Lew Semprini Oral History Interview, February 22, 2017

Title
"Engineering Solutions for the Environment"

Date
February 22, 2017

Location
Valley Library, Oregon State University.

Summary
In the interview, Semprini discusses his Italian family heritage and his upbringing in Connecticut, touching upon his interests as a boy and his educational path growing up. He then describes his undergraduate experience at Worcester Polytechnic and the circumstances that led him to transfer to UC - Berkeley, where he studied Chemical Engineering. From there, he outlines his years working at Pacific Gas & Electric as a chemical researcher; notes the emergence of his interest in environmental engineering; and details the studies that led to his earning three graduate degrees from Stanford University.

Next, Semprini reflects on his years as a research associate at Stanford, describing a variety of research projects with which he was engaged, including important work focusing on *in situ* clean-up of areas contaminated by a commonly used degreaser, trichloroethylene. Semprini also comments on the evolution of his own environmental consciousness during his years at Stanford and the political hurdles that have frequently hampered academics working in the environmental sciences.

The interview then turns its attention to Semprini's years at Oregon State University, beginning with the circumstances of his move from Stanford and his early impressions of the university and the College of Engineering. In thinking back on his career at OSU, Semprini discusses his involvement in helping to create a distinct program in Environmental Engineering, and also speaks of several of the research programs that he has overseen. In particular, Semprini details his analyses of contaminants discovered in the Willamette River at Corvallis; a variety of subsurface clean-up projects conducted in collaboration with Stanford colleagues; and an investigation on the potential to convert methane into biofuels. Semprini also shares his thoughts on federal funding for science; his work as an administrator and teacher; and the continuing evolution of Environmental Engineering as a program at OSU. The interview concludes with a discussion of change within the College of Engineering and the outlook for OSU as it approaches its 150th anniversary.

Interviewee
Lew Semprini

Interviewer
Chris Petersen

Website
http://scarc.library.oregonstate.edu/oh150/semprini/

Transcript

Chris Petersen: Today is February 22, 2017, and we're in the Valley Library with Dr. Lewis Sempirini who is a Distinguished Professor of Environmental Engineering here at OSU. Thank you for joining us. I want to add for the record that this is actually the 100th faculty interview that we've done for our project, so a nice little milestone for us today. We'll talk a lot about OSU, but I'd like to begin by learning more about your early years and I'll ask you where were you born?

Lew Semprini: I was born in Waterbury, Connecticut.

CP: Is that where you grew up?

LS: [Nods] I grew up through high school in Waterbury, all in the same house and through high school graduated and then went on to college. It was my first move out of Waterbury.

CP: Can you tell me a bit about your family background?

LS: Sure. So I'm an Italian-American. All my grandparents were born in Italy. Two came from northern Italy, two from the south. And in their early 20's they migrated to the United States. So the typical Ellis Island story. Eventually they all settled in Waterbury. My parents grew up across the lake. So one thing about Waterbury is it's got it's name for a purpose: there's a lot of water resources in Waterbury. They went through high school. All our cousins were the first generations of going to college. I was the first generation of this immigrant family going to college.

CP: What were your parents' occupations?

LS: My dad was—in Waterbury, which I'll talk about, was very—it was the brass center of the world. So they had a lot of technical training in high school. He was a welder and he welded in some of the shops. When they went away he became an iron worker. He was an iron worker by trade. My mom raised the kids. And then after we were all out of college, or when I was out of the house, she went back to become a teacher's aide. She was a teacher's aide in Waterbury for a long, long time. She always wanted to be a teacher, but that generation never made it to college. She was a teacher. She grew up on a farm in Waterbury, and that was part of the center of our Italian heritage things, because it was within walking distance of where I grew up. It was a very nuclear family. I had aunts living on either side of me growing up, sisters of my mom's. It was a very strong first and second-generation Italian growing up.

CP: I'm guessing Italian culture was ever present in the household?

LS: [Nods] Italian cooking. Since I had a grandmother from the north and a grandmother of the south, my mother's from the farm was the south but she also had a little northern Italian cooking too, because that's what my dad's—so I got the best of two worlds and two pretty incredible grandmothers as cooks.

CP: Was this a fairly working class community?

LS: Yes. I grew up in—and, Waterbury again was a very industrial town that started with mills on the river because it had all this waterpower. Then these factories continued to grow and grow. It was a very blue collar working community with all these really big brass mills in the town that were still going when I was a kid. They were still producing things. World War II was their height with all the brass that was needed for World War II. But then there was also the—there was some very, you wouldn't know it now, but very rich centers of town from these people that owned these mills. There was this high, more educated part. The local high schools, it was their mission, part of their mission, to train people for the technical things in the factories, like some of the finest machinists in the world came out of Waterbury with technical training, but there was also this college preparatory part of the education in high school.

CP: What were you interested in as a boy?

LS: I spent a lot of time romping around in the woods [laughs]. We're given a lot of freedom after school to go explore. I happened to grow up—right across the street was a bunch of woods and after you went through the woods you got to the farm.

[0:05:03]

We spent a lot of time just playing out in nature. Either in the woods or related to the lakes that were around and things like that. A lot of outdoor time exploring, taking off on your bike and going out into the Berkshire Countryside, you know, riding your bikes and things like that.

CP: Did this manifest in an early interest in science, or did that come later?

LS: I think part. I look back at what influenced me and part was the nature thing. Part was the water. As kids, the Naugatuck River was the big river that ran through Waterbury that a lot of the factories were located on. To go down to the shore we would ride along the river. We used to play a game, "What's the color of the river going to be today?" [laughs]. Because Naugatuck Chemical was right on the river, and they released these great dyes. Like I didn't know as a kid, but it would be like bright green or bright red or whatever. As a kid I always thought that was pretty cool. Later I learned that was pollution going into the rivers. I think there were things there that got be going towards water and environmental things—just my experiences as a kid.

CP: Was there an emphasis on education in your house?

LS: Oh yeah. I mean it was the goal of being first generation Italian—it was the goal of my parents that all the kids were going to go to college. That just wasn't a question. I went to an inner-city grammar school. It was really a very inner-city experience. That's served me well. There was a lot of diversity there. Even though I didn't—at the time it was just going to school. There was a lot of diversity in my education growing up from just what the Waterbury public schools. I think that experience served me well. There was one point as my sixth grade, I think, I was pretty much helping out the teacher within the class because there was a lot of students that came in that were really behind. In sixth grade wound up helping kids in math and whatever there that were behind to catch up, so. I was definitely—Waterbury, growing up in Waterbury was like growing up definitely in a city that had a lot of different groups.

