INTERVIEWER: This is the 150th Celebration interview with professor John Essigmann. Let me start by saying where did you grow up?

JOHN ESSIGMANN: I grew up in the neighborhood. My parents were brought up and lived in my early life in Woburn, Massachusetts where I lived until I was four. We lived with my grandparents on a small farm there. Then at the age of four moved to Medford. I went to public schools there. Then grew up in Medford and then went to college at Northeastern and then came to MIT for graduate school. So I've never actually lived more than 10 miles from here. So not a lot of imagination there, but it's a great place to live.

INTERVIEWER: Tell me about your family.

JOHN ESSIGMANN: The family. Let me start with my grandparents since we had lived with them when we were very young. So as I said, we lived with my grandparents in Woburn, and my grandfather was a German immigrant, a tanner. There are many interesting stories. He worked in the tanneries that were the subject of the book, *A Civil Action*. In fact, he died of a primary liver tumor, and ironically that became my field many years later, and I'm probably more qualified than anybody to know that that was almost certainly and industrially induced tumor because we don't have much of that kind of tumor in the United States. So he was a tanner.

My paternal grandmother was an Abenaki Indian from northern Vermont. They had met -- he was a mill worker, so tanners went wherever there were mills. He happened to work in a mill, and my grandmother, he stayed in the same home where my grandmother lived. As a Native American, so at the age of 15 went to work and was working as a nanny for a doctor's family in northern Vermont. They got married and moved to Woburn. Had a small farm, almost completely self-sufficient.

Then my dad turned out to be very good in math, so he got to go to college. He had a great experience, both at Tufts University, and then he switched to MIT from which he graduated in 1947. Very good engineer, and I think that's where the beginning of my connection to MIT happened.

So a little bit more about the family. My dad, the household in which he was brought up, being brought up on a small farm I think is very telling. There wasn't a lot of money around. You had to fix things that were broken, there were animals that needed to be tended. I can still remember, my earliest memories are really of my job as a four- year- old was to feed the chickens. So my grandfather could build almost anything out of wood. So his day job was as a tanner, night job as a parent and keeping up the farm. My grandmother worked as a seamstress, taking in things that need to be sown for local people. What I can remember is that she, because of her background, never threw anything out.

They didn't buy a lot because it was a farm, they didn't produce a lot of waste. So, for example, if there were a plastic bottle, just to take one example, and it had colorless, colored, whatever. When she was done with it, she would find another use for it to store things. But more commonly, she was very artistic, she would cut it up and make plastic flowers out of these plastic bottles. I always think of the film that I grew up with, *The Graduate*, where there's this line 'plastics', and I always think of my grandmother when that happens, because that was her line, 'plastics.' This is something very useful.

If anything broke, like if a ceramic cup broke, the pieces were swept up and then she had kind of a clay that she would use to make her own pottery. She'd keep all of the broken pieces of ceramic and metal, whatever, and she'd embed them into the ceramic of these pots and so on. She'd make flower pots and teacups and all kinds of stuff. So nothing was ever wasted from their home. Sort of like at the end of the week when, as we called it, the Ashman, showed up, there was just a little tiny package of stuff like banana peels that perhaps-- well, no, actually banana peels they put in the compost.

So, I think that that environment conditioned my dad to become an engineer. He became an engineer, as I said, trained largely here, and then went off to his career at Northeastern where he was a teacher.

INTERVIEWER: So, in this environment, when did you first know that you interested in science?

JOHN ESSIGMANN: Well, my dad was an engineer, but he was really good with math. In fact, he taught at Northeastern. His main role was to teach math to engineers. So as a kid it was just logical to go to dad to ask for help with math. It was striking to me how little science he knew. We distinguished math and science. He didn't know anything about chemistry, he certainly didn't know anything about biology. He knew about physics, but not the broader areas that are taught here at MIT, for example. The freshman year at MIT is physics, chemistry, math, biology and then a humanities. He didn't have a strong science background.

