was already in college when that was going on. There were a lot of opportunities to say I was a conscientious objector, and many of my friends actually did that. I don't know how much you knew about that period in terms of these alternative arrangements, but it was not that difficult to get conscientious objector status. You could work on campus in some setting, and that could count as a conscientious objector status.

MAESTREJUAN: Is that what you registered as?

RILEY: No, I didn't. I can't remember what I registered as, but that was the plan, that if I had a low number, that that's what I would do. I think I may have registered as a conscientious objector. I think you had to do it in order to get that. So, yeah, my close friend [Denny Mazur] did get a low number, but he served as a conscientious objector for two years and worked I think in Stanford [University] Medical Center or something doing something.

MAESTREJUAN: Because there was a period of time when college deferments were not going to be accepted, towards the end, but was that a concern for you that--?

RILEY: That's right. Yeah, that was a concern. There were a lot of changes in the draft system. Early on there was a deferment and then they started going on the lottery system. There were very rapid changes. So by the time the lottery system got started and then after I went through it,

you know, it wasn't an issue anymore.

MAESTREJUAN: Okay. You had mentioned that you would go back to Thailand during the summers and that you saw things differently. Before, you really didn't interact with the Thai culture all that much. You didn't really learn to speak the language. You really didn't see in Bangkok the differences between the social strata. What changed between being a seventeen-, eighteen-year-old senior in high school and then coming back during the summers?

RILEY: Well, I think the Stanford experience, the anti-war movements and sort of the consciousness movement going on at Stanford. There's a lot of influence from just the politics as well as the sort of consciousness-raising movements going on on campus. You know, I was from Southeast Asia. I lived there for four years not knowing what was going on in Southeast Asia, when this was really the focus of all the American war efforts and things. It made me quite aware that I really needed to know what was going on. People would ask me at Stanford what was going on, and it was embarrassing having lived in Thailand, right next to Vietnam, not knowing what was going on there. So I think that really influenced my making an effort, I guess, to really get to know Thailand.

MAESTREJUAN: So how did you go about doing this? How did things change? Once you had this change in perspective, how did Thailand look to you then?

RILEY: Well, I began to understand, I guess, the role of, first of all, the Americans in Thailand, what they were doing there, and the relationships of the Thais to the Americans and then all the people who were not directly connected, like the kids of the military and how they fit into the whole picture. Whenever I went back, as I mentioned yesterday, I taught English to the Royal Thai Air Force people. So they were the Thai military, and they were obviously connected to the U.S. military. And we had very-- Thailand was not as repressive as some of the other countries, and so they were very free to talk about what was going on. So I got a good sense of what was going on, probably in a naive way because, you know, I'm still in my late teens.

But at the same time, by teaching English to them, they also would invite me to their homes in the countryside. We'd have parties. I got to know the Thai culture through them, not just the military, but their families and other areas where they lived. Because I was a philosophy major, I also wanted to attend some of the Buddhist meditation sessions, and my friends, my Thai friends, would take me to those places. So it's a mixture of a lot of different things, being exposed to different aspects of the Thai culture from the civilian life to military life to sort of the more spiritual life. I traveled around the country during those summers. So it was really just opening up my eyes and mind to the country that I had previously lived in for four years, you know, and try to catch up.

MAESTREJUAN: How did this kind of awakening of a consciousness or an interest in Thailand affect your own relationship with your family, given that your father was very much involved in the U.S. government as a civil service member procuring for the U.S Air Force and being tied very closely to the military?

RILEY: You know, I guess I was conscious of that, but that never really became a source of conflict. Although I remember one incident. You know, after college I told you I went back to Thailand and then I went to Japan, but I spent the summer before I went to Japan with my parents. I was actually going to continue to study Eastern philosophy in Japan, so I had all these books with me. Right before, I think a day before, I left for Japan, my father [Lee Riley II] looked at my suitcase full of books with quotations of Chairman Mao Tse-tung. He proceeded to just confiscate them, and we had a big argument at that time. I needed those books, but he would not let me take them because I was going on a military transport from Thailand to Japan. He was concerned that if anybody saw those it would not look good.

MAESTREJUAN: For him or for you or--?

RILEY: Probably for both of us. I was only using them for the purpose of studying part of the Eastern philosophy movement in Asia, but my father was really concerned. He wouldn't accept my explanation. So there was that sort of thing, but not anything direct in terms of what he was doing.

MAESTREJUAN: Did you have the opportunity to discuss these issues with your parents?

RILEY: Not in detail. My father and I actually went to Japan together. I remember he dropped me off in Japan. He was obviously concerned. I guess it was the first time I was going to be by myself outside of being in college. And during that trip we talked a lot about a lot of other things that we hadn't really talked about, but it wasn't about his role in the Vietnam War. It was more of a-- I guess I was sort of criticizing him for being the way I was in the four years I was in Thailand because my parents continued to sort of be isolated from the Thai culture. The newspapers that you read were American newspapers. So I was, I guess, being critical of him for being in Thailand but not--

MAESTREJUAN: And what was his response?

RILEY: He sort of took it-- He understood. And then when I came back later he had Thai newspapers. They were in the English language but locally published papers. So I guess he sort of took it seriously.

MAESTREJUAN: Well, to get back, then, to your intellectual development--I'm sure it's attached to these other developments in terms of developing a consciousness and an interest in these other larger issues--I wanted to ask, how soon when you arrived at Stanford did you lose this interest in physics and take up philosophy?

RILEY: I would say maybe my sophomore year. Yeah. I sort of started getting away from physics and started taking some philosophy courses at that time. Then it was in my junior year that I decided that I wanted to go to medical school. So I started taking my premed[ical] courses towards the end of my junior year, so I didn't quite finish all of the courses to apply. That's why I was so-- I was willing to skip a couple of years before I started medical school. So when I came back from Japan after a year, I went back to Stanford as a graduate at large to finish up all the premed courses. But, yeah, I remember very distinctly walking back to my dorm one day from one of my classes and deciding I wanted to go to medical school. It was, I guess, like a very distinct, specific time of the day. One spring day I think I decided that's what I wanted to do.

MAESTREJUAN: And why was that?

RILEY: I don't know. I guess because I had been thinking about it. I had also been in Thailand the summer before that, and I guess I came to the realization that if I really wanted to go back to Thailand and be useful, I couldn't do it as a philosophy person. It was not-- Philosophy was I think, even though I liked majoring in it, too self-centered I thought. You know, I was only doing it for myself. So if I wanted to go back to Thailand and do something useful, I had to do something that was really useful, more practical. So, no, it was not something that was influenced by my parents or my friends or anything. I just made that decision.

MAESTREJUAN: And what did you see yourself--? In terms of what would you--? When going to medical school, would you become a physician? [tape recorder off]

RILEY: You were asking--?

MAESTREJUAN: I was asking when you had this moment and you decided to go to medical school, what did you see yourself doing when you returned to Thailand with an M.D. degree?

RILEY: I don't think I had any specific idea of what I wanted to do. I wanted to go back to Thailand as a physician. You know, I was very naive. I really didn't know what-- I didn't even

know anything about epidemiology or public health at the time, and I didn't realize that epidemiology is much more powerful in terms of being able to do something than just being a clinician. But my limited knowledge about medicine at the time was really clinical, and so I wanted to do something clinical, you know, be in a clinic or a hospital or a rural clinic setting and take care of patients. I think that was my romantic sort of image, sort of like Albert Schweitzer kind of approach to working in a third world country setting, which later changed, obviously. But I was also interested in international health. It's really not so much-- It's Thailand but also international health. I even thought of-- You know, there were all these-- Médicin Sans Frontière, the French group, were in Vietnam doing things. The American Rescue Committee, ARC, were also in Vietnam and also in Thailand when the Cambodians were forced out of Cambodia into Thailand. Those were the kind of images that I wanted to sort of fit into, and that's why I wanted to go to UCSF [University of California, San Francisco], because UCSF had an international health program [Department of Epidemiology and International Health]. I didn't know if I was going to get in, but I applied to programs that had some international programs.

MAESTREJUAN: Which were?

RILEY: Which were Cornell [University Medical College, Division of Infectious Diseases/International Health/Special Studies]. Cornell had one, although I didn't apply to Cornell. I actually ended up applying to Columbia [University College of Physicians and Surgeons]. Columbia had a limited international program at that time, but UCSF was the big one. I applied to Stanford [University] just because I happened to be already there. I applied to, I think, UCLA and USC [University of Southern California]. I'm trying to remember all the other places. I'm mixing up the residency with medical schools. I can't remember which was which that I applied to.

MAESTREJUAN: Did you want to stay on the West Coast or was that an issue?

RILEY: Let's see. I'm trying to remember. When I was applying to residency I wanted to go back East, but with medical school I think I wanted to stay on the West Coast.

MAESTREJUAN: Why did you choose to continue with your philosophy degree rather than just drop that completely and pick up premedical studies?

RILEY: I had already taken many courses in philosophy, because I was a double major, premed and philosophy. I didn't have to do anything more to do it. I wanted to have that degree after my name in philosophy because I guess at that time there weren't very many premeds or people applying to medical school with a philosophy major. I think that helped. It certainly helped.

MAESTREJUAN: Where was the issue of doing bench science? Did you have much opportunity to work in a lab at Stanford?

RILEY: You know we did just the typical course bench work, but no. I never even considered doing bench science, even through medical school. I was always interested in research questions, and whenever something came up I would always think about a way of doing research to answer certain questions. But it was just always-- That was just the way my mind was working, but I never actually tried to do anything about it until I guess between my junior and senior year in medical school. I went to Thailand for an elective for three months, and then before I went I discussed what I was going to do with my adviser, one of my advisers. It had to be a research project, and that was really sort of my first real clinical research opportunity I had. But, you know, it was never bench lab science stuff. That interest didn't really come up until much, much later.

I guess I've always been in situations where I'm easily influenced by whatever I was doing at the moment. But at the same time I would try to then justify what I do, I guess, with what I had done previously and try to synthesize all those things, if you know what I mean. If I sort of break off ties with what I had been doing before, I feel like I've wasted that time. So I feel that somehow I have to incorporate what I've done in the past into what I'm doing now and try to build from there. And it turns out that's been very helpful, to not forget about what I had done before into what I'm doing now. It's much more time-consuming and maybe inefficient to go about it that way, but they certainly help.

So, yeah, in medical school I began to appreciate or understand what public health could do. And I think it was towards-- After I came back from Thailand, the elective, I decided I wanted to do some epidemiology, and that's when I started learning about CDC [Centers for Disease Control and Prevention]. I didn't even know where it was, but I knew about CDC. So when I started my residency there were actually a couple of attending [physician] s who had gone through the EIS [Epidemic Intelligence Service] program at CDC and, you know, I discussed with them.

When I first started my internship my initial plan was to go to London School of Tropical Medicine and Hygiene to get the-- I forget the name of the degree they had, but there's a program for one year where you can do public health, tropical medicine. But that was also when [Margaret H.] Thatcher came in, and she actually raised tuition for all the foreigners to attend that school. Before then everybody had-- It was the same for everybody, all the fees. So it suddenly became very expensive to go there, so I started thinking about CDC more seriously.

Then I applied and got in. So, yeah, by the time I was in residency, I was already really committed, I think, to do international health. In fact, I wanted to be back East in Columbia again to be in a sort of region where-- You know, just being in New York City you get exposure to international health type of activities. But my main reason for going back East was my

girlfriend [Donna Doane] was at Yale at the time. She was going to graduate school. She was from Stanford also, but she started graduate school at Yale. So we wanted to be closer together.

MAESTREJUAN: There usually always are these more practical reasons. Well, to go back just a little bit-- I want to pick up with this philosophy that you have of how you do things, but we need to fill in a lot of gaps before we get there. Once you decided to go to medical school, why then did you decide to take the year off and go back to Japan?

RILEY: Well, I had always planned to go to Japan. I wanted to sort of pick up the language again. I had lost the reading and writing ability a lot, and I wanted to pick those things up. I also wanted to see my mother [Ikuko Satoyoshi], my biological mother, because that was sort of the real first independence that I had after I finished college. I was on my own, and I could make my own decision.

MAESTREJUAN: Were you able to meet up with her?

RILEY: Yeah, I met her, not immediately after I went to Japan, but after several months I decided to finally look her up. It was a very intense year in terms of making a lot of good friends. In just that one year I still have very close friends. I really got to know Japan again as an adult rather than as a kid. Yeah, it's still-- Emotionally that's my home.

MAESTREJUAN: Did you have to pick up your forgotten Japanese language or had you--?

RILEY: No, my spoken language was fine. It was more my vocabulary. I stopped going to Japanese school as of fifth grade, and so my vocabulary was really limited to fifth grade. I was attending Waseda University, sort of as an exchange student kind of and then trying to do Eastern philosophy stuff.

MAESTREJUAN: Did you try and take any biology or premed type--?

RILEY: No, no, it was all Eastern philosophy stuff. It was only for a year, and I was teaching English to support myself.

MAESTREJUAN: Had you considered dropping the medical school idea?

RILEY: No. That was the plan. So I was going to spend a year in Japan and then go back to the States to finish the premed requirements. But, you know, I didn't want to go to medical school right away.

MAESTREJUAN: When you entered San Francisco, UCSF, how aware were you that you had followed a maybe nontraditional path to get into medical school with all these, maybe a couple of years younger, eager premeds?

RILEY: Actually, there were a lot of people like me who did that, a lot of people who-- In fact, maybe-- I can't remember what the average age was, but the average age of our class was certainly older than you'd expect it. At that time there were a lot of people who did things like this, you know, some who took off many more years than I did, who had other professions. There were nurses who decided to go to medical school and came in. I think the average age of the women medical class in my class was early thirties or something. So it was not unusual. I would say about one-third to maybe even half the class had done something before they started.

MAESTREJUAN: How did you adjust to the rigors of the first couple of years of rote memorization after studying Eastern philosophy?

RILEY: It was exactly that. It was like learning a foreign language, you know. I mean that was the way I looked at it, something that was necessary and a chore and you sort of accept it and do it. But it's interesting; I have a lot of friends from my undergraduate period, but I don't have a single close friend that I can say, you know acquaintances-- But I haven't kept in touch with anybody from medical school.

MAESTREJUAN: Why do you think that is?

RILEY: I think we were so busy doing things, being medical students, that we just never had time to get to know-- It may also be the way UCSF is arranged. There's no dormitory there. Everybody's so scattered, living all around the city. The medical students that I talked to at Cornell have a different experience. They really get close because, actually, they're required to stay their first year I think in the dormitories right across from the hospital. So it may have more of that sort of thing rather than just the intensity of having to do the work. But because of the intensity of work, and you're so scattered, you just never made an effort to get to know anybody. There's also, you know, positives. The ones who went straight to medical school, many of them were from the same institutions, so they sort of knew each other from undergraduate years. Whereas I was two years sort of past. So I didn't really know anybody. I mean, even the ones from Stanford who came in, you know--I didn't know that class. I mean, I became friends with them just because they were previously at Stanford, but they weren't my

friends when I was at Stanford.

MAESTREJUAN: At any point did you think that you would do anything else, once you did start learning more about medicine and clinical things, that you would do something else besides epidemiology or community health or international health?

RILEY: No, that was--

MAESTREJUAN: Become a surgeon and make lots of money?

RILEY: No, I didn't want to be a surgeon. Yeah, I wanted to do international health. That was it. Epidemiology wasn't quite-- It hadn't blossomed [laughs] in my head yet. In fact, the epidemiology course elective they had was so bad that I hardly went to class. So actually, I had a bad image of what epidemiology was in medical school. It wasn't until much later-- But I did have this strong interest in international health. Bob [Robert S.] Goldsmith was my adviser--he was in the Hooper Foundation there--who, you know, had connections abroad. So he sort of helped me to make the arrangement to go to Thailand. I guess I also had an opportunity to get an M.P.H. [masters of public health] at the [University of California, Berkeley] School of Public Health here--they have this joint M.D./M.P.H. program. But it was either that or the elective in Thailand. I decided to do the elective in Thailand. I didn't have time to do both.

MAESTREJUAN: At that time how did you see the distinctions between, say, medicine and public health and how one defined those two areas?

RILEY: You know, I hadn't had any public health experience to really be able to think about that critically, but at that time there was a lot of interest, which I guess is a resurgence for this now, in primary health care. In fact, UCSF had one of the strongest programs in primary health care. They really started emphasizing that. So that was sort of my first introduction into prevention and that sort of approach to medicine rather than a more traditional treatment-oriented approach. But I never really did anything specifically that got me exposed to those things, you know, other than going to Thailand.

In Thailand certainly I did. It was at a missionary hospital, but it also ran these outpatient services where they would go out into the villages with Land Rovers and open up these one afternoon clinics and see all these people with all kinds of illnesses, you know, monitoring for TB [tuberculosis]. They would bring these portable x-ray machines. They also had a very strong birth control program run by this missionary, head of the mission hospital, where they would go to these villages and administer Depo-Provera to women for birth control. So there were these outreach services. I think it was pretty advanced for Thailand even back then. That really was

my first exposure to sort of another aspect of medicine that I just was not exposed to at UCSF.

MAESTREJUAN: Was this project--? Did you initiate this project or--?

RILEY: In Thailand?

MAESTREJUAN: In Thailand. Or was it part of an established--?

RILEY: Yeah, it was already an established program. It was actually run out of UC Davis [University of California, Davis], but I did it through UCSF. It was essentially a clinical rotation in a missionary hospital, but you also had an opportunity to do these other things while you were there. So it's kind of a survey, you know, for an exposure to working in that sort of setting. I also spent three days in a leprosy hospital, and that was also run by this missionary hospital. You know, you got this intense exposure to all kinds of aspects of leprosy. It was quite an experience. The whole leprosy hospital was run by a couple of Australians who would come from Australia and spend a few months there, and then they would do this on a rotating basis. You know, you talk to these people and you try to find out their motivation, you know, why they do these things. When I was in the missionary hospital I had an American pulmonary physician [Robert Walkup] who came from Arkansas someplace to work for a month as a chest physician offering his services, bronchoscopy services and things like that. You really get to know these people, and then everyone-- You really sort of admire them. They sort of become a role model because they take the time away to do these things. You know, as a medical student you're very impressionable, and you sort of picture yourself doing that later on. I think that was the beginning of this interest in public health and a public health approach to medicine.

MAESTREJUAN: What were your concerns for yourself in terms of being exposed to all these diseases that people in the United States only read about in history books?