CP: It sounds like school came pretty easily to you.

LS: [laughs] I look back and my first three years of school, I don't know what—maybe my mind was just wandering, or whatever, because I'm a terrible speller, for example. So those early years of spelling and grammar were not for me. Then towards the middle of school starting to get in the sciences and math more is where I clicked, clicked a bit. As we got into things I think that I was more interested in.

CP: That was emerging for you then, by the time that you're in high school?

LS: [Nods]. By high school I had my—science and math came easy for me, and I tended to—in those days you did have some accelerated classes, say, in the sciences, so I was fortunate to get in those classes as we went along. I knew that languages weren't for me. I took German in high school—I just never got it. It was just really, really rough and even English and writing it's been a work over time.

CP: Well, it came time to start thinking about college and you made a decision that took you across the country.

LS: Actually, yeah, it actually was—my last two years were in Berkeley, but I actually went to Worcester Polytech in Massachusetts for my first two years. In my senior year I didn't know much about applying to schools and I had a physics teacher that said, "If you're thinking of engineering and science there's a small school in Massachusetts called Worcester Polytech. You should apply." And I applied to the University of Connecticut because everybody did in my family. But I got in to Worcester Polytech and got a scholarship. That was good for me because it was maybe about 200 of us that entered, 300 in the freshman class. So it was a small, small setting. I think if I started out in Berkeley I would've gotten lost.

[0:10:01]

Because just in getting through the math at Worcester and the chemistry and some of the chemistry smaller classes and things. So I started there. But then I started to outgrow Worcester, I think. I actually went my sophomore year to visit my sister in California and she just said, "Let's go to Berkeley for the day." And my eyes just like [amazed facial expression]

"Wow, this is a real university." I just went up to chemical engineering because that's what I was studying, and I said, "Do you have any openings for the fall?" And they said, "Yeah, if you're a good student, sure." So I wound up applying and that's how I wound up going to Berkeley.

CP: Wow, easy as that.

LS: Huh?

CP: Easy as that.

LS: Not that easy, really [smiles].

CP: [Chuckles].

LS: My first quarter at Berkeley I almost flunked out. I wasn't used to these big classes, the quarter systems. I was just adjusting. I just—being in Berkeley was a whole new thing than Worcester Polytech. At the end of midterms I was actually flunking out. And then said, "Wow, I really buckle down here." I pulled it out, barely at the end of the first quarter, but then I was okay after that. But it was a big adjustment going from these small towns and things to Berkeley kind of setting.

CP: How had you arrived at chemical engineering as a focus for study at Worcester?

LS: At Worcester I went up there thinking—of course, what I experienced with my dad and stuff, his construction sites and things. He always said to me, "Don't become like me. Become the engineer. They have the job." That's what he'd come back as, being a welder and an ironworker, right? I always thought I'd become a civil engineer. They build things, you know. I went to Worcester thinking signing up, civil engineering. But then I really discovered my love of chemistry, right? Then it was, like "Well, you know, I really want to be an engineer, but I like chemistry. So I honed in on chemical engineering." That's, again, being at a small school, you're exposed to these different fields of engineering. So it wasn't that difficult to go over and talk with some chemical engineers and find out, "Oh yeah, this might be a home for you." So that's how I stumbled into that.

CP: You make this shift to Berkeley and it's a much larger university and campus but it's also a massive cultural shift, I have to believe.

LS: Yeah [nods].

CP: Can you tell me what that was like? I mean, this was Berkeley at the end of the Vietnam War era.

LS: I would spend—my apartment, which that was a whole other thing getting an apartment at Berkeley, you know? It was right off of Telegraph Avenue. I would walk up Telegraph Avenue on the way to school in the morning. This was totally a kid growing up in Waterbury walking up Telegraph Avenue. It was funny because there's Sproul Plaza there. Any Friday afternoon you could go down there and somebody would be drawing a big crowd preaching something. Oftentimes you'd get these different preachers in arguments with one another. Someone that was very religious and someone that was very liberal and they would be having this discussion with this huge crowd around them. That was fun. It was really fun seeing a lot of these different characters and these discussions that would go on in Sproul Plaza on a nice Friday afternoon. That was really different and exposed me to a lot of—you know, nude people out playing bongo drums and just getting together and stuff. It was really a pretty interesting experience. Most of the protest stuff died down by the time I got there. I was there in '72. My wife was there before me. She was at Cal. She experienced the tear gas and the shutting down of—but that didn't happen when I was there. There was still a lot of remnants of what went on.

CP: Did you meet her during this period of time?

LS: No I actually met her afterwards. We lived right around the corner from one another, but we didn't know it at the time. But we met after we were through school.

CP: You spent two years at Berkeley, it sounds like?

LS: [Nods]. I spent, well, two years in Berkeley, and then after I graduated and was working I was living in Berkeley afterwards.

CP: Okay. What stands out to you when you think back on those two years of your education time at Berkeley?

LS: Some was that there was some very famous chemical engineers there, and they were older. But there was one, his name was Sherwood and he's for the Sherwood number, which is a very important number in mass transfer.

[0:14:59]

And we'd go around and say, "There's a walking number," you know, "he just went by." [laughs] So there was some very famous chemical engineers that I got to either see or have classes from. So that was pretty inspiring, because you'd be using their textbooks or you'd see their dimensionless numbers coming up when you were in class. Also chemical engineering is in the department of chemistry. I almost came out of there with a degree in chemistry. They really made us take a lot of chemistry, physical chemistry, physical chemistry lab, organic chemistry. There was a strong influence of chemistry that, even today, when I teach there's this chemistry influence just based on the classes I took and what I was exposed to at Berkeley.

CP: When you finished up there, was it your intention to go into the private sector? because you did do so, it sounds like, for a little while.

LS: In graduating, I had job interviews and at that time if you had a degree in chemical engineering there was a job waiting for you out there. It was a big choice at the time. Like I had a job offer from Monsanto, but it was going to live back east again. This is where my father, he was really nice but he couldn't understand me refusing a job with Monsanto without having another job lined up. But I wasn't quite ready to go back east. I traveled the summer after I graduated all over the west and went until I had my last dime [laughs], and then I decided I better find a job. I was working just in regular jobs to get by, and a friend said to me, "You have a job in chemical engineering I think maybe you should get a job and earn real money." That's how I wound up working for Pacific Gas & Electric Company. I finally got a job with them. It was with their research department, which was really nice. I did have a really nice experience for my first job that led me into research because that's what I was doing with them.

CP: Do you want to talk about that anymore?

LS: Sure. Actually, my job—I worked at the first geothermal power plants in the United States.

CP: Wow.

LS: They were up above Napa Valley in the mountains there in northern California. Steam would—they would drill down and steam just comes up out of the ground there. Then they would pipe all the pipes together and run it through turbines. One of the problems with the steams was hydrogen sulfide—that smelly stuff when you go to hot springs was coming up with the steam. It was an air pollution problem. My job was trying to figure out how to abate and keep the hydrogen sulfide from emitting to the atmosphere from these geothermal power plants that were already constructed. That was a real challenge. I got to use a lot of chemistry. I was out in the field 50% of the time. I'd come home at night to beautiful wine country to go biking. It was a really interesting and fun first job. But that's where some of the environmental engineering interests came from. Because my first job was really related to an environmental problem that I had to work on.

CP: So that was a coincidence? You didn't seek it out?

LS: Well when I was at Berkeley I would take elective courses in the undergrad, some environmental engineering. I'd go over to civil engineering because that's where all the environmental classes were. I took a couple elective courses. At the end of chemical engineering degree I was starting already to think about environmental engineering in some of the elective classes I took. But then this solidified that if I was going to go back to school it would've been in graduate work in environmental engineering.

CP: You did go back to school?

LS: I did go back to school. I just thought I was going to go back for a Master's degree. I actually took a leave from PG&E thinking I would be away for a year and come back and work with them. Then I got to Stanford, and I never went back.

CP: Well, tell me about Stanford. You were there for quite a long time. I'm interested initially in how—the comparison between Stanford and Cal?

LS: One was chemical engineering was centered in chemistry at Cal. Environmental engineering was centered in civil engineering at Stanford because that's where most the environmental engineering grew up in civil engineering at the time. I didn't even know it when I applied that they were the number one rated school in environmental engineering. I just picked—well, Stanford's in the Bay Area and I applied to Berkeley too for graduate school.

[0:20:03]

But I wanted a change from Berkeley because I had done undergraduate so I wound up going to Stanford. After I got there I realized some of the professors that I eventually worked with were the leaders in the field in environmental engineering. So I was lucky. It was one of those things you just kind of walk into. I knew it was a good school, but I didn't really know the reputations of some of the professors that were there.

CP: How well-developed was environmental engineering as a curriculum or as a discipline at that point?

LS: It was pretty well-developed. A lot of the components and the classes we were taught then I still use material there. Environmental engineering grew up with wastewater treatment, water treatment, the major problems that came early on. I was there when it really, these emerging contaminants started to come into play. There were these groundwater contaminants that people really didn't know existed. A lot of these trace carcinogens in water were starting to come out at that time, and the work was starting on that. There was this transition from typical wastewater treatment research, which still goes on today because there's still a lot of issues related to that, to tall these kind of emerging contaminants out in the environment and a lot of the funding started to come in to work on these emerging contaminants and things. There was this early—when I was there in the late '70s and early '80s is when a lot started to focus on these emerging contaminants started.

CP: That was your research topic?

LS: No. that's another interested story [smiles].

CP: [chuckles].

LS: I actually worked on something very different than I work on today. I actually worked on radon in geothermal reservoirs and actually how to use radon as an internal tracer to study what was actually going on in geothermal reservoir when steam was being made and there was water boiling and things like that. So I actually did my thesis on how you could measure radon and study the internal processes of what was going on in geothermal reservoirs. But that again combined, which is what I do today, lab work, field work, and modeling. When you have to put all those things together. Although it was out of the field of what I work a lot in today the research really gave me those three things that I still do a lot of today, the combination: basic lab work, field work, and then trying to put this complicated stuff together in model to explain what's going on.

CP: Computer models?

LS: Yeah, computer models. Models where you have to integrate transport and reaction in models.

CP: Probably a somewhat different approach back then than it is now, I have a feeling.

LS: Yeah, the models have gotten a lot more complicated now. I'm not really a—modeling is not my thing. I do it to try and understand what's going on. There's some people that their whole field is really modeling. I've always done modeling to try to understand what's going on in the lab or try and put it together with what's happening in the field. Still, my still programming language is Fortran, which is what I learned and programed in. But it was interesting because I got to go to geothermal reservoirs all over the world: Italy. I didn't get to go to New Zealand, but I did samples from New Zealand. I did a lot of work in Mexico. So it was really fun going to all these geothermal reservoirs and collecting samples and trying to figure out what was going on.

CP: Was this a topic that emerged out of your experience in the private sector, or was it a larger issue that was--?

LS: What happened is when I applied to Stanford, one of the professors there, Paul Kruger, saw my experience with PG&E and he had this project: "I'm working on radon in geothermal reservoirs," and offered me a GRAship in the door, "Come to Stanford." That was a funding thing. And Stanford was an all coursework master's degree, and I just wasn't ready to go in and take a year of just taking courses. So I got to do research and go in and take courses at the same time. It was like what happened with getting funding and where it was from. But it was interesting enough to keep me there to do a Ph.D.

[0:25:15]

CP: In between you got an engineer's degree?

LS: Right.

CP: What is that?

LS: Because the master's degree was all coursework I wanted to do research. But I wasn't sure that I really wanted to commit to a Ph.D. So an engineer's degree at Stanford was where you actually took more courses and did what would be kind of equivalent to master's thesis. So that's my degree where I really started to get in the lab and do research and I had to write a thesis for it. That solidified that I really wanted to do this research. A lot of people just skipped the engineer's degree and went on to get a Ph.D. degree, but this was a little way of me saying, "Do I like this research and stuff?" Actually my advisor wanted me to do it, and so I did it. That's how I wound up with three degrees from Stanford.

CP: Was it a continuation of the same topic?

LS: Yeah. So then for my Ph.D. I got more involved in the radon project and more theoretical with the modeling and what was going on. It was a nice continuation, but it took me a longer time to get through the process of getting a Ph.D. than if I had come in with that on mind that that's what I wanted to do.

CP: At what point did you start to do some teaching?

LS: I did TA-ships when I was doing my Ph.D. so a little there. Then after I went on to have a—I was a research associate after Stanford after I completed my degree. My first course I taught was when someone went on sabbatical and I wound up doing a course for them. That was my first experience of teaching a whole course. It's actually that course is like the course I'm teaching right now: "Fate and Transport of Contaminants in the Environment." I've been teaching that course here at OSU for 23 years. The groundwork for that course was this course that I didn't have when I went to school because all this emerging contaminant stuff was just starting out, but then I got to actually teach it while I was in Stanford in my post doc years.

CP: The Ph.D. was in civil engineering, was that correct?