RILEY: No. [laughs] I guess I was very naive. It didn't concern me at all. You know, I got sick a lot, mostly diarrheal illness. But I had never-- I don't think I even took shots before I went there because I had lived there before. I had lived in Thailand before. I was getting sick all the time even when I was there before, so it wasn't a big deal. You think about it. Medical students always-- You know, the medical student syndrome, whenever you have something, a fever, you think of the worst possible thing that you most recently learned in class. [laughter] So I went through those periods in Thailand, but it was never a big concern.

MAESTREJUAN: What was the reaction of your colleagues and instructors at medical school, who are practicing in a relatively safe area--and some have dreams of opening their own private

practice in Marin [County] and having a fairly lucrative lifestyle--to people like you who were going off into the wilds and practicing a different kind of medicine?

RILEY: I don't remember any strong reactions one way or the other.

MAESTREJUAN: Okay.

RILEY: You know there were-- I wasn't the only one who was doing that sort of thing. There were a group of us interested in this sort of thing, and so we sort of reinforced each other in our interest in these things. There were a lot of people doing a lot of other things, not necessarily in international health, but working in free clinics here in the city. There were other alternative styles of doing medicine. There's people-- You know, I had a couple of friends who were like one of the first ones, I think, to start getting into sports medicine. There were a lot of really creative people at that time going into-- I think people going into private practice were almost a minority in our group. I don't think-- Yeah, I don't remember anybody specifically saying that's what they wanted to do. Most of them-- If they were going to do private practice, they were going to do primary healthcare type of work in some rural setting or some inner-city setting. So it was an interesting class.

MAESTREJUAN: How much of it is due, do you think, to being at that time and place when--? Because when I was going through people became physicians. I was a biology major that was not a premed, so therefore I was something odd. But all my colleagues and fellow students who were biology majors were premed, and they were all going into it for the money. I mean, that's just-- They could have a relatively nice lifestyle. Maybe it was my own cynical view, but I was never sure where the issue of promoting a better life for people in general or humans in general-- How much do you think was that for you a product of coming of age at a time when these issues were important, when love, peace, and--?

RILEY: No, I'm sure that had a lot to do with the attitudes of at least the people in my class in medical school. I don't think I remember anybody talking about going into medicine because they wanted to make money. I think that would have been very, very unusual at that time. I think most of them really wanted to do something, either go into academics, do research in medicine or in some inner-city setting or rural setting. My roommate [Bob Rowan] in medical school went off to do Indian Health Service, you know, first in New Mexico and then went off to Alaska. It wasn't just as a payback thing to the Public Health Service. He actually stayed and did those things. Yeah, many of the residents that I worked with when I was a student-- One [Gary Slutkin] went off to WHO [World Health Organization]. I don't know anybody who actually went into private practice from my group at least that I've kept up with. I'm sure that was a product of, you know, our going through the Vietnam War period and you know-- I guess the time when all of us made a decision to go to medical school, we were still in college during

that period. But, you see, by the time we started medical school, the people who were going through college had already changed. That's when all the sort of intense competition for going to medical school started, I think, you know, where people would steal books. I mean, I heard all kinds of stories about premeds at that time, which was I think-- I don't know if that was going on when we were going through our premed period, but I certainly don't remember the intensity of the competition. But I did it sort of in an unorthodox way, too, because I didn't do it through the regular way.

MAESTREJUAN: Okay, let me flip this over.

[END OF TAPE 3, SIDE 1]

MAESTREJUAN: So would you describe this as the golden period of medical education or medical idealism?

RILEY: At that time?

MAESTREJUAN: Yeah. That there was this sincerity?

RILEY: I guess it probably comes in cycles. I'm sure there were other cycles early on, but certainly, yeah, I think that was a very good period. You know a lot of the-- You've heard of the "yellow berets".

MAESTREJUAN: Right.

RILEY: I think in terms of the biomedical research right now, if it weren't for the "yellow berets"-- I'm not sure if the quality of American biomedical research would be as good right now if it weren't for them. That was really influenced by the war, you know, in that these people decided-- They made a choice. They didn't want to go to war. They wanted to serve in the Public Health Service, NIH [National Institutes of Health], and they went. Some of the major players went through that period, and CDC, too. I mean, most of the people-- When I went to CDC, my bosses were all people who went through that period, and they wanted to go to CDC because they wanted to avoid the war. They're the ones who sort of directed it. That's why CDC is the way it is, I think. You know, their whole attitude towards public health is influenced by those people. So it was a good period, and, you know, unfortunately, that didn't get sustained.

But what's refreshing and reassuring, I guess, is that no matter what year of medical

school students you talk to there's always a few, two or three, that still have this idealism. That was one really good thing about Cornell [University Medical College], that every year some student would come to me and wanted to work and go to Brazil and work on summer projects. They were probably the best students of the class. They're usually very exceptional students. So it hasn't gone away completely. There's still I think people like that. I don't know where they come from. I don't know why they do it.

None of them has had the kind of background that I've had. They're growing up in New York City or, you know, the Midwest someplace. Warren [D.] Johnson [Jr.] is someone who grew up in the Midwest and did his medical school at Columbia [Columbia University College of Physicians and Surgeons] and his residency at Cornell [University Medical College]. He stayed in New York City, and he's the one who started this whole program in Brazil and has a big program in Haiti. He's been doing this for more than twenty years. You know, why? So background has nothing to do with it, I think. I think it's-- You know, you make that choice at some point to do that.

MAESTREJUAN: Okay, so what is it?

RILEY: I don't know. I don't know what it is. [laughs]

MAESTREJUAN: Well, after spending a couple of years in the kind of rote course work that one needs to go through medical school and then going into Thailand and getting clinical experience in the field, how did your attitudes change towards the role of medicine and the individual medical officer or physician with regards to developing countries?

RILEY: You mean--

MAESTREJUAN: What the role of medicine could be, a responsibility--

RILEY: You mean as a practicing physician?

MAESTREJUAN: Yeah, as a practicing physician and the responsibility of medicine in general to kind of the global community?

RILEY: Well, I guess during my three-month elective time in Thailand I think I gradually begun to realize that it's not enough just to be a practicing physician in those settings. In fact, it's not very efficient. The problems are so overwhelming that I guess I began to feel that a

single person is not going to be able to make that much of a difference. You're like a drop in the bucket, in the ocean. So there had to be some other ways, and I had to see that, to come to that recognition, that realization. That's when I really began to feel that you have to look at this from a bigger picture and from a point of view of public health. The negative side of that is that you don't get the immediate, sort of, more direct physician-to-patient interaction. You have to remove yourself from that and then look at the problem that contributes to these individuals becoming ill in a community. It takes a much longer time to identify those factors that contribute to the illnesses, but once you identify these factors, then you can make a big impact. You can influence hundreds of people at once just by identifying a particular risk factor for an illness or coming up with a new way to detect a pathogen very rapidly. But you just don't see the patients individually, so that's a sacrifice you make. If you are seeing individual patients, then maybe you're making a difference in one or two people a day. In your lifetime, how many is that? It's not very many, so--

MAESTREJUAN: And that was a result of your experience?

RILEY: Yeah, my experience in Thailand. I remember one patient that I had was an elderly man. He had chronic obstructive lung disease. Just the difference in I guess the culture-- When you see your patients in San Francisco General Hospital [Medical Center], the attitude of the way people see illness, their own illness, and then their relationship to the practicing physicians is something that I didn't realize until I was in Thailand. So this elderly man, you know, I would see him every morning and would make recommendations for certain medicines that he needed to take. Every morning I would come in and he would not take the medicines. One morning he was dead, but he left a note for me. It was a note apologizing for not taking the drugs, but he just didn't want to do it. You know, it just sort of makes you realize--I don't know-- Why do you have to apologize? But just sort of realize that this kind of patient-physician relationship-- For me it was very difficult. You know, there's nothing I could do to make this person take this medicine in that setting, and that was what kept him alive.

I didn't really encounter those situations over and over. I wanted to do something that would prevent that sort of thing from taking place, you know, to begin with. There are many examples. My rotation in Thailand was the first time I saw somebody dead, you know, a patient. It happened-- Not this man, but even earlier there was a young woman who came into the intensive care unit. You sort of realize how completely different a dead person looks. Because that person was alive the previous day, and I couldn't recognize this person. I guess as a medical student you sort of discover those things, and [I was] going through a discovery period.

But there's a lot of intense moments I think when you have to deal with individuals, even later on. When I was a resident-- No, I was a fellow, actually, at Stanford [University]. After having been at CDC-- When I first started CDC it was 1981. That's when AIDS [acquired immunodeficiency syndrome] cases were becoming recognized, and the term AIDS hadn't even been coined yet. But through the three years at CDC all I heard about AIDS was just numbers, you know, statistics. I never actually saw an AIDS patient until I started my fellowship at

Stanford. One of my first patients that I saw at Stanford who had AIDS was a man who was dying, and he decided he wanted to die at home. So that afternoon when we saw him as I was leaving the room, you know, I didn't know what to say. Do you say, "Good-bye"? "See you later"? You know, you're not going to see him later. I was just completely at a loss to say the appropriate words to leave that room from that patient. Again, these are the kind of things that--

MAESTREJUAN: What did you end up saying?

RILEY: I can't remember. I just-- It was obviously awkward. He died that evening at home. So that's why I wanted to go into public health. [laughs]

MAESTREJUAN: So why was it that you wanted to go into public health? So that you wouldn't have these intense one-to-one physician-patient--?

RILEY: Yeah, those were difficult. At the same time, I didn't think I was being very efficient in being able to--or not efficient, maybe, you know, effective.

MAESTREJUAN: And with this man with this chronic obstructive pulmonary disease, when you reacted to his-- What was the basis of the reaction? Was your responsibility in that you should have seen to it that he takes his medicine? Or that you felt strange that he apologized to you in this note that he didn't take his medicine?

RILEY: It was both.

MAESTREJUAN: Okay.

RILEY: I mean it was a combination of guilt, maybe not having pushed enough, but then that was an American thing to do. I didn't know what a Thai physician would have done in that setting. And then just getting this note-- It was attached to a little flower, and it was given to me by a family member. Yeah, I didn't know how to react to it.

MAESTREJUAN: Did your background in philosophy, in Eastern philosophy--

RILEY: [laughs] No.

MAESTREJUAN: --provide any--?

RILEY: No, nothing. [laughs]

MAESTREJUAN: Okay. So in terms of your philosophical background, you weren't any better prepared than your medical interns?

RILEY: No, no. [laughs]

MAESTREJUAN: Okay. You brought up AIDS, and I wanted to ask-- In going to medical school in San Francisco in the late seventies in community health, was there any sense at that time that something larger was going on in the community?

RILEY: No, there was no idea. In terms of AIDS?

MAESTREJUAN: In terms of AIDS--that anybody was making any observations?

RILEY: No, no nothing. I didn't learn about that towards even my senior year in my residency, third year in residency. It was one of those cases [pneumocystis] in Los Angeles that got reported. So, yeah, there was no idea.

MAESTREJUAN: Then how did you decide on your clinical specialty and where you would do your intern and residency?

RILEY: Well, I wanted to be in New York City and close to my girlfriend. [laughs] In New York City the only place I applied to was Columbia. Oh, I applied to-- No. No, I didn't apply to Einstein [Albert Einstein College of Medicine of Yeshiva University]. Einstein was a medical school. Yeah, just Columbia. Then I applied to Johns Hopkins [University School of Medicine] and Yale [University School of Medicine]. I got into Columbia.

MAESTREJUAN: Okay. What was your intent in pursuing what you were going to accomplish during your intern and residency?

RILEY: Oh, you know, just finish my internal medicine residency and then--

MAESTREJUAN: Become licensed and a practicing clinician or--?

RILEY: No, no, no. Use that as a stepping stone to doing international health, as I mentioned; go to the London School [of Tropical Medicine and Hygiene]. But then towards the end of my internship I learned about the CDC program. There was a good friend of mine, very close friend, a friend that became a close friend in my class of internship, Jeff Harris. He was much more informed about the CDC. So we talked, and then we both applied. We both got into the same branch of CDC. So, you know, he and I reinforced each other to go to CDC. So that was the plan. It was either that or an infectious disease fellowship afterwards. I had all the applications sort of completed, ready to go out in case I didn't get into CDC, but when I heard I just threw them out. That's probably the best decision I've made in my life, to go to CDC.

MAESTREJUAN: Really? And why was that?

RILEY: No, it just sort of affirmed everything I wanted to do, you know, going back to what I was saying earlier about trying to incorporate all my previous training and putting that together at CDC and being able to really do what I wanted to do. The people there, too, or at least in my class, were also people with very similar-- People who go to CDC are people who don't know what to do with their life. So they go there for a few years and sort of discover what they want to do.

MAESTREJUAN: Would that apply to you? You didn't know what you wanted to do with your life?

RILEY: In the long term, yeah, I didn't know what I wanted to do. So there were many people in my class who did the IRC [International Rescue Committee] in Thailand, working in the refugee camps, and others who did other things and others who were like me, just straight out of their residency. So it was a really nice group. At the same time you learn how to do epidemiology. I was in the enteric diseases branch. Should I start talking about CDC now?

MAESTREJUAN: Sure, sure. Well, I have one question I wanted to ask before we move on. How did you perceive the differences between, say, practicing medicine in Thailand in a developing country versus your internship and residency in an urban center like New York City and the kinds of diseases that you would find, the differences between the two?

RILEY: Working in New York City, it was a real eye-opener for me, I guess, even more than the San Francisco General Hospital. But you know they're-- San Francisco General is an inner-city county hospital, so you saw the kinds of things you'd see in a county hospital: a lot of drug-related or violence-related cases coming into the emergency room. My very first rotation at Columbia was in the emergency room, and it was in the summer, so we saw all kinds of things coming in. It was much more intense than it was in San Francisco General Hospital. You sort of learn about different types of patients. At Columbia, like many places, many large teaching hospitals, you have, sort of, the private side, where you see people from one segment of society with very different sorts of diseases, and then the other side, which are the inner-city populations. Most of the time you spend taking care of the latter group, and that's when you learn. You sort of learn medicine by taking care of the indigent population. That's where most of the learning takes place. That was very similar to what I experienced in Thailand. You learn by taking care of people who are not able to provide for themselves in terms of their health care. So there were some similarities, but then the intensity was really—

You know, what you'll see as a resident, it was very frustrating. A lot of things you see are more lifestyle-oriented things. You see things because of overabundance, whereas in Thailand you see things because of lack of resources, lack of food. Whereas even in the inner cities in the U.S. you see diseases because of overeating, obesity-related diabetes, hypertension. Those are all overeating related or over smoking or over drinking. Those are all lifestyle-related things. Eighty percent of the things you see are things related to overabundance, availability of these things. You learn a lot, but you also get turned off by the whole thing, especially having worked in Thailand, where you see diseases but they're for different reasons. So that's when I became interested more and more in infectious diseases. With infectious diseases, at least, it's not your fault. [laughs] I mean, nature does that to you. So, yeah, I got more and more turned off by certain subspecialties.

MAESTREJUAN: Were you making these observations that there were these new epidemics like AIDS but also a resurgence of things we thought we had under control like tuberculosis?

RILEY: Well, actually TB was at its lowest during the whole period of my residency. In fact, in 1981 New York city had the lowest incidence of TB in history, so that's when I finished my residency.

MAESTREJUAN: And so it wasn't--

RILEY: Yeah, it wasn't coming up at the time. It was after I had left that TB really started taking off in New York.

MAESTREJUAN: And going to the CDC, was this a specialized program, a defined period

kind of program?

RILEY: Right, it was called Epidemic Intelligence Service [EIS]. They take in maybe fifty to sixty people each year for a two-year program where they go through sort of on-the-job training in epidemiology and doing outbreak investigations. There are many branches. Mine was in enterics, but there are also noninfectious disease branches, a reproductive health branch. There's an international health program office which dealt more with programs, you know, evaluation of health programs abroad. There was a parasitology branch that dealt with tropical diseases. When I was going through the initial application process, I became more drawn towards enteric diseases because of the opportunity for outbreak investigations, and that's what I wanted to do. Even though I was interested in international health, the problem with that particular branch was that you end up going abroad for program evaluations. So you didn't have an opportunity to really learn the didactics of epidemiology. I wanted to learn the didactics and practical epidemiology, so I ended up in enterics.

MAESTREJUAN: And you could choose, then, the branch that you wanted to do?

RILEY: You go through a matching procedure. So what you do is in April there's a week--it's called an EIS week—where the second year people present their work. Then at the end of that week, Saturday and Sunday, you go through these intense fifteen-minute interviews with all these people in the branches that you are interested in possibly applying to. Then on Monday they do a match. So the branch makes a list of their choices, and you make a list of your choices and you match. So I matched the one that I wanted to get into.

MAESTREJUAN: Was there any other branch that you wanted to get into?

RILEY: Parasitology was my second choice, and then the international health care program office was my third, I think. You also had an opportunity to go to the States, work in the state health departments. Some people did that, either that or stay in Atlanta. It's a two-year program, but at that time they also started this thing called the preventive medicine residency program, so you had an option to stay the third year to get board eligible for that. I did that, so I was there for three years.

MAESTREJUAN: And what kind of program was it in terms of clinical experience?

RILEY: No, it's all epidemiology, a lot of fieldwork. I mean, I can give you an example of what I did. The first month you go through this three-week course, just a little intense course on epidemiology, biostatistics. It was a lot of fun because they actually use real outbreak

investigations, investigations that have been done to teach as opposed to the kind of things I learned at medical school. Then you sort of wait and you get assigned particular ongoing tasks in the branch.

I became responsible for the *Salmonella* surveillance for the U.S. You go through these surveillance forms and look to see if there are any outbreaks going on. I think it was August when I got sent on my first outbreak in Philadelphia, at [Wills] Eye Hospital, salmonellosis. You go with a second-year student and investigate where the source is, where the source of the outbreak was. We found the source. And you do a case control study. You learn how to do a case control study, how to collect specimens for lab processing. So it's really on-the-job training. It's like being in the emergency room except that you're in an outbreak setting. We found that it was associated with precooked roast beef. So we had to go to this food processing center in downtown Philadelphia, and we had to recall the meat, make arrangements for the meat to be recalled. So you really learn about public health and about how the USDA [United States Department of Agriculture] works and, you know, how the USDA doesn't work sometimes.