LS: Right. At the time environmental didn't have separate graduate degrees. Often, although my coursework was in environmental and all my research was there you would get a degree in civil engineering. There was all these different disciplines: transportation engineering, structure engineering, and environmental was within that. It was known that within that you would take these environmental courses or courses that support that. I'm not the guy to build a bridge for you [laughs]. I'm actually a registered chemical engineer, professional engineer in California based on my work experience and everything. We do have these degrees on our diploma that say civil engineering, but I'm not a true civil engineer.

CP: Through that whole time period at Stanford environmental engineering was definitely your focus?

LS: Yeah. So it's focus. There was an MS degree in environmental but then the advanced degrees—the engineers and the Ph.D. you actually got in in civil engineering.

CP: So you finished the doctorate and then you became a research associate at Stanford. How did that come about?

LS: Well I was finishing up and, again, I didn't quite know what I wanted to do, whether I wanted to go back into industry, go into environmental consulting, or become an academic. I really wasn't sure about the academic part. I had some job offers, again I had a job offer from Shell research in Houston. But I declined that. I wasn't ready to go to Houston, and I wasn't ready to work for as big a company as Shell, although it would've been a very good job. It happened when I—it was a matter of timing. I was finishing up and they got this really big project that was going to be one of the first big projects on in situ bioremediation. It was funded by the EPA. One of the people that was on my graduate committee, Paul Roberts, who was the PI [Principal Investigator] of that, said, "Would you think of staying on a few years and manage this project?"

[0:30:03]

Because he saw the connection of my lab, modeling, and fieldwork. That's what was needed in this project. But it was going to be a big change for me, because now I was working with microbial systems, and I had coursework but no lab experience at all with working with microbial processes. But I saw, wow, this is the future. I accepted the job to manage this project, new in it. I was in the right place at the right time. Just one of those fortuitous things that sometimes happens.

CP: This is the groundwater contamination that you referenced earlier?

LS: [Nods]. Right. So this is all related to in situ cleanup of aquifers, bioremediation. From then I've been working in that field. I worked on a number of projects at Stanford that were some of the first—actually trying to go from the lab to the field. We had a pilot study area at Moffett Field in California, the old Naval air base where we actually had a well field and we can actually do experiments in the subsurface by injecting chemicals and stimulating microorganisms and see how it worked. I was just lucky to get in on one of the very first demonstrations out in the real world of trying to do a process like that.

CP: Can you talk about some of the milestones or the breakthroughs from this period of time?

LS: One of the first projects—and I work on a contaminant that is still a contaminant of concern: trichloroethylene [TCE] which was used as a degreaser. Any military base that did machining of planes and fixing planes often used TCE as an industrial solvent. What they would do, the practice was take it out and throw it in the fire training pit, for example, and then come and mix it up with gasoline or other things and light it on fire [laughs]. Well, over the years all this stuff was sinking into the ground because TCE didn't burn. It was a chlorinated solvent, so it didn't burn. Many of the military bases used these chlorinated solvents and you have contamination problems related to it. There was some of that at Moffett Field that went on there so there was contamination in the groundwater. One of the first projects we did is the process of co-metabolism where you grow up microbes that are growing on something else. These were methanotrophs that grow on methane and oxygen. You stimulate those microorganisms and then they produce these very powerful oxygenase enzymes that go after the TCE, so it was a fortuitous reaction.

It was one of the harder ones to start out with. But at the time this was one of the first processes that we knew that biologically you could transform TCE by this co-metabolic process. The breakthroughs there were we did stimulate indigenous methanotropes by feeding methane and oxygen to the subsurface. We did get a range of chlorinated solvents to be degraded, and I created a model to model this. I actually created a transport model that had all these coupled processes in there of stimulating methonotrophic bacteria, the degradation of the TCE. And I was able to model what we observed in the field with this model I created. That was a major breakthrough, that actually you could start to engineer these things. You could use engineering principles to actually figure out what was going on in the subsurface when you try to do something like this.

CP: Was there any intersection with politics or political controversy in this work?

LS: I would go out to some community groups and explain what they were doing. They were very exited about us. The question you usually get back is, "Are you going to simulate something that's going to take over the world?" [laughs].

What are you doing when you actually go in when you add these substrates to the subsurface? What's going to happen after you're not there? Are they going to just continue to be there? You'd have to explain: No, they'll eventually die away because they're not getting their food source any longer. There was this whole instructing the public. One of the fun things I did early on was an interview by the *Christian Science Monitor*, where they actually really sat down with me for a whole day, interviewed me about what was going on.

[0:35:02]

We went out to the field site. It actually wound up being a very nice article for the lay person of what was going on in these bioremediation studies. So I got to do some of that early on here when this whole thing of bioremediation was this whole new field. That was fun trying to—and learning how you get asked questions by someone like the *Christian Science Monitor* trying to figure out what you're doing in that.

CP: The nature of the research associate designation I'm guessing it was basically 100% research, then?

LS: [Nods]. It was 100% research but I also got working in a multidisciplinary team. Because these were a million-dollar-a-year projects. Back in the mid-'80s that was a lot of money to have to do research with. So we had interdisciplinary teams. There was 4 or 5 professors involved in the research. I self-learned a lot of the microbial stuff by reading journal articles, because my Ph.D. research wasn't in that area. I had to educate myself on what was going on and also to understand the creation of the models I was creating—what was going on in these microbial processes. There was a lot of keeping the project going. All the different components of it, how it was progressing. Then I had my research part of it, where I was actually the lucky one to get to analyze what was going on in the field and do the modeling of it. I had a very good—there was a guy Gary Hopkins that did the fieldwork that was just this amazing technician that figured out how to make all these measurements and how to do it in real-time out in the field. We created some of these databases that at the time were pretty amazing to actually create. It was a lot of fun all these different components. At the time the EPA was well-funded, so they would have a lot of extramural funding things. We were working with ADA, the lab of the EPA, that was the head of the groundwater contamination of what was going on at the EPA. It was a really fun time of interacting with the scientists at the EPA that were working on these problems.

CP: During this time period did you feel like you were motivated more out of a scientific interest or out of a moral concern for the environment, or probably a combination of both?

LS: A combination of both. I knew that I was working in an area that was important, that was really going to have practical applications. The research was important. There was also this environmentalist side of me that the research I was doing I could feel good about when I was doing that. So there was a combination of the two. And being local. There was a lot of use of these chlorinated solvents in the Silicon Valley because they were also used as degreasers early on in the manufacturing of chips and things like that. So there was a lot of this stuff coming out on the news of these pollutants of subsurface contamination that were being found all over the place in the Bay Area, so you knew that this was something that wasn't going away. It was a major problem that had to be dealt with.

CP: Your environmental consciousness, I guess, I'm trying to trace the evolution of it. It sounds like it has roots in the river that was different colors--

LS: Yes! It started out with the river, and I was a senior in high school for the first Earth Day in 1970 and someone came in from the industry and said, "Well the water that goes out is cleaner than the water that comes into our process." And I was saying, "Well, [laughs] maybe, but that's not what I've seen as a kid." There was this disconnect with industry I thought at the time with what was going on with what I observed as a kid. But then it progressed as it went along. Like a lot of when I was in Berkeley they used to tease me, the chemical engineers, about going off to take the environmental classes. I used to get a lot of: "Oh what are you going off to? You should be taking a course in palmers as an elective, not environmental processes." And I was saying, "Well, I don't think I want to work on palmers the rest of my life, you know?" [smiles]. There was a little of this that I knew that chemical engineering was a good background for what I was going to do. Even there it was starting to get that I was going to use this in environmental. And the chemical engineering background has been a great background to have for what I've done, because it does come down to processes and chemistry in what I do. Then it's interesting now my home is in a school of chemical, biological, and environmental engineering. When I first came here it was in civil, but then we put all the process-oriented people together in the school.

[0:40:22]

CP: You spent a long time at Stanford. I'm interested in a broader reflection of what Stanford meant to you?

LS: Stanford was—again, there was some of these really top people in the field. I got to work with Perry McCarty, Paul Roberts, they're both in the National Academy. Perry McCarty is the father of microbial processes, just an incredible person. And Paul Roberts was this amazing guy in transportive contaminants and things. I got to, especially in my post doc years, I got to work with both of those professors. And they had a real impact on my life, just seeing how they went about things and how they worked with students and how they came up with ideas. My Ph.D. experience was how to do research and that, and then my post doc experience I really got work with these people that really helped, that was further training that really helped. Probably if I went directly out from my Ph.D. into a faculty position I don't know how it would've worked out. Those years were really fundamental of my success afterwards and learning how to be a professor and how to work with students and trying to bring out the most you can out of students. Because that's how they treated me and I got how they worked.

CP: Not a typical path, though.

LS: Not a typical path. Not a typical path of, and again I think it's part of my background. I was the first one of my whole extended family to get a Ph.D. I was the first one that went all the way to get a Ph.D. I was blazing the path. There were no examples for me to go on growing up of what it meant to be a professor. There was just [shakes head]. There was this whole first generation thing that I didn't even realize at the time, really. I reflect back on it now, but at the time [shakes head]. But I did realize it a little bit. One student there that was at Stanford his father was a professor and he really knew what he was getting into a Ph.D. and really did a great job in getting through, but he came out of a family that there was a professor in the family. He came directly into the program knowing what it was going to be like to get a Ph.D. and doing the research and that.

CP: Well in 1993 you came to Oregon State University. Why the switch?

LS: At the time Stanford and Oregon State had this EPA Hazardous Research Center and I was an assistant. Perry McCarty was the director. I was assistant director. And I got to know the people at Oregon State and the position came up here, and they say, "Oh we'd really like you to apply." I got to know Ken Williamson, he was at Oregon State, and he said, "We'd really like you to apply for this position." A tenure track wasn't coming up at Stanford for me. I was in a non-tenure position and I had been working there for seven years as a research associate. It was time to either stay there but never be—at Stanford you couldn't be a Principal Investigator as a research associate. If I had my own research, which I started to get, I always had to do it through somebody else. It was time to say, "If I'm going to do a tenure-track position it's time to go do that." So the position came up at Oregon State. It also allowed me to bring some of the research I was already doing up to Oregon State because we already had this EPA center. It was not seamless, but I could still have my ties with Stanford because I was still working with people there and bringing in some of the research I was doing with the Hazardous Substance Research Center, I could bring it up to OSU. I had a pretty fast start getting going here.

CP: Give me a little bit more background on that Western Region Hazardous Substance Research Center. You were the assistant director from '90-'93 it sounds like.

LS: The EPA had created five centers to focus on hazardous substances.

[0:45:00]

One for each two regions of the EPA. We were the hazardous substance research center for regions 9 and 10 for the west coast. The funding there was, I think over a million dollars a year. It was a pretty good amount of funding. They have a center where you would be working collaboratively on lots of different research areas related to hazardous substances. A big focus of ours was on in situ bioremediation. We had a strong focus for research in this area we already were working on. It allowed us—there were maybe 7 or 8 different projects going on in the center at one time: some at Oregon State, some at Stanford. And then we would get together and have summer workshops where we'd talk about things as a center. It was my first experience with a big thing with multiple research projects going on within this big center.

CP: So Stanford and OSU are the two nodes more or less for this?

LS: Yeah [nods]. There are two nodes. OSU had more of an outreach part, but they were doing research too. But they had an outreach. There was an outreach program to communities that were affected by hazardous waste sites and groundwater contamination, and they were doing a lot. At the time we didn't—we also were exploring technology transfer: how do you take what you're learning in all this research and actually transfer the technology out to the real world? There was this whole "how do you do that?" as part of the center. How do you transfer this technology and get consulting firms using it actually get it being used to clean up hazardous waste sites. There was an evolution there of learning, "What do you do to do technology transfer?"

CP: It almost feels like there's a bit of an Extension mission there, or at least...

LS: It was. Part of the funding actually came down to trying to do practical things out at real contaminated sites. You could get funded and also people could come in and add money to the center. Like the Navy wanted projects they wanted done and they would bring money and funnel it in through the center but to actual work at Naval sites that had contamination problems. Having one of these centers was really nice, because you got some federal money but then you got other monies coming in from industry or branches of DOD that had specific problems that you could really go out to a real site and work there.

CP: I'm guessing then that there was a fair amount of familiarity on your part with OSU before you arrived as a faculty member?

LS: My trip up here, though for the interview—no, that's not true. I came up when I was at Stanford we had one of the center meetings up at OSU, so that was my first introduction to OSU coming up for a center meeting and I got to know some of the faculty that I later worked with when I came to OSU: Jack Istok, who is in civil engineering. He and I did a lot of projects together over the year. Jack was a really good groundwater modeler and was interested in subsurface research. So I got to know Jack, and we did a lot of work together over the years. I knew some of the people and what the type of research they were doing.

CP: I'm interested in early impressions, in part because I have to believe that it was a very significant contrast between Stanford and OSU, OSU especially at that time coming out of a major funding crisis in the state.