What was interesting at that time was that there was a person named Mitch [Mitchell L.] Cohen who had just returned from Seattle. He was previously at CDC, and then he went to do his fellowship training with Stan [Stanley] Falkow, who was in Seattle at the time. He came back, and he introduced a lot of these molecular techniques to do epidemiology. So he was the first one to sort of bring in the technology of fingerprinting enteric pathogens like *Salmonella*, and we were like the first EIS officers to really start playing with that. So I was actually-- That's when I first started working in the lab. I would go down to the basement and extract the plasmids from *Salmonella* strains and do electrophoresis analysis and then look at the patterns.

When this outbreak happened, one of the questions that came up was, okay, this precooked roast beef was all over the community in New Jersey and in Pennsylvania, and there were a lot of *Salmonella*-- The serotype was *Salmonella newport*. So the question that came up was-- Okay, we knew what the vehicle was. We knew what caused the outbreak in these specific settings, like the hospital, and there was another in a wedding in New Jersey, but there were a lot of sporadic cases of salmonellosis, sporadic cases of *Salmonella newport*. Now, how many of those cases were really due to the precooked roast beef? That question really couldn't be answered by traditional epidemiological methods, even traditional laboratory methods. So we applied the molecular technique, and it turns out 45 percent of all these sporadic cases had the same pattern as the pattern that we saw from the *Salmonella newport* isolate from the meat. So we were able to say for the first time ever that during this period, July through September 1981, 45 percent of salmonellosis due to *Salmonella newport* in these two states was due to precooked roast beef.

What was even more interesting was that even after we recalled the meat, there were still some cases occurring in the community with this identical plasmid profile infection. So what was going on when the meat had already been--? It turns out that the cases who had these after the recall were siblings of the ones who got sick earlier. So, here again, we were able to, for the first time, show the dynamics of transmissions for this organism. It gets introduced into a

community by a food product, but it gets sustained by person-to-person transmission. So there's two modes of infection going on here, two mechanisms.

This was really the first time when this new technique produced a completely new concept of how a disease is transmitted in a community setting. It's very easy to identify a source if you have an outbreak, but how do you identify a source in sporadic cases, in cases that are not obviously connected to any outbreak? This was really the first application and example of that. So I got more and more interested in that kind of molecular approach to doing epidemiology.

MAESTREJUAN: How much experience did you have with molecular techniques before you--?

RILEY: Nothing, nothing. That was my first time. I didn't even know how to hold a pipette at that time. [laughs]

MAESTREJUAN: Oh, wow. Okay, so how does one go from knowing absolutely nothing to becoming very proficient in two or three years at molecular techniques?

RILEY: The molecular things that I learned at CDC were very simple, and even CDC at the time was just beginning to do those things. But I had a very good technician who helped me, Kris [Kristin A.] Birkness, who worked with me. I mean, everything I know from that period I learned from her, even just discovering that you're not supposed to put *Salmonella* in the refrigerator. You know, they get killed, [laughs] just real basic stuff. That's essentially all I did in extracting plasmid, running them in gel; that was the extent of my understanding molecular techniques.

That's why I went to Stanford. I wanted to learn more advanced molecular methods. The reason I chose Stanford was because Stan Falkow had already moved from Seattle to Stanford by the time I finished EIS, and so I wanted to do my infectious disease fellowship there, not so much to do the fellowship, but to learn molecular techniques.

MAESTREJUAN: At the time you were at CDC, how aware were you and your colleagues of introducing kind of a new epidemiological paradigm of molecular epidemiology?

RILEY: It was completely new. Nobody else was doing it. We were the ones who were really setting the territory, I mean, the definitions. You know, how do you apply it? Even Mitch Cohen-- He'd introduce the techniques, but nobody knew how powerful it was until we actually applied them in real outbreak settings. That was the discovery, that these things are empirically

determined. You can't just come up with a technique. That's what I tell my students now. You can't just come up with a subtyping technique or straight typing technique. You have to apply it and then see if the technique is useful or not. You don't know *a priori* whether the technique is useful or not until you apply it in some real world setting.

So the second chance that I had to apply this was when I got sent to Brazil my second year, to Sao Paulo, Brazil, which is the largest city in South America. There were all these cases of drug-resistant salmonellosis going on among kids, *Salmonella* meningitis, 90 percent mortality. There were no antibiotics that they could use to treat these kids. There was no way to do anything for these kids once they had the infection. The only way to do something about this was to prevent the infection from occurring in the first place. So how do you do that?

You have to know where the infections were coming from. So we did a case control study, and it turns out about 40 percent of the salmonellosis cases were *Salmonella typhimurium*, this one common serotype. They were all associated with hospitals, but we didn't know if it was the case that the kids were getting the infection in the hospitals or that they came into the hospital for some other reason and then got sent home, and because they received antibiotics in the hospital, they were selecting for drug-resistant *Salmonella* in the community. So you couldn't answer those two possibilities because it's been well established that when you take antibiotics, you are at risk for getting infection with drug-resistant *Salmonella*, and that usually occurs in the community in the U.S. because you select for those. But in Sao Paulo, we didn't know. Were they getting infections in the hospital or were they getting them in the community? That was the problem that we had to solve.

So we applied the molecular techniques and did the fingerprint analysis, and then when you actually look at all these *Salmonella typhimurium* strains by plasmid profiles they clustered in time. Each cluster was associated with a particular hospital in the city, so every particular cluster pattern came from one single hospital. So we were able to say that up to 50 percent of *Salmonella typhimurium* infections in Sao Paulo were coming from specific hospitals in the city. They were able to go to those hospitals and say, "Look, something is going on in the hospital setting and these kids are getting infections in the hospital. You have to do something about it." So we were able to make a very specific recommendation based on the molecular information. If you can reduce the problem by 50 percent, you know, that was better than anything that anybody could come up with.

So this is what I mean. I didn't see the individual kids who were getting the salmonellosis, but after a long period of time we were able to make a very specific recommendation that was going to make a real difference to a lot of kids. So that was sort of the second really powerful example of how this new technology could contribute to public health problems. And there are many other things that we have done since then.

MAESTREJUAN: What was your statistical expertise?

RILEY: Well, you learn during the whole two years. There was a very good statistical backup, and whenever you had questions you just go up to them and you learn. I mean, you learn the basic things, and those stay with you. When it comes to more advanced things, you at least learn where to go for help. These days there are so many computer programs that you can use. If you go through the EIS, you know what sort of programs you need, and [you] do it yourself or talk to somebody. You know, even in Berkeley there's a lot of people here who can help you. But it's a real skill that you develop in addition to just the lab skills stuff, being able to design case control studies and study designs and manipulate data and data management. That's essentially the training of the EIS.

But my claim to fame in the EIS was the identification of this *E. coli 0157:H7*. That was my second outbreak investigation that I did. It was in Oregon, this bloody diarrhea case. Nobody knew what was going on, and I spent about a month investigating in this little tiny town in southern Oregon. We didn't know after the first outbreak what the cause was, but we knew that it was associated with eating hamburgers at a fast food restaurant there. Then two months later, three months later, the same outbreak occurs in Michigan. The second time we are able to get to the lot of meat that was implicated in the outbreak and we were able to isolate this *E. coli* from the meat. So that was sort of the smoking gun, and we were able to say for the first time that this particular serotype of *E. coli* was the cause of hemorrhagic colitis. Now you hear it all over the country. It's really--

MAESTREJUAN: Big Mac attack.

RILEY: Yeah, Big Mac attack or at Jack in the Box they had-- Well, apple juice from Odwalla [Inc.] last year. The big recall of the meat just a couple of months ago. So it's becoming a major pathogen, an emerging pathogen, but I did the very first outbreak ever seen on that one. It was a very interesting time because just the process of going through identifying a new pathogen for a new disease entity, you know-- It was very exciting.

MAESTREJUAN: How aware were you before you came up with your results that this would be your claim to fame? What was your hypothesis as to--?

RILEY: You know, it wasn't just me. I mean, I did the investigation, but the laboratory people really had to work hard to isolate the *E. coli*.

MAESTREJUAN: I mean, what were you thinking--? What did you think was going on before?

RILEY: No, when I was first sent to the outbreak, we had no idea that this was even an

infectious disease process. It could have been some sort of chemical toxin. It could have been anything. It wasn't until we started doing the fieldwork-- I was helped by Steve [Steven D.] Helgerson, who was from the Oregon health department, or Washington. He came down. We did several case control studies. And we narrowed it down to this one food establishment, McDonald's [Restaurant], but we couldn't really initially narrow it down to a particular food item. We didn't know if it was the bread or the onions or the little sauce they put on or the hamburger meat itself. So when I went back to CDC with all the specimens and stool samples--

You know, we had the *E. coli 0157*, but we didn't believe it at that time that *E. coli* could cause this kind of disease. Because at that time there were only three classes of *E. coli* associated with diarrhea: *enterotoxigenic E. coli*, *enteroinvasive E. coli*, and enteropathogenic *E. coli*. Only *enteroinvasive E. coli* caused bloody diarrhea, but not this kind of bloody diarrhea. *Enteroinvasive E. coli* also caused fever, and in this particular bloody diarrhea, fever was minimal or nonexistent. It was just-- It didn't fit anything, and we just couldn't believe that *E. coli* could do this. So we sort of kept that in the background.

When the same serotype was identified in the Michigan outbreak, then we became really suspicious because when we looked at the collection of *E. coli* at CDC--you know, that goes back to the forties--there was only one strain of that particular serotype. It was 1975. It was sent to CDC from California in 1975. So I tried to track down this patient from which the *E. coli* was obtained. It turns out she was at the naval center [Alameda Naval Air Station] of the--

MAESTREJUAN: In Monterrey?

RILEY: No, Alameda.

MAESTREJUAN: Oh, okay.

RILEY: Alameda Naval--

MAESTREJUAN: Air base.

RILEY: Yeah, it's a base. She had already retired or something. She was no longer there, but I tried to locate the medical chart. It had already been sent to storage somewhere in Kansas. The Navy has storage someplace in the Midwest. But, you know, about a month later this huge stack of mail arrives at my desk. I open it, and it's the medical chart. I read through the chart, and it describes an illness that was identical to the kind of illness that I saw in Oregon. I said, "This must be the organism, (the cause of the organism.)" There was a young woman who had bloody diarrhea with no fever, and so there were a lot of these things that were beginning to fit together.

When we isolated the same *E. coli* from the meat sample, then we nailed it. But there were still a lot of skeptics at the time that *E. coli* could do this, so I had to design another study, a prospective study. I set up a national surveillance, and I asked all the physicians, mostly gastroenterologists, if they saw bloody diarrhea cases, to culture them for the usual pathogens, but also to send us the *E. coli* that they isolated. It turns out over 30 percent of those *E. colis* that were sent to us were *E. coli 0157:H7*, and at that time that was a rare serotype. To see 30-35 something percent, you know, really was significant. So that was sort of the second evidence that this was the cause of hemorrhagic colitis, and since then there have been so many outbreaks that it was no longer an issue.

But one of the interesting things you discover about science is when you first describe something that's sort of counter to everything else that's been known, there's a lot of reluctance in a lot of well-established scientists to accept those things.

MAESTREJUAN: And why is that?

RILEY: I don't know. I think it's just human nature. You know, I've discovered that many, many times after that, too, in other things that I've done. But just the intensity of disbelief, when I presented the findings in ASM [American Society for Microbiology] or meetings-- People will come up to you and they'll say, you know, in your face, that they don't believe it. Those same people that said those things are now working with the same *E. coli*, [laughs] you know, making their living working on this *E. coli*. It's interesting how this happens, but I think that's true probably with any profession. There's always this kind of an attitude. But it took several months before I was convinced myself that it was *E. coli*. I went through a lot of other hypotheses beforehand. Other organisms were considered but then dropped.

[END OF TAPE 3, SIDE 2]

MAESTREJUAN: There are a few scholars of science, social studies of science, who say the same exact thing, that there is this huge reluctance to overthrow these paradigms of thought. I guess my question to you was, why was it that you were--you more so than somebody else--willing to throw out these old notions of--? "Could this be a new strain of *E. coli* doing this?" What was it about your ideas or your background that allowed you to come up with this new theory or new discovery?

RILEY: Well, you know, it wasn't really a new theory or discovery. It was really just using the traditional epidemiological approach. I found association with this particular pathogen to be the agent of this particular disease. It was just a standard way to-- You know, how do you decide that a particular agent is a causative agent of a particular disease? There are certain criteria that you follow. The most famous example is the Koch's postulate. We can't do a Koch's postulate

in this setting, you know, so what do you do? You do what I call an epidemiological Koch's postulate. You first do a case control study, identify an association-- You know, it's only an association of an illness with a particular organism. So that sort of establishes one hypothesis. Then you have to do a prospective study, a prospectively designed study. If that prospective study confirms or points to the same organism, then I would say that's the proof of the epidemiological Koch's postulate. So that's what I did.

Now, it also-- From a biology point of view then you have to show the mechanism of the production they display when they get infected with this *E. coli*. So those were then the series of studies that got started. It turns out this particular *E. coli* has a phage, a converting phage, which produces a certain type of toxin. But the *E. coli* itself is not that different from another class of *E. coli* associated with diarrhea called enteropathogenic *E. coli*, which I happen to be working on also, which I worked on later. So the combination of this host *E. coli* with this new virus converted it into a completely new pathogen or at least an organism that was capable of causing a completely different type of disease. So there is an explanation, but you couldn't get to that point until the epidemiology was done. The epidemiology helped pinpoint that this is an organism to work with, and now you have to understand what the mechanism is. So there would have been no discoveries made about this converting phage and about the mechanism of the production of diarrhea without the epidemiological work that was done.

It was nothing about my background that helped make that discovery. It was just that I happened to be an EIS officer doing what I was supposed to be doing. I was in the right place at the right time for an unusual outbreak, at least at that time an unusual outbreak. I was very lucky to have had an opportunity to investigate and have the laboratory backup at CDC, which really went through the stool samples to isolate all these organisms. Joy [G.] Wells was the person who really sort of orchestrated the whole laboratory aspect of it. That's what makes CDC so strong, that epidemiology and laboratories are so intimately linked. There are just not very many other institutions like that in the world that can do that.

But you know I'm also-- I mean, later on I came to the realization of the power of epidemiology in understanding pathogenesis, which is the basic research I do now, and that if you just do pathogenesis at the bench side, from the microbiology point of view, you might make some interesting discoveries. But I'm not sure if those discoveries are going to make a big impact.

MAESTREJUAN: I guess to pursue this area of where's the connection between your kind of classical epidemiological experience or expertise and kind of the revolution of molecular biology, where is this connection--? To start off I guess I 'd like to ask, how aware were you of the revolution in molecular biology and keeping up with literature, say, in more of a basic science field? We knew of bacteria-- In terms of coming from a molecular biology perspective, we knew the role of bacteria in creating this revolution and how virology made new techniques possible, but now you' re turning them and looking at bacteria--?

RILEY: Yeah. Well, even when I was at CDC, a lot of things were new, even in the molecular biology field. So certainly when I was at CDC I didn't really keep up with any of the molecular biology literature. I didn't read *Science* and *Nature*, those kind of journals. It really wasn't until my fellowship, you know, that I started getting into it. The fellowship-- I went to Stanford [University] with an idea of just learning molecular techniques to really apply to epidemiology. My plan wasn't to really get very much in depth into the fundamental molecular biology of anything, but I ended up getting hooked by that.

I started working with enteropathogenic *E. coli*, which was a major cause of infantile diarrhea in Brazil. I ended up working in Gary [K.] Schoolnik' s lab. So I actually brought all the EPEC [enteropathogenic *E. coli*] strains with me from CDC to work on this. Gary was working with *enterotoxigenic E. coli*, another *E. coli*, so it was natural for me to work on an *E. coli* project. I was interested in looking at the mechanism of attachment of this *E. coli*. It has a very interesting pattern of attachment with HeLa cells. So we were trying to clone whatever bacterial factors there were that facilitated this association, and the idea being that if we can identify such a factor, then we can maybe develop a new diagnostic test for EPEC so I can take it back to the field in Brazil to identify the-- Because you have to--

Most of these *E. colis* are non-pathogenic, right; they're in the intestines. So how do you distinguish non-pathogenic *E. coli* from a particular type of diarrheagenic *E. coli*? And how do you distinguish enteropathogenic *E. coli* from *enterotoxigenic*, which was also very common in Brazil? Those were the big issues, you know, in epidemiology at that time in *E. coli* diarrheal diseases. So I wanted to clone something that was specific for EPEC and then use that as a molecular diagnostic tool.

Stan [Stanley] Falkow had already identified a way to detect *enterotoxigenic E. coli* by identifying the gene responsible for the LT and ST toxins [heat-labile enterotoxin, heat-stabile enterotoxin]. So Steve [L.] Moseley looked at some strains from Thailand, *enterotoxigenic* strains from Thailand, and they were able to distinguish, by the way it hybridized with this probe that specifically recognized these virulence genes, the so-called heat-labile toxin gene and heat-stabile toxin gene.

Well, we had to have the same kind of tool for EPEC because EPEC was a major cause of mortality in infants in Brazil and other urban centers of developing countries. So I wanted to identify something that was very specific for EPEC, but it became more and more a pathogenesis project as I got more and more into it. And I became more interested in the pathogenesis question more than trying to just come up with a diagnostic tool.

MAESTREJUAN: Did that interest in pathogenesis develop at the CDC or when you were--?

RILEY: No, it was at Stanford. Yeah, it was really at Stanford.

MAESTREJUAN: In terms of the kinds of molecular techniques you were using at the CDC--You know, you have this epidemiological problem, and you have all these techniques that could send epidemiology further along, push the barriers of the current knowledge. How was it that you chose the methods you chose, the RFLP [restriction fragment length polymorphism] techniques? Is it a matter of having this epidemiological problem, you have this case study, and here are all these things and we'll just kind of pick one that works? Or is it the other way around? Were you looking at the intellectual development of molecular biology techniques and saying, "Okay, this is going to work here"? Or did you know what an RFLP was?

RILEY: Sure. No, I mean, we were using it.

MAESTREJUAN: How was this--?

RILEY: Well, no, there are techniques that come up, and somebody at CDC--you know, especially the lab people--were much more on top of those newly introduced techniques. They would actually start applying them themselves for their own pathogens. Then we would learn about those and say, "Can we try that in enteric pathogens?" So we started with plasmid profile and RFLP and phage typing--I guess that had already been there before--and then we'd try and see if they're actually really helpful. Some of the techniques are not helpful, or some of the techniques are just too complicated to be really practical.