LS: Coming here I was fortunate to have funding already that I could transfer. As I moved out of Merryfield lab over last quarter into the new Johnson Hall, with all the equipment out of there and everything I said, "I really did research here in 24 years." So Merryfield was the 1910 woodworking shop that eventually got, whatever we could remodel it. But it was a 1910 woodworking shop. And we were trying to do this modern research. And it worked. I mean, it worked. But the facilities, let's say, were really drastically different than what Stanford had, what I was used to working at Stanford. Again, ignorance is bliss a little bit. You're happy to have a faculty position, and we did have—the faculty here did a lot to remodel Merryfield and there was modern instruments, GCs that I could go to work on right away. So that was good. But the facilities looking back, were—it was a big transition.

[0:50:04]

CP: How would you describe the state of the department when you arrived at civil engineering?

LS: I really like the faculty members in civil engineering. Environmental at the time seemed like it was bringing in a fair amount of research funds. The other area was transportation. It was doing research. I found that I was a big fish in a small pool I think when I got here, based on my Stanford experience and just getting the research going. It was, compared to now, I mean now we have just got so many talented faculty in engineering. Not that we didn't have then, but there was a strong emphasis on teaching and then the research built over the years. We were out in Merryfield and civil engineers were over in the old Apperson Hall. But they were very supportive. They were really supportive of me and my research getting up here when I first got here. It made the transition easy.

CP: Environmental engineering was not a major at that time, I believe it was—

LS: [Nods] No. So we would teach within the civil engineering program. Again, it was like my Stanford, our graduates got degrees in civil engineering, but the core of the courses they were taking, say, for a master's or a Ph.D., were environmental but their degree was in civil engineering. We started our own environmental engineering degrees, it's only been about 5 years ago or so that we actually created independent graduate degrees in environmental engineering.

CP: Were you involved in that process?

LS: Yeah. I was involved. It was a little bit of a transition going over when we went, left civil engineering and went to chemical engineering that we decided that we were going to have distinct degrees: chemical engineering and environmental engineering when we developed that school.

CP: Well you developed this portfolio at Stanford and you had funding it sounds like you carried from one institution to the next. Now you're a tenure-track faculty member and finally you can be a PI. Tell me about how things get set up and move forward once you're at OSU.

LS: I had some research that came forward with me. I scrambled a lot early on. I would take on a $25,000 grant with the Navy or I got some funding from CH2M HILL that would get me out to a contaminated site and get me samples of subsurface materials and be able to fund a master's student to get going. I started small, but even some of the cultures that I have in my lab today. There's one culture I call the "Evanite culture" that came from the banks of the Willamette River where the Evanite site was using TCE and the plume went into the Willamette River. One of my cultures that I still have in my lab today came from where that groundwater plume was intercepting and coming into Willamette River. Dug down and got the sediments.

CP: In South Corvallis?

LS: [Nods] In South Corvallis. There's this culture that's been published called the "Evanite culture," because it came from the Evanite Plant—that was the name at the time in South Corvallis. So I did a lot of opportunity things like that. There was a site there, they let us on the property, go in, take samples, and from there came some of the cultures that I still work with in the lab today. There is one from Point Mugu in Southern California. I got a little project with the Navy. They sent me the core material and the groundwater to enrich some of the microbial cultures that I work on. With time it got bigger. I got the Department of Energy grants. The Department of Defense grants. Some NSF funding. Over time it built up to some of these major, major projects that were involved in developing these microbial processes for in situ remediation.

CP: I have a list of topics, or research topics that you published on your website. I feel like we've been talking about most of them over the course of this conversation, so I'm interested I guess in learning more about what those big shifts were from scrambling to getting bigger contracts and the breakthroughs along the way.

LS: One was that eventually some of the Department of Defense created actual organizations that would fund subsurface research.

[0:55:00]

One of them was SERDP [State Energy Research and Development Authority], ESTCP [Strategic Environmental Research and Development Program] where these were funding agencies that would put out a RFP [Request for Proposal] on a specific topic. One year we kind of fit into the chlorinated solvents. I was up at OSU for a while. I got to work with Dan Arp here and we collaborated soon after I got here and we discovered groups of microorganisms that grew on butane that would do this co-metabolism of this chlorinated solvents. We worked on that together.

One of my big, first project was on these butane utilizer microorganisms that could transform a broad range of contaminants. This is where I got together with Stanford and we went back to Moffett Field with this big project. It was one of the first projects of adding a microorganism, called bio-augmentation, to try and improve the performance. Can you take a culture that you know works well in the lab, could you add it back in situ and could you help perform the native microorganisms that was there? There was this field of can you use bio-augmentation to do that? That was a big project and got me working a lot with different types of co-metabolic processes.

Another discovery at the time I was getting here was anaerobic microorganisms. Anaerobic microorganisms can actually breathe TCE like we breathe oxygen. It's called halo respiration. They actually could use the TCE as, it's called an electron acceptor and break it down that way. It was discovered that microorganisms could actually grow these chlorinated solvents. Which was a big breakthrough. Because in co-metabolism you were always growing up a microorganism in the hopes that it was going to transform your chlorinated solvent. Now we actually had microbes that actually could grow up if you fed them a donor, something like hydrogen or lactate. They would actually grow up which means you could transform really high concentrations. Those were the bugs that I got out of Evanite, actually microorganisms that could do halo respiration and really do really high concentrations of TCE.

There's been a part that's been this aerobic co-metabolism and this part that's been these anaerobic microorganisms and for a while these anaerobic microorganisms, and today they're used a lot. I worked in the lab of trying to figure out the kinetics of these and how you model them. How would you go about creating models for these anaerobes. I've been in two worlds. Some researchers are often just experts in aerobes others anaer—I've had to work on both: figure out how to work with anaerobes how to work with the aerobes. And do that type of thing. That's been a lot of fun, me having this broad range of microorganisms that I work with that do different things.

Had a lot of collaborations with DNRP. Worked a lot with nitrafying bacteria. Then it started to come in, this whole genomic revolution. Can you look at the genes and see what's going on when you expose things to contaminates, and what happens with that? I'm not a molecular biologist. Again, I was learning all this stuff on the side. I had the fortune to work with Dan here, Steve Giovannoni, we've got together and worked. I've been able at OSU to work with some really great experts who know what's going on in all these molecular methods and processes. I brought the engineering into that. I had a nice collaboration with Steve where he actually characterized the microorganisms that were being stimulated when we did this indigenous stimulation—all the cast of characters that were there and understand them. With Dan Arp we got a big project working with nitrosomonas europaea, this nitrafying bacteria with a first micro arrays—with all the genes in the genome could be put on a microarray and you could see how gene expression changed when this microorganism was exposed to heavy metals or phenol, things like that. We really had some nice collaborations of using these modern molecular methods to track what was going on when you were doing an engineering process. I've also kept my collaborations with Stanford. There's an Alfred Spormann there that's one of the experts on anaerobic molecular biology. We've had collaborations going on for 15, 20 years of how you bring molecular methods in to study these microbial processes when you're using them. That's been a really important component of getting funding—that you're able to say you're able to do this molecular work along with the engineering things and the lab things and the field things.