My interest was also in the application of these techniques in the field in developing countries. So we had to keep it really simple and doable. And so that was my motivation in trying to look for the appropriate techniques. It's a gradual discovery process in a sort of empirical, trial-and-error manner. But I sort of got away from that when I was at Stanford. I was really heavily getting into pathogenesis.

MAESTREJUAN: Were you aware of PCR [polymerase chain reaction] techniques at the CDC or was--?

RILEY: They didn't have it at the time. That wasn't discovered until I was leaving Stanford in 1988. The technique was earlier, but nobody started really applying it until in the late eighties. So when I left Stanford, we were actually the first ones to do PCR on enteric pathogens. We actually did it by hand, you know, from water bath to water bath at the time.

MAESTREJUAN: Again, what was driving this? Was this to go, "Okay, well, let's see if we can use this new technique, put PCR in our work"?

RILEY: Well, again, it's a gradual discovery process. I think I've been quoted to make the statement that doing PCR in trying to identify enteric pathogens directly from stool samples is like taking a Rolls Royce in a jungle for a safari. You know, it's not an appropriate technique.

See, in epidemiology it's not the rapid diagnosis that's important. With TB [tuberculosis], yes, that's important. But in enterics, you know, the treatment is the same. You either give oral rehydration or antibiotics in invasive diarrhea, and invasive diarrhea you can just tell from the clinical picture--fever, blood, or mucous in the stools. You don't really need a diagnosis. But diagnosis is important for epidemiology if you want to look at risk factors for a particular type of organism, like we did with the *E. coli* or the *Salmonella* in Brazil. We need to know the diagnosis, but that doesn't have to be gotten immediately when the patient is sick. You collect the information over time and then identify a risk factor and then change the factors that contribute.

So we've developed a PCR method for distinguishing *E. coli* pathogens, but it's still-- You know, you just go through the traditional plating first, and overnight you have these colonies. Then you take the colonies into the PCR and identify what those are. I know my friends who have spent their entire fellowship trying to process the stool sample so that you can eliminate all the inhibitors to do the PCR directly from that. That process itself took, you know, like a day, with all kinds of reagents, just to extract the DNA to do the PCR. Whereas with the conventional method, you know, before you go home you take a plate, you swab it, and the next morning you'll see these colonies--very clean. You don't do anything. Then you take the colonies and do the PCR.

So it's knowing what's appropriate for a particular setting, and that came from my epidemiology training. Just because you have molecular technology, that doesn't mean that that's going to replace the conventional method. There are very many appropriate, useful, conventional techniques that could be used for epidemiology in combination with molecular techniques, and then they become very, very powerful. So you pick and choose what's most appropriate for a particular setting and a particular question you have. That's what we try to do. That's what I was saying earlier about how you have to incorporate what you learned in the past to do what you're doing now so that you know what's appropriate. If you just learned molecular biology, I would not have come up with this kind of approach.

It's even more fundamental than that because if you do PCR directly from stool samples, you don't really quantitate. In order for diarrhea to occur-- You know, people have done this work in the forties and fifties. A certain number of organisms are required to produce the clinical picture. You could just be colonized-- You could just be infected, and you may not have an infection. Now, if you have such a sensitive technique like PCR and do a stool sample analysis of PCR directly, then you could come up with a positive result. Does that mean that that organism is causing the disease, or is it because the technique is so sensitive they are just picking it up? That person could be infected with something else and colonized with this organism that the PCR picks up. You can't say for sure by PCR that that's causing the disease you see in that person.

By doing it the way we do it, where you isolate the colonies, you actually sample a certain number of colonies for the PCR. This is exactly what they do for the conventional method-- They take a certain number of colonies and then subject them to the standard biochemical analysis to identify them. So we maintain the same standard that's been already well established to be an associated characteristic for disease production. So we preserve what's already been done for decades and yet make it quicker and cheaper because you don't have to have all these chemical reagents. When we do this in Brazil, we do it right in the field. All we need is a thermocycler and electricity. We did all kinds of things in the field to really understand the epidemiology of *E. coli* diarrhea. So it's a real appropriate transfer of technology, make the technology accessible in settings, you know, where it was just not possible before. You know, these are the kind of revelations you have about molecular techniques.

I have a very good collaboration with a person over at UCSF [University of California, San Francisco], Eva Harris. Did you ever hear of her? You know, she does exactly that. She does the appropriate transfer of technology to this. When I moved out here I just happened to learn about her, and so we have a very good kind of a relationship doing exactly this sort of thing. She's more of a lab person, a Ph.D. lab person, so she develops these techniques. I sort of help to apply them in the field.

There's a lot of interest in this kind of approach in the School of Public Health and other places. People are applying from all over the world, you know, just trying to learn these new approaches to molecular epidemiology.

MAESTREJUAN: So how did you make the transition, the intellectual transition, from being interested in epidemiological questions of how infection is spread, how organisms run their course, to really basic questions of host-cell--?

RILEY: --interaction. Well, when I was doing the EPEC work, I was looking at the way the *E. coli* attached to HeLa cells. So that was sort of the first example of how-- You know, when I became interested in this interaction of the pathogen with the mammalian cell, that was sort of the basis later for my Pew Scholars [in the Biomedical Sciences] application. After Stanford I went to India for two years, so there was a break for two years in India where I wasn't doing any of those things. So, yeah, there was a break for two years, and then I joined the faculty at Cornell [University] and I resumed my EPEC project at that time, and I got that going again.

When I was in India I became interested in TB. Actually, I became interested in TB even at Stanford. I worked one evening a week in the Santa Clara County TB clinic. We actually did a research project looking at multidrug-resistant TB [MDRTB], just an epidemiological study, so you know, risk factor for MDRTB. When I went to India I saw lots of TB, and I became really interested in the question. That's when I became interested in applying the PCR to diagnose TB. Actually, I don't know if you know, but the Indians were one of the first ones to apply PCR for TB because I actually took the DNA of TB that I extracted at CDC before I went to India and gave that to them to develop the PCR. So they did that. When I came back to the

States I was still interested in doing something with TB. I started trying to develop a PCR method for TB, and I entered a collaboration with the New York City Health Department [New York City Department of Health].

But then I became more and more interested in applying what I already had done with EPEC to TB and looking at the mechanism of invasion of TB into cells. I was very lucky, you know. We made a genomic library. You chop up the genes of TB and then put it into *E. coli* and look for an *E. coli* that invaded cells. We found such a thing, and that was the basis for our *Science* paper [S. Arruda et al., 1993. Cloning of a *mycobacterium tuberculosis* DNA fragment associated with HeLa cell entry and survival inside human macrophage. *Science* 261: 1454-57] , the identification of this gene called mce, mycobacterium cell entry gene, and that's blossoming into all kinds of very interesting things now. But that was our first sort of major paper at Cornell, identifying the invasion gene of TB. So I continue to work on the mechanism of this invasion of TB. We're still doing the EPEC project, too, and that's also produced some other interesting twists in the relationship of this *E. coli* with the cells. So those are the two parallel bench projects that we've been doing over the last almost eight years now.

But sometime in, I guess, the third year of my stay at Cornell, we were doing-- We started a surveillance system in New York City using Cornell-affiliated hospitals, where all the hospitals would send to my lab all the TB strains, and we would do genetic fingerprint analysis on them. I don't know if you have that paper [C.R. Friedman et al., 1995. Transmission of multidrug-resistant tuberculosis in a large urban setting. American Journal of Respiratory and Critical Care Medicine 152: 355-59] . Cindy [R.] Friedman is the first author. We were looking at risk factors for so-called clonal strains of TB, and we identified a number of risk factors. Peter [M.] Small in San Francisco did the same sort of thing, and we came up with very similar conclusions. Certain characteristics were associated with being infected with these clonal strains--meaning that they were recently infected TB.

So with TB you can get active disease shortly after an infection or many, many years after an infection. The second type of disease is called reactivation disease. The organism is inside you for many, many years, and then for some reason it reactivates. Whereas the first type is called primary disease, and that's when you get the disease really almost immediately after, then, infection. So clonality tells us whether it's reactivation or primary disease. It's kind of an accepted assumption that a lot of people make now.

So we were able to say for the first time that in HIV [human immunodeficiency virus] infected people, 60 percent of those got disease from recent infection. So it's not reactivation. But if you do the same study in Brazil, 60 percent is actually reactivation disease. This is probably because in Brazil there is much more TB prevalent, so you get infected very early on in life. So they get AIDS later, and then they actually reactivate the infection that they already had. Whereas here it's a new transmission, so the person didn't have the infection to begin with. It's a new infection. But if you get the new infection you develop disease faster because you're immuno suppressed.

Eighty percent of the MDR, the multidrug-resistant TB, in New York City is recent

infection, which was completely unexpected. Which meant that when the organism is transmitted to a new person it's already resistant. See, traditionally it was felt that because you are not taking the drugs properly or because the physicians are not giving the drugs properly, the person who is initially infected with a drug-sensitive strain becomes resistant in the same person. That's not the case in New York City. The organism is already resistant when it goes to a new person, which was very important because it's a totally different approach to intervention if one or the other. So by just having that information, New York City Health Department could make a new policy about intervention, and that's when they started directly observed therapy. I mean, they were doing that regardless of our work, but it justified that kind of approach to intervention.

But anyway, I guess to answer your question, in the process of doing that study we also discovered certain clones to be predominant in New York City. It was very interesting. There's one strain that was called-- We called it C strain. It was a drug-susceptible strain. It was not a drug-resistant strain. We didn't know why it was all over the city. So we did a long-term study and eventually found an association with intravenous drug users. Fifty percent of the TB patients who had this particular strain were intravenous drug users. Then we said, "Why intravenous drug users?" You know, they are not all going to the same place to shoot themselves up. They were all over the city. And there were also non-IV drug users. Fifty percent were obviously non-drug users. And they were all over the city, HIV positive, negatives, women, men, all ethnic groups. So there was no particular pattern except that a large percent were IV drug users.

In the meantime, we were doing parallel studies in the lab of the susceptibility of these strains to all kinds of stress conditions that they might encounter in a macrophage, and one of the conditions is nitric oxide, exposure to nitric oxide. It turns out this particular strain is completely resistant to nitric oxide, whereas all the others were killed. So why the association between nitric oxide resistance and IV drug use? It took us a while to really come up with the hypothesis. We eventually hypothesized that intravenous drug users are constantly injecting themselves with all kinds of antigens, so they are stimulating their macrophages to make low levels of nitric oxide. So if they get infected with TB, they eventually will select for nitric oxide resistant strain.

So it's the host that's making its own drugs that then eventually select for the resistant strains. It's like a natural selection, as opposed to when you take drugs improperly you of course select for a resistant strain. In this case your own body is making the drug because you are an intravenous drug user. So if that resistant strain infects a non-drug user it's more likely to cause active disease faster than other strains that are not resistant. So the primary disease occurrence is much faster or more likely. [tape recorder off] To make a long story short, we found this particular strain to be resistant to nitric oxide, and we went off to clone the gene that made it resistant to nitric oxide. That just came out a couple of months ago in J. Exp. Med. [Ehrt S. Shiloh et al., 1997. A novel antioxidant gene from *M. tuberculosis*. *Journal of Experimental Medicine* 186: 1885-96]. I don't know if you have that paper?

MAESTREJUAN: Yes.

RILEY: This is the first example where we identified a gene that was responsible for its widespread dissemination in a city based on our original epidemiological work. This was sort of the new kind of a trend in my lab to really understand the molecular basis for disease transmission in a community. This is what's really getting to what I call real molecular epidemiology, that we really believe that every pathogen has a molecular basis for its epidemiological behavior. If you think about it, every infectious agent is transmitted by its own unique process, and it has its own unique epidemiology. *Salmonella typhimurium* is only found in mammals, you know, in intestines. It's also associated with food, and it causes diarrhea. Why? TB causes diseases in the lungs, and it's transmitted from lungs by airborne route. HIV, transmitted either by blood products or by sex. Every pathogen has its own unique way of transmitting to other persons.

And, also, communicable agents are there not to cause disease in a single individual host. It's there to sustain itself, you know, to maintain its population in a community of hosts. So its target is not an individual host but the community, and there's a molecular basis for that. If we can find the molecular basis for that then we can really get at the vulnerable aspect of the organism and really control the disease. If you just focus on a single host, you'll just never get at the important genes. It's the genes that contribute to its transmission in the community that really makes a pathogen a true pathogen, and so that's where our research is now leading to.

This example of the nitric oxide resistant gene is something that came from this big epidemiologic project that we did, which is much more satisfying than identifying some interesting gene at the bench and then trying to spend your entire lifetime working on this gene and then saying, "Is this relevant to the real world?"

MAESTREJUAN: Why is that more interesting for you? Because that's how many bench scientists, and I would argue that most Pew scholars that I have interviewed--

RILEY: That's what they do, yeah.

MAESTREJUAN: - -do that. That's the groovy science right now. The sexy science that gets you published in the big journals like *Cell*, *Science*, and *Nature* is to identify this gene and then maybe contemplate its significance later. So why is it you--and you stand out among the Pew scholars--look at it the other way around?

RILEY: The other way around. Yeah. Because you already know from the beginning that this is going to be relevant whatever you discover because you start with epidemiology. You start off with relevant information first and then narrow towards the gene. So for me that's much more

satisfying because you already know ahead of time that it's going to be important instead of waiting years to find out whether it's important or not. I mean, from a basic science point of view it's interesting to work on a particular gene that explains the mechanism, the physiology, or the basic molecular biology. It's very important. You know, I'm not criticizing those things. There are obviously people who should be doing those things, but that's not my background. The people who do those things don't have the background to really be able to say, ultimately, whether that's going to be important for some big picture purpose or not. I mean, that's not what they're doing those things for, anyway. They're really interested in understanding the mechanisms and how that information might eventually become a chapter in a textbook. That is an important goal, to perpetuate knowledge, science information. It's a noble goal, and I'm not criticizing it. But that's not my interest, it just does not happen--

I mean, it is my interest-- You can do the same thing. You can still identify a very interesting gene the way I do it. It may take a longer time to get to that. But you can still then study that gene and the gene product and do everything that the other Pew scholars are doing. So I still get to do the same thing but eat the pie at the same time. [laughs] So it's much more fun. That's why I'm in the School of Public Health as opposed to molecular and cell biology department. I mean, I came here because this is what I wanted to be. You know, it introduces a new discipline--they call it molecular epidemiology--where you get to do pathogenesis work, but at the same time, the pathogenesis work may lead to some new discoveries that are going to have relevance or impact in public health.

I'm doing this because I'm interested in public health, not because, you know, I want to have something put into a textbook someday. One of the favorite or commonly used expressions here when I first came to Berkeley was-- I mean, I go on these search committees and things, and you interview candidates. One of the things that committee members often ask is, "Is the work that this person is doing going to lead to a chapter in a textbook someday?" I hear this so often, and I guess, obviously, for some people these things are very important. But, you know, I don't want that to be just the final goal of the work that I do. If it doesn't end up in a chapter, that's fine with me as long as it makes an impact somewhere out in the real world. That's what I'm interested in.

MAESTREJUAN: And that impact is?

RILEY: Well, coming up with a product that is based on basic science work, such as a new vaccine or new drugs that then can be used, or a new diagnostic test that will make a difference in the world we're working in, in Brazil and other places. [tape recorder off]

You never know where these things lead to. This invasion protein that we cloned, we eventually identified a very short segment, just twenty-two amino acids, that has this invasion activity. So we made a plasmid incorporating the DNA that encodes this peptide sequence, and we made this expression plasmid in such a way that every piece of DNA fragment that we clone will express a fusion protein with this twenty-two amino acid at the N-terminus, which means

that any protein with this at the N-terminus will go into cells.

So we started a new project to develop a *Salmonella* vaccine. I don't know if you know, but *Salmonella enteritidis*, which is one of the serotypes of *Salmonella*, is the most important cause of salmonellosis in the U.S. You know, very high morbidity and even deaths occur. And 80 percent of the infections probably come from chickens, poultry products. So we want to make a vaccine to be given to chickens to interrupt the transmission from chickens to humans. So how do you administer a vaccine to chickens? Well, you can't give it by injection to every chicken. It would just be economically unfeasible. You have to put it into the feed. If you put it into the feed, then it has to be absorbed orally. We're going to make a chicken vaccine with these proteins that will have this peptide sequence at the N-terminus, so when you put it into the chicken feed then it will be absorbed, be taken up into the cells, and then maybe elicit a cell-mediated immune response or whatever immune response you may elicit. So instead of testing one protein at a time, this gives us an opportunity to test the entire genome of an organism. You chop up the genome into all these fragments and express every possible protein that *Salmonella* can make and then just pack them together, put them into the chicken feed, divide them up into subsets and then identify which subset protects and then keep narrowing it down until you come up with a set that's most protective. This way you can screen the entire genome of an organism to come up with a right set of protective proteins so that you don't have to spend several years of your life trying to see if one protein that you happen to have is going to be protective or not.

So this was a completely unexpected, unplanned application of a discovery made about working with TB. This is what's fun about science, but this is also what I mean by being able to study the genetics, the sort of mechanisms, to understand these things and then, again, transfer that to an application. For me that's a lot more fun than crystallizing a protein to see how its conformation relates to some mechanism in an intercellular process. That is intellectually interesting too for me, of course, but there's something else that's even more interesting than that for me. So that's why I do it the way I do.

MAESTREJUAN: Okay, and one last question and then I think we can stop for today. So in your view what is the better means to the scientific end?

RILEY: Oh, I don't think there's any better means. I mean, I think they're all different means. I think you should certainly do different means to get to the scientific question at hand. Certainly the more traditional approach is much more efficient because you're really focused on those issues and spending all your time doing that. My method is a little more sort of a round-about way to get to the same point. It takes a longer time, but when you get to the point you can go back to why you did this thing in the first place much more quickly. So, yeah, I think both approaches are necessary because you never know what you end up getting. But I just feel that I have to justify all of my previous training, so that's why I do it the way I do it.

MAESTREJUAN: I think we're at a good place to stop.

RILEY: Okay.

[END OF TAPE 4, SIDE 1]

[END OF INTERVIEW]

INTERVIEWEE: **Lee W. Riley**

INTERVIEWER: **Andrea R. Maestrejuan**

LOCATION: **University of California, Berkeley**
Berkeley, California

DATE: **31 December 1997**

MAESTREJUAN: It is December 31, 1997, and happy New Year to you. I'm with Lee Riley in his office at UC [University of California] Berkeley for his Pew Scholars [in the Biomedical Sciences] oral history interview. I don't have too many follow-up questions. This is basically a continuation of where we left off yesterday. Listening back over the tapes last night I was really struck by your progression of going from a trained clinician to a bench scientist. Most Pew scholars have this notion of being a bench scientist from very early on, and they develop their research programs as a graduate student and then continue as a postdoc [postdoctoral fellow] either learning new molecular techniques or refining the program that they started. And that's what they continue to do. It seems to me that you had started with a basic clinical background, and as your work has progressed, you've had to not only adopt and learn the techniques used but also the knowledge base of cell physiology, bacterial cell physiology, host cell physiology, biochemistry, genetics. How does one amass that amount of information and synthesize that amount of information, or is it more simple than it seems?

RILEY: Well, I think time is definitely a factor. I've been doing this now for almost-- If you include my fellowship years, it's been about fourteen years. That's when all of the basic--the molecular biology knowledge pursuit, I guess, got started. So my approach is that when I do certain-- There are certain things that I want to do, that I feel I have to accomplish in terms of my research questions, which are still really focused on public health, but I don't want to do just conventional public health. So to get to the final goal I sort of try to identify what I need to learn, what sort of skills I need to develop. I came to the realization that I really do have to know molecular biology and biochemistry and cell biology to really get to the point where I want to get to. So I guess my accumulation of these types of knowledge is more focused. I don't look at all aspects of molecular biology or all aspects of biochemistry. I just pick and choose what I think I need to accomplish, what I want to accomplish. So it was a little more streamlined in terms of my accumulation of knowledge in those areas.

I don't have the in-depth knowledge that I think many of the other more traditional sort of bench scientists may have. So I would always have to go up and look up, you know, some basic stuff. But I am able to accomplish what I need to accomplish at least by picking and choosing from the knowledge base. So that may have helped to accelerate this whole process and be able to do it the way I've done it.

I still feel-- When I go to the Pew [Scholars in the Biomedical Sciences annual] meetings I don't feel as secure in my basic science knowledge base as maybe some of the Ph.D.'s can do. But what's nice is that I can really understand the presentations that these other Pew scholars make in these meetings. It was interesting, because I remember the very first meeting I went to I was totally lost in most of the presentations, you know, the zebra fish and neural development stuff. But by the second, third meeting, the fourth meeting, I was able to actually follow them, and so then I was also very interested in those things. I became interested in those things. And then, also, you recognize that no matter what discipline of so-called biomedical science that you're involved in, there's always some knowledge that you can grab from what other people are doing to the work that you are doing. There were some presentations I think by people working on cell signal transduction in cancer which turned out to have relevance to what I'm doing with my *E. coli* work in terms of the way the *E. coli* triggers cell signal transduction in mammalian cells and how calcium flux is affected by this interaction. Apparently this is a big field in cancer. So one of the Pew scholars presented his work on that, and then I talked to him about that. I guess that's at least a recognition that I've learned something in these fields and that I can do it. But as you can see, the only reason I was captured by that is because I'm doing exactly that with *E. coli*. So now I can focus on that and look at that in more depth, what's going on in the cancer field, just that aspect of calcium flux in mammalian cells, and that would be immediately relevant to what I'm doing in my research field.

But it's a lot of work. I spend a lot of time doing a variety of things. That's only one aspect of what I do. I have this entire set of field projects going on abroad that I also have to take care of and run. So I'm here every weekend and late into the evening [laughs] so that I could just do all these things.

MAESTREJUAN: Okay. We'll get back to spending your life here in the lab and then the field when you have a wife and children. But to go on a little bit more about this in terms of-- Well, I guess let me ask first that-- Many historians or scholars of science argue that one of the hallmarks of twentieth-century science, be it quantum physics or molecular biology, is that it has grown increasingly distant from any kind of popular understanding, that a lay person couldn't pick up a textbook and read and understand and inherently make sense of these questions that are being asked in papers. Given your own background, in that it seems to me that much of your accumulation of knowledge has been self-taught, how do you see this issue of, "This is an insiders' world, and only people that serve an apprenticeship from their college years on can understand this information," versus "We can strive towards a more popular understanding or attempt to make what we do or scientists do understandable to the lay public"?

RILEY: Well, I guess the first question that I have is, is it important that science be better understood by the lay public, especially the way that science is going now? Why is it that the lay public has to really understand that? I have sort of mixed feelings about that, the answer to that question. I remember when I was growing up I used to read books by Isaac Asimov, you know, *The ABC of Relativity*. There's no spokesman like that right now for molecular biology or quantum physics who can really sort of explain these scientists in the way Isaac Asimov or

people like that have been able to do. I mean, I was really elated when I could understand relativity in the way Asimov explained it. So I think that's one sort of deficiency right now that we have. We don't have someone who can really translate these things in lay terms in a very amusing or enjoyable way. So I think a lot of the kids are not exposed to this as well as they could be. So to answer my first question, I think, yeah, it is important that these things be translated to get young people excited about science. I think I told you yesterday, I was interested in physics, and I think those kind of books that I read early on really influenced my interest in going into physics and sort of theoretical physics and that sort of thing.

In terms of a more practical, I guess, need for the lay public to understand this, yeah, I think if this kind of knowledge could be better understood by the public, maybe that would enhance your funding opportunities by having public support for funding for research. If the lay public could really understand what their tax dollars are being used for, maybe there would be more support from the public. I think that by making it obscure to the lay public, it's going to make it difficult to get the public support to do this kind of work. So that maybe is another sort of rationale at least to satisfy the need to make science understandable for the public. That doesn't answer your question directly, but I think that we have to first answer the need for doing this.

Once that's recognized, I guess to answer your question-- I think that's true with anything right now because the information, the field, is just exploding, and to really translate this whole mass accumulation of information to the lay public in a really understandable way is much more complex than I think it used to be. So you need some sort of spokesman. I think some of these science writers in newspapers are beginning to fill that type of role. There are also these popular books that are coming out, but they're more sensationalism, kind of. They're not really trying to explain the science. They're more sort of a-- Although there are some really good science writers that I think do a really good job in explaining what's going on to the public.

There's also, I think, a problem--not a problem--but there's also a change in the way information is disseminated now. When we were growing up it was usually books, but now you have all these other media of communicating information. We talk about newspapers. Where there's really good science writing, you know, that really reaches out to a limited audience. It doesn't go into real mass circulation. So I guess because of these changes in dissemination, the modes of dissemination of knowledge, there's also still a limited, I think, dissemination of the knowledge. If you are going to have access through the Internet to information, you have to have a computer, and again, that limits it to a certain group of people. The way that information is communicated by television is just a very small segment of information. Unless you are really into programs that are shown on PBS [Public Broadcasting Service] or Discovery Channel, things of that sort, you don't really get the detailed information. But I think the opportunities exist, for the same reasons, because there are so many ways of communicating the information that--

MAESTREJUAN: What is it about your work that makes it obscure? Is it inherently obscure? Is molecular biology inherently obscure?

RILEY: I don't think it's inherently obscure. I think it's just complex. To understand the information that-- For instance, what we currently have is based on a lot of other background information, and so to understand what's going on now you have to understand other steps that came to this process. I think that's what makes it complicated. But the final knowledge itself is not that obscure. It's just that you have to have the background information to sort of really understand it. It's the complexity, so if you can break down the complexity into individual parts then I think people can understand it better.

Even the concept of PCR [polymerase chain reaction]-- That is a good example because PCR is a very simple technique, very elegant, simple technique, but to really understand it you have to have knowledge about how polymerase works, even what a DNA is, how DNA is affected by temperature in terms of its association with the two strands. You know, that's not typical high school knowledge. I mean, maybe in an advanced high school biology [class] you might get that kind of information, but it takes a certain level of education, I guess, and understanding of the background.

There are people making attempts to sort of simplify or demystify these new technologies. I told you about Eva Harris the other day, who is writing a book on making PCR technology accessible so that it could be used in developing countries, it could be used in high schools here, and trying to really make the technology more understandable--why you do certain things and why we use certain reagents. So I think it's just beginning to happen. It hasn't quite happened yet, but somebody has to take the effort to make things less obscure.

MAESTREJUAN: In terms of your own professionalization and having your work accepted by different audiences, going from, say, a CDC [Center for Disease Control] bureaucrat to somebody publishing in *Science* and the Journal of Experimental [Medicine], kind of the core, basic science journals, how was your reception to an increasingly more basic audience as your work progressed?

RILEY: I think people think there are two Lee Rileys. [laughter]

Yeah, people ask me if I am the same Riley that did the original *E. coli* work and then published the thing on TB in *Science*. I deal with two different groups anyway, so those two groups haven't really themselves merged. There are a few who are doing those things, too, but it hasn't been an issue. I present my basic science work to the basic scientists, the Pew group I present my *E. coli* work. But for the public health, the epidemiology group, I present my epidemiology work, and they recognize me for that work.

There's a paper [C.R. Friedman et al., 1995. Transmission of multidrug-resistant tuberculosis in a large urban setting. American Journal of Respiratory and Critical Care Medicine 152:355-59] that I did that tries to fuse the two, which is the one where we looked at

the C strain from New York City and then found that this was resistant to nitric oxide. There I was trying to bridge the two together. So that paper plus the J. Ex. Med. paper [S. Ehrt et al., 1997. A novel antioxidant gene from *mycobacterium tuberculosis*. *Journal of Experimental Medicine* 186:1885-96] really are sort of the two seminal papers that show that these two things have to be linked. I'm just hoping that this approach can be recognized by both groups. I think there is some appreciation of that approach by members of both groups.

Traditionally, people thought that pathogenesis work had to be done at the bench, but there are big people beginning to realize how important epidemiology is for pathogenesis. In fact, I get postdoc applicants because of that approach. That's what they want to do. This is the way they want to approach pathogenesis questions. Then people who want to go into epidemiology who also want to learn the basic laboratory techniques so that they can apply the techniques to really get further into understanding the epidemiology of infectious diseases-- I get a lot of postdoc applicants because they want to do that. So the discipline is finally beginning to be recognized, and this is what I wanted to do. This is what I came to the School of Public Health for--to really force that discipline as a new discipline. So it's beginning to happen, but there are just not very many people doing that yet.

But I don't know. There's also the risk of being labeled as a dilettante, you know, that I'm doing too many different things, not doing anything in depth. But I think the work will speak for itself, hopefully.

MAESTREJUAN: And what are the advantages and disadvantages of being considered a dilettante?

RILEY: Well, yeah, you may not be taken seriously when you publish something until this is something that other people can reproduce or other people see as being important. I don't know if there's any advantage of being called a dilettante, but the disadvantage is the potential for having your work not being taken seriously. It hasn't happened yet.

MAESTREJUAN: How does one establish the necessary "credentials," quote, unquote, and the necessary context to be invited to the right conferences, to have the inside track when your articles or papers are being reviewed at the top-tier journals, or your grants are being reviewed by study sections at NIH [National Institutes of Health]?

RILEY: Well, I don't think you have to consciously make those efforts to assure those things. I think it just happens. [tape recorder off] I think you sort of recognize that those things are going on when it starts happening. I've never made any sort of conscious effort to put myself in a situation where my work is recognized. I think it just happens if you get published and if the work is novel enough or important enough. I'm a member of the bacteriology-mycology study section, and obviously to be invited to become a member you have to have some expertise in

some field. I get invited to the major meetings. In fact, the only time I'll go to the meetings is if I get invited.

What's pleasing is when you have multiple kinds of affirmation in different, unrelated sources of your work. So when I got my first grant from NIH on this TB pathogenesis work, it actually-- I was awarded the grant before our *Science* paper came out. So it was done independent of the *Science* paper. The *Science* paper didn't influence the reviewers, and then the *Science* paper came out. So there were two totally independent affirmations of that piece of work, and that's very satisfying. It's real. I mean, you need that kind of reassurance that what you're doing is real. It's not something important just because I think it's important. You're so subjectively involved in your work that, of course, you are going to consider your work to be important, but how is it objectively evaluated? So when something like that happens, then you sort of have an outside confirmation of the importance of the work.

This happens all the time, sometimes maybe not even immediately either, like the discovery that this new *E. coli* is the cause of hemorrhagic colitis. That took several years before it was really recognized as a real thing. Now it's a major public health problem in the U.S., which is kind of an ironical way to have that work recognized as being important; it's a major public health problem. [laughs] You know, if it was recognized the other way around, it would have been okay, too, that the problem was solved. But, no; why it's important now is because it's a major public health problem and that we were the first ones to describe this illness and discover the *E. coli*.

So I guess some people try to make conscious efforts to get themselves into the right situation to be recognized, but I don't feel that that's satisfying when you have to do it that way to get the recognition. If your work speaks for itself and then it gets recognized, that's much more satisfying than playing the game, going to the right meetings, meeting the right people. No, I just don't like to do it that way.

MAESTREJUAN: Okay. You had mentioned just a few minutes before that there's these two groups that you kind of talk to and there's these two Lee Rileys. Clearly, it seems to me that-- And you mentioned going to the Pew annual meetings and not always feeling like listening to these talks; you can understand them, but clearly there's other things you can't understand. How do you see yourself, as an insider or as an outsider to these different groups?

RILEY: Yeah, that's a good question. I still feel a lot more comfortable with the epidemiology group. I feel like-- I mean, I consider myself an epidemiologist more than a molecular biologist. But I do feel comfortable with the pathogenesis people, molecular, bacterial pathogenesis people. I have no discomfort discussing in depth about bacterial pathogenesis work. In fact, that's what I do in the study section. I'm sort of the bacterial pathogenesis expert of the group, one of the bacterial pathogenesis people focused on mycobacterial pathogenesis. So I review those grants, *E. coli* as well.

So I feel very comfortable in the study section, but I think the Pew scholars group is a little different. I think that's even further removed even from the type of people who are in the study section. You know, the study section has enough M.D. representation, and even the Ph.D.'s do work that is more or less clinically related, or at least their basic science may relate to a pathogen of clinical importance. The work itself may have nothing to do with pathogenesis, but it still relates to a pathogen that's of clinical importance. And that comes up in our study section meetings. If someone's working on a signal factor for a nonpathogenic organism, you know, that's not going to be looked upon very favorably no matter how good the science is. But if somebody's working on a signal factor of a very important pathogen, that will be looked upon favorably. So there is that difference. They can be working on the same sort of mechanisms, but one happens to be a pathogen and the other not. Then, of course, the one that's working on the pathogen is going to be better evaluated.

But the Pew group, when you start talking about zebra fish neuronal development and things like that, yeah, I don't feel comfortable with that aspect of molecular biology, but then neither would someone in the same Pew group working on--I don't know--cell signal transduction. You know, that person may not be comfortable talking about people working in neuronal development. What's nice about the Pew group is that people come up to me when it has something to do with clinical questions about the disease that may relate to the work that they're doing. And, in fact, in dinnertime conversation, they'd rather talk about the kind of thing I'm doing than what they're doing because, you know, it's an infectious disease problem. When I was talking about the *E. coli* work-- These meetings are held in Mexico or Costa Rica, places like that, where you can get infected with this *E. coli*, [laughter] so they're asking me if it's okay to eat this or that. I can go into those things, and it's fun.

MAESTREJUAN: And what do you say to them?

RILEY: Yeah, you can get infected. In fact, that's how I presented I think in my last talk. You have to give a talk in the first year and the last year. And I said 15 percent of you in this audience are going to develop some sort of diarrhea before the end of the conference based on what we know about *enterotoxigenic E. coli* in Mexico. So, you know, they liked that.

MAESTREJUAN: Only scientists could like that. "Oh man, this is really cool. I'm going to get diarrhea." Okay. Why do you think you where chosen to be a Pew scholar?

RILEY: I don't know. I submitted my work. I was nominated by Cornell University [Medical College], and so I guess at that level Cornell recognized that that work was interesting enough to nominate me. I was surprised that I was selected in the final group because there's not very many M.D.'s to begin with, and in fact, I'm the first and the only M.D. from Cornell to ever receive the Pew. All others have been Ph.D.'s. I don't know about last year, but I don't think anybody from Cornell got selected. But up until that point, and even after that, it's always been

Ph.D.'s. I'm certainly the only one from the department of medicine that's ever gotten the Pew, and so it was a nice recognition of that work.

I think that also it was the fact that I was very lucky to have actually been in Cornell, because nobody else was doing bacterial pathogenesis. I filled a real big gap there. See, Cornell and Rockefeller [University] have this-- Every institution has a tradition influenced by some big figures, and so they've always been on the cell biology side. If they were doing any infectious disease work at all, it was really cell biology, the host side. So for me it was great because I could go to Cornell and learn and work with these people who were working on the host side of the infection host-parasite relationship, and so I could gain all the knowledge from them, but then contribute to the work that I was doing. So it was a perfect match for me, and yet I was filling a gap that they didn't have. So what I was doing was completely novel to them. It wasn't novel if I went to Stanford [University] or Harvard [University] or some of the other places where they're doing a lot of really good bacterial pathogenesis work, but to Cornell it was new. So maybe that-- I was, again, in the right place at the right time. So it's not just the science, obviously.

MAESTREJUAN: Okay. Well, to talk about the serendipity factor that many Pew scholars talk about, let's go back a little bit and figure out how you ended up at Cornell. We'll bring up these broader issues again, but to go back to the chronology a little bit. I wanted to ask after your tenure at the CDC and getting the clinical specialty the extra year that you did, was it necessary to do a postdoc? Why did--?

RILEY: Oh, why did I decide to do the postdocs?

MAESTREJUAN: Yeah.

RILEY: Well, the main reason was I wanted to learn more molecular biology techniques. No, it wasn't necessary. I mean, I had the option to stay at CDC. They wanted me to stay, actually, but—

Well, one other reason for not staying at CDC was more of a personal reason, family reason. Jesse [Frances Furman], my wife, didn't like Atlanta at all. She was from New York City, and at that time in Atlanta things were still backward. She didn't like Atlanta at all, and so we couldn't stay in Atlanta.

It was either that-- I could have gone to WHO [World Health Organization]. If I had wanted to I could have tried to make the arrangement to do that, but I wanted to learn more molecular biology and do more molecular biology. But even then I wasn't thinking of an academic career. I wanted to be involved in some sort of public health institution, some place to apply these sort of molecular techniques to do this new molecular epidemiology work.