[1:00:14]

CP: It must also be exciting to have that toolkit at your—

LS: It's nice to have it and be able to work with some of the experts in the world on that.

CP: [chuckles]

LS: We recently had a paper come out in *ES&T* where there's a microorganism called *dehalococcoides mccartyi*, the "mccartyi" comes from the guy I worked with at Stanford; they named the microorganism after him. It's this microorganism that does this halo respiration of TCE. We were able, and I've been having these keno stats, these growth reactors in my lab, they've been running for 7 and 8 years, just continuously growing these microorganisms, and we just had a paper come out that there's all these little different strains of mccartyi that are just a little different genetically, but we were able to tease those all apart in a keno stat setting and show what happens if you change the growth conditions. How do the populations change inside the reactor using molecular methods? Then I track it based on the kinetics. Yes, the kinetics are changing along with how the microbial population is changing in the keno stat. It's gotten to the point where you can pick out the different enzymes that are being expressed, levels of expression, and what happens in an engineered system when you make a change. It's been a fun time of being able to combine the molecular methods with the engineering and the lab work.

CP: Where have been some of your more primary fieldwork sites over the years?

LS: I've worked at Moffett Field, which was a continuation where I continue to work there. I've worked at Navy Sites, Point Mugu. I've worked at McClellan Air Force Base in California. We did projects on co-metabolism there. Fort

Lewis. I've done work at Fort Lewis. Recently done some work at Fort Carson in Colorado. So a variety. We'll be starting up a project this year down in a Naval base in San Diego, one out on the island there where there's a mixture of contaminants I've been working on. Recently it's become that they put things in chlorinated solvents to stabilize them that are contaminants themselves. There's one called 1,4-Dioxane and now we found we have 1,4-Dioxane plumes mixed with all these chlorinated solvent plumes. It's getting more complicated of how you actually transform some of these emerging contaminants that were there, but we weren't measuring for them. We weren't thinking of it, and they're at low concentrations. Then when we went looking for it, we find that there's these 1,4-Dioxane plumes and it's a suspected carcinogen. It's getting more complicated. A lot more now dealing with mixtures of contaminants and getting out to field sites where you have these mixtures and things.

CP: You've had a connection with ONAMI [Oregon Nanoscience and Microtechnologies Institute] as well, is that correct?

LS: Yeah. So recently a number of things. We started working with the chemical engineers more. We have a project that's funded by ARPA-E, which is an advanced research thing at the Department of Energy, and it's trying to take methane and convert it to biofuels. This is more a bioconversion. We've been working with Goran Jovanovic on micro-reactor technology—how can we take microbial processes and put them into an advanced reactor and try and take methane, which there's a lot of excess methane right now in what they're doing in fracking things that's just being wasted, it's just being flared off to the atmosphere. The Department of Energy is interested in could you take that methane and convert it into a liquid fuel or used for projects? But it gets me all the way back working with methanotrophic bacteria, which is the first bacteria I worked with in bioremediation. Now it comes around we're actually trying to use methanotrophes to do a process that's useful for making a liquid fuel. That's now bridging into areas of fuel production, things that maybe you could take something that's being wasted and make it into a valuable resource. That's been a new focus area.

CP: I have a question about this particular moment of time that we're in right now and the threats to funding of science. Is this something that's been circulating in your world as well? Especially when we talk about the EPA?

[1:05:07]

LS: Yeah, the EPA. It even comes up when you're teaching the undergrads, and they're going into environmental engineering and they're starting to say, "Oh did I make the wrong decision?" You try and say, "Well, we've been through this before, and things go in cycles and hopefully this is just another cycle." When I was at Stanford we went through the Ronald Reagan years and he wasn't necessarily a friend of the EPA, but we got through it. We're just hoping that this is a cycle, but a lot of the professors in their early career they're concerned of funding out of EPA and what's going to happen or even the National Science Foundation that funds a lot of the basic research, concerns of what might happen in funding there. You work all these years on things to clean up the environment, and a lot of that is regulatory-driven and even our students, when you go out—I have a lot of students that work for CH2M HILL in town, and they get concerned about when you start lightening up on the regulations the industry doesn't want to spend the money on environmental cleanup, so it has an impact on the jobs out there too.

CP: A couple questions about administrative posts. You were the director of the Western Region Hazardous Substance Research Center for 5 years. What did that mean for you?

LS: When I got here, Perry McCarty who was the original director retired and we were looking for who would take that on. We first asked the professors at Stanford, but no one was interested in taking it on so I decided, okay—it was write a whole new proposal for a second round of funding for that. I was involved with writing that proposal for the EPA and getting all the teams together to work on projects and things like that. That was a lot of work, but it was a lot of fun. What happened there was that we thought that would go on for 10 years or so, but the EPA got funding cuts so that center ended after 5 years, so it didn't go on with Oregon State being the lead and me being director for as long as I would have liked.

CP: What is the OSU Subsurface Biosphere Initiative?

LS: The provost years ago they decided to do these competitive initiatives to create centers of excellence and they actually put out for proposals for the faculty, and I had been working with Dan Arp, Peter Bottomley, talked to Marty Fisk over in—we had one of the first IGERTs, the first IGERT that came to OSU was a subsurface biosphere IGERT, that's the NSF IGERT training-ship program. We had been working in this IGERT and then these initiatives came up by the provost and we said, "You know, maybe we should put one together on the subsurface biosphere." We had people in microbiology, oceanography, engineering all doing things together. We were already working on this IGERT together. That became of that was the ability to hire people. We got $1.5 million in funding. We used that as leverage to help get people hired in that area. Over the course of that I think we helped in the hiring of 5 different faculty members to come to OSU to work on subsurface biosphere processes.

CP: Are they still here?

LS: Yep, they're all still here and they're all doing really well.

CP: Wow.

LS: It helped us come together. We would go to the dean and say, "We have some money. We could use it for startup packages if you're interested in hiring someone in this focus area and we'd help out with the startup packages." We also did a thing that was a lot of fun. We did an undergraduate research experience in the subsurface biosphere. We had up to like 20 to 30 undergraduates in the lab over the summer working with various professors around OSU getting experience. We also did that in the subsurface biosphere initiative.