I still wanted to go abroad at that point, too. So as I was leaving CDC, I specifically asked them if anything ever comes up in India let me know, and so they kept in touch with me throughout my fellowship, and whenever something came up, they would send me the information. I think it was in the second year of my fellowship that they announced this new program in India, so I said I was very interested.

But, no. Basically I wanted to go to Stanford to have the opportunity to work with Stan [Stanley] Falkow.

MAESTREJUAN: Right, and which you didn't.

RILEY: Which I didn't because Stan already had all these people on the wait list, and Stan sort of referred me to Gary [K.] Schoolnik, which turned out to be fine because I still got to work with Stan Falkow's group. They were upstairs from us. In fact, I think I learned a lot more from Stan Falkow's group than I did in Gary Schoolnik's lab in terms of just the approaches to pathogenesis and things.

But, of course, I learned a lot from Gary in sort of general approaches to doing science and being a bench scientist. He was very, very generous in providing the opportunities for me to be able to do that because I essentially came with my *E. coli* strains, and I had this idea that I wanted to work with, a project that I wanted to work on. Essentially Gary provided all the facilities for me to be able to do it, and he supported the project itself. And it turned out to be very interesting.

Eventually it led to another *Science* paper, which was done by Gary's group after I had left, but it was based on the *E. coli* that I had brought to Gary's lab. It actually led to somebody else being able to have a real nice piece of work come out. But I didn't think that I would really heavily get into pathogenesis until I really got interested in the process towards the end of my first year in my fellowship.

MAESTREJUAN: What kind of mentor was Schoolnik?

RILEY: He was a very good mentor. He is very knowledgeable, very generous with his time, and also just the resources. I think he was the editor of *JCI* [*Journal of Clinical Investigations*]. He had an opportunity to review many papers and things, so he was able to communicate what was going on in the field to all of us. That was very, very helpful.

He also was interested in international health. We called it geographic medicine, and, in fact, we started the geographic medicine program at Stanford together. I went to Mexico and started this field site for the division, and it continues to operate. Gary eventually became the

chief of the combined geographic medicine and infectious disease division [Stanford University School of Medicine Division of Infectious Diseases and Geographic Medicine]. But we did that together.

I was very impressed when we were just getting started how he used his own personal money to buy all the supplies and the van to work in the field. You know, it was his retirement money he transferred from VA [Veterans Administration Medical Center] to Stanford and he just put that into the project. That's when I really recognized that Gary was really committed to this whole thing. So that's when I really committed myself to really get the field projects going.

We had several papers come out of that work. It was a lot of fun. So even then I was still doing fieldwork in addition to just trying to get the basic science work done. So, yeah, Gary was a very, very supportive--

MAESTREJUAN: Was Falkow's group doing a lot of field- work?

RILEY: No, they were a really basic pathogenesis lab--molecular, bacterial. I think there were people in Falkow's group interested in fieldwork. There was a woman named Pam [Pamela L.C.] Small, who used to be an anthropologist and worked in India for four years before she decided to become a graduate student in microbiology and then eventually became Stan Falkow's fellow. We're still very close friends. She's also in my study section. She was someone who really has this interest, but she's now doing real basic pathogenesis work. So there were a couple of others interested in fieldwork or at least recognized the importance of fieldwork. Stan Falkow himself recognizes the importance of fieldwork. It's just that he's not trained to do that.

His wife, Lucy [S.] Tompkins, is a hospital infectious disease person and applies a lot of the molecular techniques to study hospital infections. In fact, she was probably one of the first ones to apply molecular techniques to doing nosocomial infections and staph [*Staphylococcus*] and methicillin-resistant staph when she was in Seattle. So it was a really good group.

I mean, they're just really great sets of faculty at Stanford that really helped me to crystallize what I wanted to do at least on the molecular biology side. Yeah, there were certain people who really had to be there at the right time for me to have been able to do what I'm doing now. And those include people like Gary Schoolnik, Stan Falkow, Lucy Tompkins. I'm trying to think of others. There was another person, Harry [B.] Greenberg, who was a gastroenterology person and doing rotavirus pathogenesis work. I got to know them really close. We're still friends, and we communicate. And at CDC, too, my chief, Paul [A.] Blake--he's very, very important. And Mitch [Mitchell L.] Cohen, who brought the molecular techniques to CDC of course to get going. Roger [A.] Feldman was another very important mentor. In fact, Roger Feldman and I worked in India together after my fellowship. So those were sort of the big mentors I had.

MAESTREJUAN: And why geographical medicine? Why the name geographical medicine?

RILEY: I don't know why. Gary came up with that name. I was always saying international health. I don't know why he came up with that term. I think there were other universities that already had such programs. Like Tufts [University School of Medicine/New England Medical Center Division of] Geographic Medicine [and Infectious Disease], their program was called geographic medicine. I think there's one in Case Western [Reserve University School of Medicine], too. It's called [Division of] Geographic Medicine. So I think Gary wanted to use the same name. Whereas at Cornell it's called [Division of] International Medicine.

MAESTREJUAN: What is the role of serendipity in making a creative and innovative or risk-taking scientist, a biomedical researcher?

RILEY: What is the serendipity involved?

MAESTREJUAN: Yeah, what is the role of serendipity?

RILEY: Oh, I think there's lots. I mean, I think they're very important. If I didn't go to New York City at the time when TB was rising, I don't think I would have the grant to do the work that I'm doing. I don't think I would have even done the work that I did. I don't think that I would have even come up with this concept that resistance to nitric oxide is a very important pathogenic mechanism for TB. The only reason I was interested in Cornell was because they had field projects in Brazil. It had nothing to do with TB. I wanted to be in New York City, and I was interested in Cornell because they had field projects in Brazil. And Warren [D.] Johnson [Jr.] was a very sincere, interested investigator doing work in Brazil. I had another friend, John [L.] Ho, whom I've known since residency. He also went to CDC. And he'd been pushing me to come to Cornell, and that was the only reason I went to Cornell. It had nothing to do with my interest in pathogenesis. Cornell wasn't even doing pathogenesis. It was the wrong place to be if I wanted to have a critical mass of people to work with.

[END OF TAPE 5, SIDE 1]

RILEY: - -you know, the hemorrhagic colitis outbreak, finding this *E. coli*, why me? You actually rotate when you get sent out on outbreaks. I can't remember how many of us were there. I think there were like five or six of us in that branch. So when this outbreak came up, it was my turn to go. Somebody else could have gone, and that person would have been the one to have made the discovery. But it was my turn so, again, that was serendipity.

One serendipity also influences another, too, I think. There's a series of-- I guess that's true with anything in life. Even the basic science work itself, too--there are these serendipities that influence what takes place next. You know, this invasion protein that we identified--we never thought that it was going to lead to a totally new way of developing vaccines when we discovered it. Why is it that *Salmonella enteritidis* happens to be the most important serotype of *Salmonella* food-borne disease right now in the U.S.? Because that's the perfect bug to apply this technology to. It just happens that the transmission occurs from chickens to humans, and we wanted to develop a vaccine for chickens.

Even now, as we talk about this, you have this influenza thing going on in chickens in China. I just suddenly thought of applying this technology to influenza in chickens. I mean, this is a totally new approach to preventing the problem of influenza because if indeed humans get infections from chickens or from domesticated animals in China, these vaccines could be applied to all kinds of animals.

MAESTREJUAN: Are you undaunted by jumping into such a fray?

RILEY: No, because it's connected to what I'm already doing. The nice thing about moving to a new institution is that you have an opportunity to move into a new field, because you're really provided with the resources to be able to do that initially, and you have a certain flexibility. It's also just temporarily a new opportunity to get into new areas because you've switched the institution. It's kind of an excuse to get into new areas as well as being at a new institution. And vaccine is something that I've always been interested in. In fact, it's quite relevant to the School of Public Health. It's the one most important prevention modality that you can develop, but you need technology, you need basic science to be able to do that.

We have that knowledge base. We already have in my lab enough knowledge base to be able to develop vaccines, and we also have enough knowledge base in the field to apply the vaccines that we develop. So we have everything to be able to do it, and we have the resources, the School of Public Health, the epidemiologists, much more sophisticated epidemiologists, who can really help us with the study designs in the field. We can offer our field sites to be able to do these things. So everything is here to be able to do those things, but very often what happens is if you have the epidemiology resources, you don't have the people to do the technology work. If you have the technology work, you don't have enough knowledge base to be able to apply it anywhere. You don't have a field site.

So, no, it's not that difficult for me to apply this immediately to do something--influenza in China. Of course, I have to collaborate with people. I mean, I can't do that myself. I don't have enough people in my lab to just really get into that. Certainly if somebody's doing influenza virus work, we just communicate, you know, say, "I have this plasmid. Would you like to make an expression library of proteins with this plasmid and then study it in chickens?" So that can be done. We already have a collaboration with another virologist [Fenyong Lu] here

to try to develop CMV [cytomegalovirus] vaccines and herpes virus vaccines, and so it just sort of blossoms. Again, these are all serendipitous. I didn't think of it ahead of time to do this.

MAESTREJUAN: Well, I was in Europe when the BSE [bovine spongiform encephalopathy] situation exploded, and it came at a very critical political time for the European countries. We debated it at a university that I was at that had a biotech program, and I do the history of science. It was covered in the newspapers. And it became very clear, to me at least, that it wasn't just about BSE and this disease. It was about politicians, and it was about economics, and it was about farmers, and it was about international diplomacy. It wasn't just about science. So what is the role--?

Being in such a highly conspicuous position, whether it's because you do research on a vector that has caused the death of children because they just happen to eat at Jack in the Box-- It seems to me that this influenza virus is going the same way as BSE. We don't really know what's going on. This morning in the news they showed pictures of the Hong Kong people, the Chinese, flocking to temples to pray for the souls of the chickens because if they don't release their spirits, then more plagues are going to inflict themselves upon Hong Kong. So what's the role of science and the scientist in these epidemics versus, say, the role of politics and international diplomacy? How do you keep all these things separate? Or can you? Am I seeing it wrong? Is it unnecessary to keep these things separate?

RILEY: Yeah, I don't know. There are many levels I think you can sort of address this. As a bench scientist—Bench scientists concerned enough or knowledgeable enough about the public health implication of these things may try to do something at the bench that would try to minimize this problem. So you attack it from a scientific point of view. But if you are an epidemiologist working in a public health department-- I was just talking to my friend [Steve Waterman] who is a state epidemiologist here. He's dealing with this obviously, and he's anticipating the potential introduction of this influenza virus from Asia. He has to deal with this and deal with the potentials. He was at CDC with me and trained as an EIS [Epidemic Intelligence Service] person. He's a physician, so he has a different way of dealing with this. And then at the level of the CDC they have another level of dealing with it, and WHO is another level. So I think it really depends on what you are doing.

I don't feel that I have to make any publicity about the economic or political implications of this. That's not my role. I don't know enough about the politics or even the economics to be able to say anything or comment. But from a public health point of view, at least I have some idea of how one might be able to prevent this from getting even worse in terms of the potential for an epidemic to occur. And I have some ideas about how to prevent this in the future, sort of long-term plans, which will have an economic impact as well. I think there would be certainly an economic interest on the part of many groups to have a technology to prevent this sort of thing from occurring. But I don't know what the role of the scientist should be. Unless that scientist is really knowledgeable, I don't think it's the place of a scientist to really make comments. There are scientists who are really in touch with the politics and the economic issues,

and those people, by all means, if they can be a spokesman, they should be spokesmen. Because then they can really speak from the science point of view and translate the science to the politicians and economists. I think that would be important. But for myself I can't do that. I get asked all the time. People call me up about these things, but I just stay with the science questions and not get into the politics.

MAESTREJUAN: Well, I can only ask this question, pose this problem, because of the past couple of years and the changing public expectations and changing public knowledge of the threat of new epidemics or, say, tuberculosis, which was thought to be kind of a problem of the past, that is resurfacing. But we've had several books come out, *The Coming Plague*, In the *Hot Zone*, talking about uncontrollable viruses, and *Outbreak*, a very popular movie that romanticized your very role of going out into the field and discovering these new pathogens and creating new laboratory techniques and the screening techniques to identify these and control these. There is this kind of facade of safety when there are all these bacteria and viruses out there just waiting to annihilate the human race. So the public expects or has come to expect more of a role from scientists and physicians, whether it's true or not, because of the media. How do you react to these media depictions and kind of the raised public awareness of these new or perhaps previously undescribed threats from bacterial and infectious diseases?

RILEY: Well, it's funny, because when you deal with international work, these threats are there all the time. They've been there for hundreds of years. So when people started becoming concerned about this here in the last couple of years-- I guess I have a very cynical view about this. They should have always been concerned with it, but I think there's a lot of hype right now. It's a good hype because I think it does emphasize the importance of these issues. That's something they should have been thinking about all the time. But that concern is still not sufficient in the sense that they're concerned because they're worried about what's going to happen to people here in this country. They think that these infectious agents will come into this country and then wipe everybody out. I think that that attitude is still not-- That's a rationale to do something. I mean, so you have these emerging infectious disease programs that are coming out of NIH [National Institutes of Health] and the government agencies and CDC. The way to convince the Congress and the American public that this is an important area to have more research funding is because if we don't do something about this, it's going to come to this country. That rationale I think, unfortunately, is a practical rationale, but it really doesn't get to the real issue. The rationale should be that these infectious diseases are all over the world. It doesn't matter whether it's in the U.S. or not. There are kids dying from this all over the world. That's why we have to do this, not because it's coming to the U.S. It's very difficult to convince the Congress or anybody else of this, but I think that's what scientists have to do. Scientists have to convince, it's not because it's affecting you here in this country, but it's an important problem in all places. As long as those problems exist in other parts of the world, it's always going to be a threat to the U.S. if you want to think of it that way.

So my feeling is that if scientists were going to do something about this, then you think of it globally. If they're going to try to sort of communicate this information to the lay public, I

think they need to be able to convince the lay public in a more global picture, a global manner.

But also, at the same time there's a certain hysteria that gets engendered by these things, too. I guess AIDS is a good example, just all the early stuff--I mean, it still happens--but stuff that came out with the transmission of HIV and all the concerns about that. Even with TB, I mean, when I first came here to Berkeley, it's amazing just the sort of unsubstantiated fear about TB in the Berkeley campus itself, just the rigor-- It's good. But at the same time it was a little excessive in terms of what I had to do to set the lab up just to do the TB work. Even some of the biologists here just didn't know anything about TB and raised issues that were really irrelevant, nothing to do with reality about safety issues related to TB. I was very amazed that highly educated people had very little knowledge about what's going on with TB and what TB is. So if Berkeley professors didn't understand this, how are we ever going to have the non-academic lay public understand this sort of thing?

MAESTREJUAN: How do we?

RILEY: [laughs] I think these sort of things have to-- Education has to be provided when people are still young, in junior high school, high school, and college. I think more-- You know, there's very little emphasis on public health, even in medical schools and in college premed preparatory courses. I think those things have to change. One thing I can think of, just a better dissemination of the information, better but also accurate dissemination of information.

MAESTREJUAN: So when our American Nobel-Prize-winning scientists like Joshua Lederberg and David Baltimore stand up and also make very public pronouncements about the dangers of all these new viruses, or growing number of viruses, in your view what is at stake when people like scientists of their stature are also part of this kind of growing public awareness of the dangers of virology? Is it part of the hysteria? Is it part of the hype? Or is it part of a concerned scientist that there is really something there?

RILEY: That is a good question. I know this is a controversial area, and again, I have a slightly cynical view about this. I think when Nobel laureates expound on these issues, a part of it, I think, is to bring attention to the need for more research in this area, and that's real. I mean, there's very little really good research being done in these emerging infectious pathogens, and so having people like that as sort of a spokesman is very helpful for people doing the research. But in terms of the actual perceived threat to the general population, I don't think that that's real. There's always a potential. I can't say that for every pathogen, but there are certain things that's clearly true. There are certain organisms, the drug-resistant bacterial organisms, that are rising in the hospitals, and running out of the antibiotics to be able to treat some of these newly emerging resistant organisms, that's a real threat.

On the other hand, there's a lot of publicity about multidrug-resistant TB [MDRTB] even

as recently as a couple of months ago, but when you actually do the work, it's not that much of a threat. I know some people will curse at me for saying this, but my feeling is that by emphasizing multidrug-resistant TB, they're de-emphasizing probably the more important issue of just TB in general. There are more people killed by non-drug-resistant TB than drug-resistant TB in the world, and this emphasis on MDRTB, I think, is probably not completely valid. They need to get at the more important issue of why certain clones of TB are able to kill people more than others. There are basic science questions that need to be addressed related to TB that-- The attention is sort of being taken away from those more important questions by emphasizing something that may not be a real threat. There are many other examples, like all these viral threats like the Ebola virus, those are not-- It's been going on for many years, these sporadic outbreaks. And you get more publicity about a few deaths-- I mean, they're important. But as we talk, probably thirty thousand people die of TB, and that doesn't make it into the newspapers. So while I think the raising of the consciousness about emerging infectious diseases is important, it could be better streamlined to really then focus on what's really important.

It's just my own opinion, but I think what should be considered important is something that's globally important and not just for the United States. You know, there are infectious diseases that are very, very important that are never mentioned by these people who go around on these speaking tours. It's either that they don't know anything about these things or that they don't think that it's important to the U.S. True, it's not that important to the U.S. You know, we work with an infectious disease called leptospirosis in Brazil. Every year during rain season hundreds of people come down with this and 15 percent of the people die. It's predictable, every year. Foreseeing this, you know-- We know that 15 percent of the people are dying from this. If we know what's going on, why don't we do something about this? What can we do? We have the knowledge to be able to do it. We have the resources to be able to do it. It's not being done because it takes place in the inner cities of urban centers of Brazil, a population that are not that important for the economy or the politics of the U.S. or even the politicians in Brazil. So that's an emerging infectious disease. It was traditionally a rural disease, but it's just popping up all over Brazil in the urban centers because of urbanization and the crowding and the lack of infrastructure. This is something that is a major problem, but I don't think I've ever heard Josh Lederberg talk about that or any of these people. There's, I think, too much generalization and not enough specifics that needs to be emphasized.

MAESTREJUAN: In terms of your own work, when you identified this new hemorrhagic strain of *E. coli* or perhaps the multidrug-resistant TB, how did you view these developments? That you were identifying kind of new mutations in *E. coli* that were making the virulence different or the pathogenesis different? Or did you see this as like a scientist discovering something for the first time that's always been there? You had the one case in '75 to go back to, but in terms of your own kind of understanding of the genetic potential of *E. coli* and these bacteria to mutate rapidly and cause a more pathogenic strain, how were you perceiving this at the time?

RILEY: I've obviously thought about that. You sort of get an understanding of what may be going on many years later as you learn more and more about this particular organism. We know, as I think I mentioned before, that this particular *E. coli* has a phage, you know, a virus, in it that encodes a so-called Shiga [bacillus]-like toxin, so that gives this *E. coli* a different characteristic in terms of its pathogenic potential. But that itself is not enough, obviously.

It really has to do with industry in the U.S. *E. coli* O157:H7 is a disease of industrialized countries. You never see this in Brazil. You never see this in Africa. You may see it rarely. It's a disease that's popped up in the U.S., Japan. Japan had the largest outbreak of this in the history of this organism, more than ten thousand cases last summer, summer of '96. Germany also had a big outbreak. Scotland has a big outbreak. England has some. So it's really a disease of industry.

If it wasn't for the mass distribution system that these countries have developed for their meat products, this disease would have never come up. You may have sporadic cases here and there, but it would have never been recognized as part of an epidemic. The only reason we even picked this up in Oregon in the first place was because it was part of this mass consumption of hamburgers in a fast-food restaurant. There were thousands and thousands of hamburgers. If it wasn't for the fast-food restaurant, it would have never have been picked up as an outbreak. Because if somebody bought a piece of hamburger meat in the supermarket, that person might have gotten sick, but that was only one person. And another person may be totally in a different place. It was just-- There's this concentrated accumulation of the food product in a fast-food restaurant in this system that contributed to the outbreak and to the recognition that it was an outbreak and to us being able to do the investigation and then eventually identify the organism.

But these genetic changes are occurring all the time in nature, most of the changes, whenever we recognize them, if they do anything to humans. We only recognize them if they do something to humans. So it's not a new discovery of a new organism. It's just that things are evolving all the time, and it will only be important if humans happen to get sick from it. And humans can get sick from it by what humans do to nature and industry. This mass distribution of food, meat products, is just a good example of what happens.

So that's another one of my interests that I have, the infectious disease of technology, that there's a lot of things that technology influences that bring about these organisms. Multidrug-resistant TB is an example of that. All of the resistant nosocomial pathogens are an example of technology. If you go to Haiti you don't see MDRTB because they can't afford to buy drugs to treat TB. You only see it in middle-income countries, where people have enough income to buy the drugs but they don't have the proper public health control measures to prevent those things. So that's why I do work in Brazil, because that's an example of a middle-income country where there's a clash of the older traditional infectious diseases and new technology that's coming in and it's not controlled. Leptospirosis is another good example. It's urbanization just rapidly taking place, people coming into the cities, and you have a disease that you didn't see before in the cities. So it's a very fascinating area. It has to do with the evolution of the pathogens and the genetics, but at the same time it connects to what humans do to nature. So, yeah, that's how I view how this *E. coli* evolved.

MAESTREJUAN: Okay, okay. We're going to be jumping around a little bit because today is our last session. I just wanted to pose a very cynical view of the situation in the United States-- Is what's happening with this kind of growing awareness and even, say, Nobel laureates making public pronouncements about new dangers of viruses and infectious diseases--? Is this the biomedical community's way of--? Is this the new cold war, perhaps, for the biomedical community, which had traditionally ridden the coattails of defense funding when money was pouring in for basic scientists because of the imperatives--the cold war--and the need to maintain a certain level of defense that quantum physics really benefited from? With the end of the cold war, a lot of basic science seemed to lose ground in terms of justifying its existence. So is this kind of the new plague or The Coming Plague, whatever the name of the book is, kind of, quote, "new cold war" for the biomedical community?

RILEY: That is a good question. In this case, actually, the sort of perceived threat of biological warfare may have some basis. At the same time this rationale can be used to increase funding from the Defense Department for doing research in infectious diseases. My feeling is that more than biological warfare, there's certainly a possibility of biological terrorism. It doesn't have to be an outside country or an enemy country using biological warfare. I think more of the concern would be crazy people in the U.S. putting some biological agents in the water system or that sort of thing. Those are real, and I think the U.S. is not prepared to deal with those things. They're prepared to deal with the more traditional terrorism, bombings and things probably, but I don't think there's been a real effort made to-- What do you do when that happens? How do you deal with it? How do you respond to this sort of situation? I think those things are going to become more real. As you asked me earlier, there are obviously people who are very knowledgeable about how these pathogens work. It's not a secret. It's not like how you make a nuclear bomb. Anybody can do this with some basic knowledge.

There are actually several examples where this already happened. Do you know about this *Salmonella* outbreak among this counter-culture community in Oregon a long time ago? I forget the name of the-- They had that guru.

MAESTREJUAN: Right. Yeah, I know whom you're talking about.

RILEY: This person actually obtained the *Salmonella* strain from ATCC [American Type Culture Collection] and then infected people with it. I don't know if she actually went through with the whole thing, but she was about to do it or something. Then the only reason they knew [about her and her plan] was that ATCC keeps a record of certain markers. So this has happened already. That just happened to be *Salmonella*, but it can happen with any other organism. They could have spread anthrax agent in the subway system in Japan instead of a gas, so this could easily happen. I think, yes, there should be efforts made to prevent these things. So I think, yeah, those things are real.

In terms of biological warfare, I think the threat there is probably as real as a nuclear attack. I mean, it's going to do them just as much harm as it will do us, and so I'm not sure how real that is. Certainly there is a lot of discussion now about funding for the potential of biological warfare. And if that leads to more funding, that's all the better because the other sources of funding for this kind of research are very limited, and if the Defense Department has money to distribute to do this, you know, they should do so.

MAESTREJUAN: Okay. To jump back to your own story of development as a scientist, I think we left off with you finishing up your postdoc[toral fellowship] at Stanford and seeing yourself really as a bacterial pathogenesis scientist researcher. But you do choose to go to India for two years. Why do you go to India rather than, say, pursuing an academic position?

RILEY: I wasn't ready, and I wanted to go to India. I made up my mind many years ago that I wanted to spend some time in India. It was one place-- I wanted to go to India.

MAESTREJUAN: Why India?

RILEY: When I was at CDC I spent three months in Bangladesh working on a cholera surveillance system, and at the end of the three months I traveled for about ten days in India. At that point I said, [II]I want to come back here to work someday. It's a country I think that every human being has to go to before they die.

MAESTREJUAN: Why is that?

RILEY: Otherwise you can't say you've lived on this planet. It's a fascinating country, the history, the culture. It's just an amazing country, and I wanted to live there. At that time we didn't have any kids but--

MAESTREJUAN: You didn't have any kids?

RILEY: No. No, when we went to India we did, but when I first decided I wanted to go after the Bangladesh trip, I didn't have any kids. So I didn't even realize how complicated it was going to be when we finally ended up going. I just wanted to go. It was this emotional attachment that I had. And so it happened-- Let's see. I was in Bangladesh in '83, so it happened five years later. So when I left CDC, as I mentioned, I asked them if anything comes up in India, I wanted to go. And it was also a good project. I mean, at least on paper it was a good project, and it was going to also be led by my former boss at CDC, Roger [A.] Feldman. So two of us

ended up going. Actually, also, my good friend here, Art [Arthur L.] Reingold, was supposed to go, too. But he had also just gotten started with babies. Originally there were going to be three positions, but it turned out to be two. So I had a two-year-old and an eight-month-old when we went.

MAESTREJUAN: Goodness.

RILEY: It was a very frustrating experience, but I'm glad I did it.

MAESTREJUAN: Why was it frustrating?

RILEY: Oh, just-- This was a project; it was called India Biomedical Support Project. So the money came from the USAID [United States Agency for International Development], but it was designed by CDC. I was put into a WHO program to run this. It was dealing with the Indian institution called the National Institute of Communicable Diseases, which is sort of the equivalent of the CDC of India, except the U.S. has two hundred million people. India has eight hundred fifty million people. If CDC of the U.S. were there in India, they would not be able to do what it's supposed to do. So here we are dealing with four of the worst bureaucracies in the world, and so it was very difficult to get things moving, get projects started, things we wanted to do. But I still learned a lot. It was a great experience. We had a couple of papers come out based on some of the things we started doing.

MAESTREJUAN: And were you able to set up some labs that were capable of using molecular--?

RILEY: Well, yeah, that's one of the things that I was trying to emphasize, trying to show that problems can be addressed by introducing molecular techniques. We used one example of the *Shigella*. The *Shigella* is a big problem there. We developed a synthetic probe for detecting *Shigella* from stool. In fact, it was one of the thesis projects of one of the students there, so I helped him to develop it and-- It wasn't so much just doing the work on *Shigella*. That wasn't the issue.

You know the Salt March of Mohandas [K.] Gandhi; it was just a single act of walking to the beach, marching to the beach and picking up the salt, that eventually led to-- That was the beginning of the end of the British Empire. It was a very simple act, but it was a very symbolic act. So my approach was to just come up with this one simple thing and have a paper come out from this institute, in an international journal. That was the objective. By doing that it brings recognition to that approach, but at the same time it brings recognition to that institute that they're doing this and India is able to do this. And that was very important for them.

Also it facilitated another institution that was next to this institute to make these primers, oligos [oligonucleotides] , because they were looking for-- These are scientists who were trained in the U.S. or Europe, and came back. They didn't know what to do. They had all this equipment. They had no application. They didn't know what to do with it. So we said, "Why don't we do this?" They got really motivated to do this, and it was addressing a real issue in New Delhi. It gave them credibility. They can make these primers, synthetic primers, that were going to be used. It brought recognition to that place. Now they supply the primers all over India. They can make it. So it was just a very simple gesture, but it had a very big impact. So that was why it was important to do that, even though it was just a very simple study.

MAESTREJUAN: So you aren't too far removed from your interest in Eastern philosophies, whether it's Near Eastern or Far Eastern.

RILEY: Yeah, that may have had to do with part of my decision to go to India. Yeah, I wanted to be there.

MAESTREJUAN: And make your Salt March. Okay. What happened to the work that you were doing at the bench at Stanford?

RILEY: It got placed on the back burner for two years. Yeah, I didn't do anything--

MAESTREJUAN: What were your concerns that this might be the making or breaking point of whether you were going to be able to reenter a bench-type career?

RILEY: Academic career. Yeah, it was a concern. Although I wasn't totally committed when I was in India to go back into academics. Although Cornell was already interested in my coming at the time, I didn't sign my name to anything yet when I went. I said I was interested but-- Because I still had the opportunity to go back to CDC or WHO or do other things, too, even after India. It really wasn't towards the latter half of my stay there that I decided to go to Cornell, still because of an apprehension of my wife to go back to Atlanta. So CDC wasn't really an option for us. WHO was a possibility, but that would have been a totally different type of career and I wasn't-- We actually wanted to stay overseas even longer and there was--

We had a chance to go to Thailand a couple of times when we were in India, and Jesse really liked it there. I've lived there before, and so I liked it there. So I was joking, "Wouldn't it be great to be able to do something here?" So about six months after I joined Cornell, CDC calls me up and asks me if I wanted to go to Thailand. [laughs] I said, "Why didn't you tell me this two years ago? I would have gladly done so." But it was too late.

No, that was always a concern. Where was the field going to be after I went back in the enteropathogenic *E. coli* pathogenesis field? You know, there are a few people in the world doing this, so I had essentially two years of kind of-- I had to fall back two years, but I was able to resume it as soon as I got back to Cornell. That was a project that I resumed, and I was going to do it, get some funding to do that work.

You also realize that in two years-- Science moves very slowly. It's really interesting. At least in that particular field it's moving very slowly. I also of course kept in touch with the literature, even when I was in India, with what's going on in-- I came back to the States a couple of times a year and attended ASM [American Society for Microbiology] or some meetings. I kept in touch. So I was relieved that the progress wasn't as rapid as I had expected. This is a realization that I had afterwards, but it turned out to be-- I didn't really lose much time. If anything, I also gained additional things because I got interested in TB and I was able to start a new program.

[END OF TAPE 5, SIDE 2]

MAESTREJUAN: What were your options in terms of what kind of institutional setting you would return to to practice bench science? Did you have other options besides going to Cornell [University] and to a medical college?

RILEY: No. I wasn't applying to anything. Cornell had this position for me ready to come back to. All I had to do was say yes. You know, it was either that or CDC [Centers for Disease Control and Prevention], and so I had to—

That was a big decision. Do I really want to go into academics and go through all the fighting for grants and do some clinical work at the same time? So I negotiated with Warren [D.] Johnson [Jr.] about my expectations. If I joined Cornell I wanted to minimize my clinical responsibilities, and I wanted to do international work and do bench science. He agreed to everything I asked, so that's what I did.

MAESTREJUAN: Did you have clinical responsibilities at Cornell?

RILEY: Just a month in the AIDS ward every year, so it's minimal. It was mostly teaching. I didn't have to write any notes in the charts or anything like that, so it was a perfect arrangement. It was exactly what I wanted.

MAESTREJUAN: Minimal patient--

RILEY: Yeah, minimal patient contact.

MAESTREJUAN: How were you able to get funding for your lab after being out of the loop for a couple of years?

RILEY: Cornell of course had a start-up package, right. So I was able to get the lab set up with that. Then about, I guess, a few months into my first year I was able to reactivate this grant that I had from Robert Wood Johnson Foundation, so that was that. Then I had an opportunity to apply for sort of an inside program called the Cornell Scholars in Biomedical Sciences, which I was able to get. That was for I think three years, and so that covered much of the needed support, technician, my salary. Then I got the Pew [Scholars Program in the Biomedical Sciences], and then I got the NIH grants. So it was an accumulation over time of different things. I had also a lot of local, small grants from New York City. There's a real advantage to being in New York City, just all these foundations and services. And because TB was becoming so hot, I was able to get some small grants there. And the postdocs that came-- Warren Johnson supported some of the postdocs through his own grants, so I didn't have to pay for the salary of the postdocs. It was a very supportive place for new faculty members starting up, so I was very lucky I think.

MAESTREJUAN: To continue on this issue of funding, when you applied for the private sources of money, how did those applications differ from, say, the large federal grants that you applied for and the RO1s from NIH?

RILEY: Well, I have to admit my first couple of RO1 grant applications got turned down with *E. coli* work, and so, yeah, it was much easier to get the funding from the private sources.

MAESTREJUAN: Why was that the case?

RILEY: I think one is probably that many of these private sources were local sources, so there were certain, I think, understandings or arrangements they had with major institutions in the area to provide funding for new investigators and things. So I guess the tradition was there to tap into those things and made it easier, whereas RO1 is a national competition, and so it was much more competitive. I think that's one difference. And then the funding that I got locally was all related to TB, and because New York City had the worst TB problem in the country, I think any projects related to TB-- There was a lot of opportunity to get funds. So it was, again, the right time and the right place to get those types of funding.

MAESTREJUAN: Why do you think that your NIH grants took a while before you attracted the attention of--?

RILEY: Well, I was starting out. It was my first experience in writing RO1s, and that was also a difficult time period. The funding level was quite low. So I was in sort of the midst of a period where maybe 12 percent of the grants were getting funded, at least in our area, in pathogenesis.

Also, I think my projects were not as well developed as they could have been. And then I guess the focus on the *E. coli* was not as urgent for them. I think there is a certain sort of unwritten kind of rule that NIH will fund a limited number of work related to certain pathogens that may not be all that important in the U.S. You know, there are a couple of major labs working on an EPEC [enteropathogenic *E. coli* pathogenesis] who were clearly much further ahead than I was. There was really no need, I think, to have another lab doing EPEC pathogenesis work, even though we're addressing the pathogenesis question from a different point of view. So there are many reasons, I'm sure, just the quality of the grant itself and the need for that kind of research and then just timing, the difficult time getting grants.

It wasn't until I started accumulating data for the TB work that I was able to get grants from NIH and RO1. My first RO1 was a TB pathogenesis work. Again, that was also timing because TB was really hot, and they had this extra money for TB. They set aside money for TB, their so-called-- What is it? It's a term that's set aside, yeah, earmarked for it. But anyway, so-- Oh, RFA [request for grant applications]. So I was able to do that. And then the second project I was able to collaborate with this person named Carl Nathan at Cornell who was a nitric oxide expert. We were standing at a bus stop one day with my kids waiting for their school bus. Then Carl Nathan walked by and then [I] said, "Carl, I know about this new RFA that's coming out to look at TB in the lungs." We were joking initially, but then we eventually wrote something and then we got it. It's probably the best collaboration I've ever had. It's a really great collaboration of work.

MAESTREJUAN: So given that you have several projects that you have pursued, the EPEC and the TB projects, when it comes to setting priorities in your lab, how much does it influence the decisions on what you're going to do, what you're going to pursue, when it's easier to get funding for hot topics? What drives your science at that point when there's a lot of little sources of private funding and federal funding for certain diseases? Is it clinical interest at this point, or is it go where the money is?

RILEY: No, it's really the science question that we want to pursue. My priorities are still TB and enteric diseases. That's always been the case. We're still doing too much, but since we've done a lot-- It's always more difficult to stop something than to start something. And there's still enough interest in both fields, I think, both from private sources as well as the government, that if we can keep going on this, you know, that's what we'd like to do. There's certainly less

interest in our EPEC work, and that's why the Pew was very helpful. That was what supported our EPEC work. You are also definitely influenced by availability of funds for these projects. So if suddenly funds run out for the EPEC work, I probably will have to stop that so I can focus on TB.

I also probably will take a project to a certain point and when I feel that it's done, it's answered all the interesting questions, then I sort of start winding down the project. Especially if somebody else came up with something that was even more revealing and important, then I sort of lose interest in really pursuing something further. You know, I'm always-- I always feel the need to be doing something that's novel and that's really at the cutting edge. If it's not, if it's just repeating somebody else's work or trying to confirm somebody else, then I lose interest in those things. And if that's facilitated by lack of funding there, then that makes it easier to stop those things. So there are many projects that we sort of start and then stop and do other things, you know, within the field of TB and *E. coli* work.

Even our *Salmonella* work we just recently started-- it's still related to TB. It's still connected to TB. So I don't feel that that's really a real divergent sort of a direction. And suddenly by-- You know, we're actually-- I haven't got the money yet, but we had a good score on our RO3 application for the *Salmonella* vaccine work, so clearly there's interest in that approach.