CP: Tell me a bit about your evolution as a teacher.

[1:10:01]

LS: [laughs] Well, it's been interesting. I've been teaching it'll be 24 years in March, and I've had the fortune of teaching some classes for a long period of time. Like this "Faded Transport of Contaminants in the Environment," I've been teaching. I teach a course in groundwater remediation. Now I teach the capstone design class for environmental engineers, which is like their open-ended project that they have to do as seniors. Since I'm a registered chemical engineer, professional engineer with a license, it falls on me [laughs], because they want a professional engineer teaching this class. It's broad. I have 2/3 with undergrads and a 1/3 with graduate students by teaching the courses I teach. Some are split level. My Fading Transport I have seniors in it and graduate students in that class.

I like the chemistry and I like the process stuff, so all the courses I teach have a little bit of what I do in the lab or bring in lab examples to illustrate things there. I try and do show-and-tells with the students and I'll bring in a bottle from the lab that has sediment and groundwater in it, and say "Well, in order to deal with this we have to make mass balances and we have to figure out what happens when things react and things like that." Then I'll bring in parts of trying to do some modeling and things like that with it. I do like the teaching part. I don't like the grading part [laughs], but I like the teaching part of my job. I do like working with the students.

CP: What sort of reputation has environmental engineering developed at OSU and the students that graduate from here?

LS: I think a very positive one. Our students at the undergraduate go off to graduate school. I hear great things back. When they go out on internships I hear really good things of how prepared our students are. I hear things from like local CH2M HILL like how our students really rise up in that company. They say, "Geez, they're really well-prepared when they come out of your graduate program with master's degrees and things." We get very good positive feedback of how our students are trained.

CP: It sounds like there's a strong connections to CH2M HILL. It's presence is far smaller than it used to be in this community.

LS: Yeah. But one of my original, my second master's student is over there—Mike Niemet. And I will often get a call from him, "Who do you have finishing up and do you recommend them?" Over time we seem to—there's probably five students that graduated with me that are over working at CH2M HILL over there and some have gone to different parts of the company over time. There's been that strong connection of them hiring our students. But then our students are all over in consulting firms over the Northwest. I think a lot of schools have gone to all-coursework degrees, and we still have a master's thesis of them getting in the lab and doing a master's thesis and I think that's what separates our students from students that just go and get an all-coursework master's degree, is getting in the lab, doing research, writing up a thesis really prepares them well for when they get out in the real world.

CP: I have a couple questions about institutional change. You were hired into the Department of Civil Engineering and then in 2000 the department became Civil Construction and Environment Engineering and then in 2007 became the School of Chemical, Biological, and Environmental Engineering. What do these changes mean? What do they mean?

LS: When I was in civil, environmental got incorporated into the main when we developed the Environmental Engineering undergraduate degree. We did bring—one could get a BS degree in Environmental Engineering. We were still in Civil Engineering at the time, and then environmental got incorporated into Civil Engineering's name when we had that degree established. Then when we left civil engineering and went over to chemical engineering we already had our environmental engineering undergraduate degree so the name came with us to form the School of Chemical, Biological, and Environmental Engineering. Right now we have 3 different degrees over in that school: Chemical Engineering, a Bio Engineering degree, and Environmental Engineering undergraduate degree.

CP: Did these feel like significant shifts for the faculty?

LS: Not really. One of the reasons it wasn't as significant—and a lot of places you wouldn't get the environmental over with the chemical engineers. There's lots of reasons for that. Here, we had a department head, Ken Williamson, who really grew the environmental program here. There was one time where he was both the school head of civil and the school head of chemical at the same time.

[1:15:26]

CP: [chuckles]

LS: He just said, "This is going to happen." And it happened. At the time the dean wanted to do this, wanted to get all the process people working together in one place. The outcome of that is we're now in Johnson hall where the chemical, biological, and environmental engineers are in a nice new building and the labs are for process kind of research.

CP: I have to believe that's a big step, Johnson Hall, relative to Merryfield Hall at least.

LS: Yeah, it is a big step. We have really beautiful facilities now to do our work. Our analytical room with all our instruments is state-of-the-art. It's really a nice facility. And just right now I could walk out and go find my graduate students—they're desks are right across the hall from the lab, and I could go there and get into lab really probably more than they'd like [laughs]. They're seeing a lot more of me know than in Merryfield where I had to walk from my office to the back of Merryfield and go find them in the office that was removed from Merryfield.

CP: Just a couple of concluding questions, and they're both about change. The first would just be about the changes that you've seen within the College of Engineering and the trajectory it's on right now.

LS: I sit on the faculty status committee of the college, so I'm part of the committee that reviews all the promotion and tenure decisions that are made, so I really get to see the CVs and resumes of all the people. We just have some really fabulous people, some young people coming up that have come along the way. Engineering have made a lot of really good hires, a lot of hires in the recent years but they've gotten some really good people here. There's lots of good things that are going to come out of engineering now and in the future.

CP: It's been a major point of emphasis for the university it seems for at least a decade, engineering.

LS: Yeah, and it's been driven by enrollment. There's lots of increased enrollment in engineering. The resources did start to track where there was increasing enrollment, so there has been a focus. There's been a lot of new hires. We've had a lot of new hires in our school over the past couple of years. A lot of that has come out of in support of increased class sizes, getting more faculty there and teaching more classes.

CP: On a broader level, where do you see OSU as being situated right now as it looks towards it's 150th birthday?

LS: That's a tough question. I do see that there's been a lot of good investment in facilities around campus. There's lots of really good people that have been hired. A little is getting the name out there, of OSU. Really, we have a lot of these people that could be faculty in other places, a lot of top schools here. Keeping them here. I think with time it's going to get more noticed, the work that goes on here. I've been privileged in that there's been low barriers for cross collaboration on campus. That and being able to do some of the things I've been able to do because there's been a low barrier of working with someone in microbiology, for example, or in working with someone in environmental toxicology and chemistry or working with someone in civil engineering. I think one of the things that OSU has going for them is this low barrier for interdisciplinary research, and that's where this all is heading in what we do these days. You can't just be an engineer working on microbial processes without having some molecular biology going on with that in order to get funded. These low barriers for interdisciplinary research are pretty important.

CP: Well, Dr. Semprini we've interviewed one-hundred faculty but only one environmental engineer, and I appreciate you taking the time for us and the best of luck moving forward.

LS: Thank you.

[1:19:49]