So, yeah, it's really the science that drives the research first and then try to see how we can manipulate the system to get funding to support that science. I don't suddenly switch fields altogether just because there's money here. I mean, there's been lots of money for AIDS. I've never tried to tap into that. I can certainly do work related to AIDS if I wanted to. TB you can almost justify, but I've never applied to anything in the AIDS program for TB work. It's always been the pathogenesis [study] section that I've tried to sort of get money from.

MAESTREJUAN: How does the source of funding, whether it's a private source like the Pew money or a public source like the NIH, influence how you allocate resources in your lab day to day, whether it's reagents and supplies or equipment or personnel, grad students and postdocs?

RILEY: Well, that depends on what the agencies allow. If certain private foundations don't allow the money to be used for salary, then obviously I use them for other things, supplies and travel for the postdocs and things like that. You know, unfortunately, most of the private sources-- It's unusual to have a funding that you can use for paying salaries of fellows, and so most of the salary support for the fellows comes from NIH or NIH type of funding. So, yeah, it is whatever the agencies allow you to do, we do, and so supply things here and there, go back and forth between different funds to do whatever we need to accomplish.

We also just got funding from [John E.] Fogarty International [Center Training and Research Program in Emerging Infectious Diseases] to do our international work, which is another thing that I always have to worry about, you know, how do I keep things going abroad?

And that's-- When I was at Cornell it was a little easier because Warren Johnson was very supportive. He is very successful in getting a lot of funds, but now I'm on my own here. So I have to come up with funds to send students there, support fellows there, support our collaborators there, and supplies.

MAESTREJUAN: And are there many public sources of funding to do that kind of work?

RILEY: No. Unfortunately it's difficult. Fogarty is one source, and NIH has a couple of programs to do work abroad, very competitive. So unfortunately there's not as many private sources for those things. I'm not sure why. But, yeah, those are much more difficult to get. But we keep struggling to keep those things going.

MAESTREJUAN: How do you see your prospects for the future in terms of funding, funding future--?

RILEY: Never certain. You know, that is-- You've talked to other people. It's a constant concern. We're renewing two of our grants from NIH right now, and I don't know what's going to happen. Just knowing my own study section, it's not an easy process even to renew the continuation of grants. So you always have to be looking for funding sources to keep things going. Unfortunately, I would say 50 to 60 percent of my time is spent on trying to look for funding and writing grants and doing things of that sort, which is sort of one negative aspect I think of doing research in an academic setting. Sometimes you don't even have time to think about the important research questions. But at the same time writing the grant helps you to think about those things, so maybe it's okay, too.

MAESTREJUAN: Well, we haven't talked too much about why you left Cornell to come here, but we certainly can. Just to ask, how has moving from a medical college with a very basic research focus to a School of Public Health, which is just now--the field itself--taking on a more basic agenda, how has that changed your ability to garner funding for your research?

RILEY: Well, I think it's too soon to know because I have only been here a year. But I got two grants since I've been here. One is international work, but the other one is this *Salmonella* vaccine work. So I'm not sure how-- I don't think it makes any difference. I mean, I'm doing basically the same thing I was doing at Cornell in terms of my basic science lab work, and this group is known for that anyway. It's a new program at Berkeley, but it's a pathogenesis program. They recruited also Dan [Daniel A.] Portnoy form Penn [University of Pennsylvania], who has a half-time appointment at School of Public Health and half time at MCB [Department of Molecular and Cellular Biology]. They recruited a virologist [Fenyong Lu] from Yale [University] who does just nothing but lab work. He's been very successful--

MAESTREJUAN: Here at the School of Public Health?

RILEY: No. The school is known for that work, anyway, so it ‘s nothing new- - Just because it happens to be in the School of Public Health-- You know, there are a couple of places like that. Harvard [University] has also a strong lab program in the school of public health, and this place and--

MAESTREJUAN: --Johns Hopkins [School of Hygiene and Public Health].

RILEY: Yeah, Johns Hopkins, too. So I don’t think that’s atypical. The reason I wanted to be here was because of the epidemiology side. That didn’t exist at Cornell, and I essentially had to do all the epidemiology myself there, plus the bench work. Here I can talk to people, and I have students who are in the epidemiology program who can actually learn these things by themselves. I don’t have to spend as much time teaching them epidemiology. So, yeah, in terms of the ability to get funding, it might even be better here, because the science is only-- The basic science here at Berkeley is far superior to what it was at Cornell. I mean, I just go next door to MCB and talk to people who are really doing fundamental cell biology work. There are not very many microbiology people here in terms of the kind of microbiology that we do, but they have recruited a couple of people, and so it’s really blossoming. They’ve also recruited Eva Harris from UCSF [University of California, San Francisco]. She’s going to join us in July. So it’s probably going to be one of the strongest pathogenesis groups in the country in terms of just the diversity of pathogens that we work with.

MAESTREJUAN: So as your professional incarnation as a bacterial pathogenesis researcher--and I’m just talking based on my experience interviewing Pew scholars in bacterial pathogenesis who are in traditionally academic basic departments--how do you think this will affect your ability to do the professional things, like get invited to the right conferences and publish in the right journals and attract the right kind of students or the quality students?

RILEY: No, I think this is a much, much better place to do that, yeah. I mean, I get inundated with postdoc applicants already who just know the program, much more than I did at Cornell. You know, it’s really-- The program is really becoming known already. So in terms of my bacterial pathogenesis track career, I think this is certainly a better place. It’s got the critical mass of people to be able to do that because I didn’t at Cornell.

MAESTREJUAN: I’m going to assume that you have no clinical responsibilities.

RILEY: No, I have nothing. No, completely zero. That was a difficult decision. When I watch *ER* [*Emergency Room*] on TV I start missing-- [laughs]

MAESTREJUAN: Really?

RILEY: Yeah. I get a little kind of compunction, but I just can't do it. There's just no time. When I go to Brazil I do see patients. I do see people in hospitals, kids, leptospirosis, other things, but not here.

MAESTREJUAN: Well, one last area I want to get into--I said fifteen minutes, and we're going overtime--

RILEY: No, it's fine.

MAESTREJUAN: --is this issue of time and maintaining both a domestic and an international career plus having a family and taking your family and your eight-month old, your infants, to places like India and Brazil. I think just to talk specifically about chronology, the last time we talked about your personal life, you had gone to Columbia-Presbyterian [Medical Center] to do your internship and residency because your girlfriend [Donna Doane] was at Yale. But when do you get married to whomever you get married to?

RILEY: Yeah, Jesse [Frances Furman]. I got married to Jesse actually in Atlanta after we moved from New York, but I met Jesse-- She was working at Columbia-Presbyterian Hospital, where I was doing my residency, and we didn't really start going out until I guess I was in my senior year, last year.

MAESTREJUAN: At residency?

RILEY: Residency. But my girlfriend at the time-- We were sort of beginning to break up, I guess. She went to Japan for a year to do her thesis, and it was a difficult long-distance relationship at that time. I actually visited her in Japan, too, on my vacation. But it was becoming clear that it was going to be difficult to maintain the relationship for a long time, and then in the meantime I met Jesse.

MAESTREJUAN: What was she working--?

RILEY: She was an economist. She was getting her Ph.D. in economy, studying Japanese economics. So she had to do part of her thesis project in Japan.

MAESTREJUAN: And Jesse at Columbia?

RILEY: Oh, Jesse was working as a receptionist at one of the emergency rooms. She was going to school still at the time, so she was working part-time. We decided to move to Atlanta ogether, and then we got married.

MAESTREJUAN: Did she and does she have a career outside the home?

RILEY: She's a schoolteacher. Although having just moved here, she had to renew her teacher's credentials. So she finished, and she'll probably go back to work when Emma [Riley] starts kindergarten.

MAESTREJUAN: Okay. What does she teach? What grade level does she teach?

RILEY: She was teaching junior high school when I was a fellow here at Stanford. She was teaching in San Jose.

MAESTREJUAN: And does she teach in the sciences?

RILEY: No, it's everything, just junior high. She likes language arts, I guess. She's teaching English as a second language. Most of the students she had in San Jose were like Vietnamese students, Cambodian students.

MAESTREJUAN: How did she view all this fieldwork that you were doing in developing countries?

RILEY: Well, initially I think she was very, very supportive when we got married in Atlanta. About three months afterwards I went off to Bangladesh for three months. There was no such thing as e-mail at the time. You had to communicate by real letters. I also got sent to Brazil for six weeks, and she actually joined me in Brazil. So we traveled around. But she was very supportive of that sort of thing. Now with the kids, you know, she's still supportive, of course,

but I think it's probably hard on her when I am away. The kids are a little older, so it's not as bad as it was, I guess, when I was in India. When I was in India, you know, within India I also traveled so--

MAESTREJUAN: And what were your concerns for the health and safety of your children, particularly your infant children, knowing that you've been studying this infantile diarrhea and the incredible mortality rates?

RILEY: It was always a concern. Whenever they had diarrhea in India we always thought of the worst possible scenario. We made sure that they were both breast-fed as long as possible. [laughs] Yeah, Samantha [Riley] was breast-fed until she was almost three. But fortunately nothing happened, and we, of course, gave them all the shots before we went. Once we sort of settled in India-- The first month or so we were in a hotel type of setting, so it was difficult. We always had to eat out, and we were always getting sick. But once we sort of settled in our own place where we could control what we ate, boiling the water and doing those things, you know, it was okay. We had a lot of help. So it wasn't as bad as I thought it was going to be, but they did get sick. We all got sick, but fortunately nothing bad.

MAESTREJUAN: How do you explain to your older ones about what dad does for a living and why he has to fly off to all these exotic places?

RILEY: I think he [Nicolas Riley] is beginning to accept-- He's eleven now, so he's beginning to accept it. Although the last couple of months I've been doing a lot of traveling, so when I came home one day he says, "Hi, Dad, how long are you visiting?" [laughs]

MAESTREJUAN: How did you react to that?

RILEY: Oh, it was done in a very light, jovial way. He's got a great sense of humor. I think he's used to my traveling. If anything it's Emma, the youngest, who I think has the most difficulty. She really makes sure to make you feel bad. [laughter] So, yeah, it's not easy. I try-- I've cut down on the duration of my travels when I go to Brazil. I used to go like three weeks at a time, but I rarely spend more than ten days at a time.

MAESTREJUAN: And at least did your oldest kids see *Outbreak*?

RILEY: No, I don't think-- No, Nicolas hasn't seen it yet, no. We can check it out I guess.

MAESTREJUAN: Yeah. Do you have concerns--? What are your concerns that here you are going off and in this potentially dangerous situation and--how your children would react? How do you explain kind of--?

RILEY: I don't think they really perceive those things as dangerous. I don't think I give them the impression that these are dangerous things.

MAESTREJUAN: Do you give them [the impression] that it's kind of adventurous and--?

RILEY: Yeah, it's a fun thing.

MAESTREJUAN: Do they express a desire to go with you?

RILEY: No. [laughter]

MAESTREJUAN: No? Okay.

RILEY: Yeah. We had an opportunity, actually, this coming summer for all of us to spend some time in Brazil so I could work, but they're not all that excited about doing it. You know, they have their friends here.

MAESTREJUAN: Yeah, Berkeley is a tough place to leave, I guess. You had mentioned that you're here on the weekends and at night, and when you aren't here you are away. How do you divide up family responsibility with--?

RILEY: Well, I try to, yeah, spend some time, [inaudible] time, and do things in a very concentrated time period. I'm constantly conscious of going back and forth between work and then the family. I don't think I do it enough, but it comes in spurts, too. You know, if I'm writing a grant or doing some papers and things, then I'm obviously here more often than I want to be, but if I'm not doing those things, then I try to stay home and do things.

MAESTREJUAN: In terms of your own role as a mentor, when you have graduate students and fellows who are considering starting a family and still need to do field research, how do you handle this issue with them of childbearing and child rearing?

RILEY: I guess I don't know if that's-- It's come up in a couple of people. They're both M.D.'s, because it's the M.D.'s who do the fieldwork. The Ph.D.'s just stay in the lab, so they don't have those things they have to worry about. I did have Ph.D.'s who have families, and they sort of-- I let them do whatever they need to do as long as work gets done. It was a little easier in New York because most people lived really close by to the hospital, so they'd just come in at any time they want and get the work done. Whereas here people live farther out, so I think it's a little more difficult for them to come in on the weekends and get away from their families. But the M.D.'s-- I have one M.D. fellow [Albert Ko] in Brazil right now, and he has a child with his wife. It's not easy for him, I know. We talk about it all the time. He actually came up here to do some work in September and spent six weeks here, and his wife was down there with the little baby. And they had an unfortunate episode. She had a miscarriage when Albert was still here, and that really affected him, I think, that he wasn't there when this happened. So, yeah, those things. We talk about them because I did the same thing, and I can relate with people like that. So I sort of tell him my experiences in India when I had to go through that sort of stuff, or when I was trying to set up things in Mexico when I was at Stanford.

MAESTREJUAN: Is that just part of the package of becoming an epidemiologist--

RILEY: Yeah.

MAESTREJUAN: --in terms of when you choose your lifestyle and professional career choices that it all--?

RILEY: Yeah, you have to do it that way. There's no-- No, if that's what you want to do-- I mean, if international epidemiology is what you want to do, which is what Albert is really interested in-- He loves it. I mean, it's hard. I'm trying to convince him to come back to the States because he has to set up his own career here. That's what he has to do, but if I didn't say these things, he would just stay there forever. You know, his wife is French. She's not working, and she's used to traveling all over the world, too, so it's a nice couple arrangement. Their kid now speaks Portuguese and French and English growing up in the-- So, yeah, Albert is a really great person. He really cares for what he's doing there and very exceptional. He's probably the best fellow that I've ever had.

The other person [Cindy R. Friedman] that was an M.D.-- She's now at CDC. She got married right before she went down to CDC. She's struggling to decide whether to raise a family or not, and she talks to me about it from time to time, even now. But I don't know what to advise in situations like that. She's still trying to get her career going. I talk to Eva Harris about this all the time. She's also getting started and wants to get a family going, but she's even more interesting because she's a woman who's doing things abroad.

MAESTREJUAN: And how does that make a difference?

RILEY: It's much more difficult I think as a woman because she has to have the baby. [laughs]

MAESTREJUAN: Right.

RILEY: She says she hasn't been ready, but it's funny that we talk about these things. I don't know why we talk about these things. It's really up to her, but I can see that it's much more difficult for her because she's really very dedicated to the work abroad and has spent ten years of her life in Nicaragua doing work. So I can sympathize.

MAESTREJUAN: Well, do women have to make different choices? There are kind of gender-based choices to be made in terms of whether a female researcher wants to have a family or not and a male researcher wants to have a family or not?

RILEY: No, I think it's a lot more difficult for the women. I just can't imagine if I were a woman having to make that decision. I have another friend at UCSF, Debbie [Deborah A.] Dean, who is now starting a family. It turns out it's going to be twins. Actually, I should call her and see if she's already had the baby. But anyway, she's someone who has been working in Nepal doing work abroad, too, for many, many years, infectious disease physician and doing basic research at UCSF. She finally decided to have a family. She's probably a little younger than I am, early forties, and starting a family. So she's delayed it, I guess, for all these years. Yeah, it's much more difficult, especially if you're doing the kind of things that I'm doing, trying to run a lab and do work abroad. If you're just running a lab, I think it's easier.

MAESTREJUAN: What are the gender-based professional difficulties that women run into, whether it's within an academic setting or in the field in terms of being accepted or promoting one's career?

RILEY: I think it's much more difficult in an academic environment than working in the field for women. I mean, I see this all the time. It's not obvious, but when you see enough examples of this happening, you begin to wonder. For the same type of work that women do they're not as recognized as the males, it's clear.

MAESTREJUAN: Why is that do you think?

RILEY: I think it's the usual mentality. It's definitely there. I think people don't accept it, or maybe they don't see it, but it comes up in interviews. Now that I'm in this position, I'm sort of on the inside track; it's clear what happens, I mean, in these search committees. You think these search committees are all objective and they look at objective information on candidates, but I think if you really look at the way it's done, everybody, if they're honest, will agree that there's a lot of subjective decisions made about who gets recruited for new positions. If you happen to be on the right side of those subjective decisions, then it's fine for you, but I think women, often just because they are women, tend to-- I think it's a little more difficult. It happens-- I see this at UCSF all the time.

There's one person I know-- She's actually a Pew scholar, and she's done really great work, but she just has not received the recognition that the same work that's done by a male in that position would have certainly got the recognition for. So it's a clear-cut example, just a very glaring example of what happens. I think at Berkeley, too, there was one case. I don't know if you know about this particular Pew scholar. I don't know if you've interviewed her, but that's another example. If that work was done by a male, I think that person would have gotten tenure here.

MAESTREJUAN: How can you as an individual scientist and mentor and adviser prepare students for this reality and help them negotiate these boundaries between gender-based obstacles?

RILEY: Well, I think they need to recognize that those things exist, unfortunately, and that they need to-- It's hard to say. They need to really do more to be accepted into the system, to be recognized, and that's true with minorities, too, I think. They need to really, really stand out to be accepted because otherwise--

MAESTREJUAN: Was that true for your case?

RILEY: I don't know. I mean I've been lucky. I've somehow passed through all the systems, I guess, because they don't know how to categorize me. It makes it-- [laughs] But I've never felt discriminated against ever, or at least something that was obvious. I didn't apply to Cornell as a medical student because one of my residents, who was from New York, who was Jewish, told me when I was a medical student that Cornell didn't take any Jews or minorities. He said don't even bother applying to Cornell. But when I went to Cornell, it was just totally different. I mean, it was just not like that at all. So certain institutions develop a certain perception that stays. And Cornell was a very enlightening institution that I respect. So there is the other extreme, too, that certain perception that gets created. You may overreact to those things when it's not there. From my own experience I 've never had, at least that I was aware of, anything taking place.

MAESTREJUAN: Okay. Well, I could probably go ahead and ask questions all afternoon, but time is constrained and at this point I would like to turn it over to you and ask you if there's anything that we haven't talked about that you would like to talk about.

RILEY: No, I think we've pretty much covered the major things. Yeah. We talked about the important people in my life, that have influenced what I'm doing. I think, yeah, I mentioned the scientists, talked about friends. So I can't think of anything. Warren Johnson was obviously one of the major mentors that I had. Yeah, I can't think of anything.

MAESTREJUAN: Okay, well, I think it's been a terrific interview and thank you for the opportunity.

RILEY: No. Thank you. It was fun.

MAESTREJUAN: Okay, thanks a lot.

[END OF TAPE 6, SIDE 1]

[END OF INTERVIEW]

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