So, I was brought up in a math-oriented environment thinking about problem solving, I think which is something that engineers do. But it was not until high school, I think. We had a really good biology and chemistry teacher that -- I think it's so important how one teacher can influence a pack of people. My two sisters and myself went to the same high school. We all became biology majors at the same college, Northeastern. One teacher can have that kind of an impact. Phenotypically I've gone off and studied chemistry and engineering and other things. But I think that I picked it up in high school.

INTERVIEWER: Did you choose to go to Northeastern because your father was teaching there?

JOHN ESSIGMANN: Yeah. The times were very different. I would say that I didn't give a lot of thought to college. I didn't come from a family where thinking strategically about college for the kids was something that was on my parents' minds. I think my parents had the view that things will always work out, and people find their way. Just think for yourself. I didn't even know you did things like study for SATs. You just showed up and took them, and didn't realize if you study for them you could get a higher grade. The bottom line was that for me going to college was something that I didn't really think much about. It was a preparation for a career. I really felt that going to college would give me the next step. I thought I'd only go to college and I'd get a job. That's what most people did.

I got to go to Northeastern for free because my dad taught there. So my two sisters, and myself went to Northeastern. My mother got her Bachelor's degree from Northeastern. She was a secretary, helped put him through school, and then took advantage of the financial benefit. We all get employee benefits and she got to get a break on tuition at Northeastern. So, my two sisters, myself, and my mother all got our undergraduate degrees from Northeastern. It was a great place. I think it still is. It's a great place.

INTERVIEWER: You also did sort of an interesting thing at Arthur D. Little while you were at Northeastern. Can you tell me a little bit about that?

JOHN ESSIGMANN: So, let me tell you about the Coop Program at Northeastern. One of the reasons that Northeastern became well-known was because it had a decent education program. But what happened was you would go to school for three months and then you got a job working for three months. The jobs were good. If you did well academically you'd get an even better job than someone who didn't. But everybody got a job, so they're called Coop jobs, in your field and it helped to prepare you for your career. As I said, a lot of kids from Northeastern went off right out into the industrial world. So these were for teaching or whatever -- a big education program at the time.

So one of the big selling points of Northeastern was the fact that you could get a job, and not only was that experience, but you could almost pay for college, going through your five years. It was a five year program. So that was attractive to me. I'm not going to say I chose Northeastern for that reason because I only applied to one college, to be honest with you, Toby. You could apply one place and you'd get in. But it was something that from birth was in my mind. Through my dad having his students over to visit and up to our cabin in New Hampshire, I got to see this wonderful impact that working had on the undergraduates. It's as good if not better -- maybe a little bit better than our UROP system, which I think, if you look it up, what we do in our undergraduate research opportunity system, that's about the best thing that we do for our undergraduates.

So Northeastern provided a great opportunity to get out into the real world. It provided an ability to graduate for a lot of kids without debt or with minimal debt. And it provided access to education for a lot of people that otherwise wouldn't, and in particular in the Boston area, that otherwise wouldn't have access to education. May I say a little bit more about Northeastern. It's reminding me of some other things from the time.

I had a friend who was in high school. He got admitted both to MIT and to Northeastern. He ended up going to Northeastern, and he was saddened by this. It had to do with the fact that he came from a very lower- middle class background, he was Italian, the first generation to go to college. This was before MIT had, what we call now Need-Blind admissions. So family finances were absolutely a factor, and this fellow's first name's Ernie, his ability to go to MIT. I can remember during our freshman year at Northeastern we came over to walk on the campus, and Ernie was feeling kind of bad. We were standing on this little atrium that's outside of Hayden Library. And he was just, gee, I think that I possibly would have really a much greater shot at success in life if I'd had the opportunity to come to MIT. Ernie did fine. He came here for graduate school. All paid for, because we pay for graduate school off of our research grants and so on.

But I think that one of the things that I would look at that has -- Northeastern filled an important role at that time for taking a lot of kids who were quite intellectually gifted, giving them the opportunity to get a good education that would allow them to go the next step. I think that among the many things that I admire Chuck Vest for was really putting his foot down and saying I don't care if we're going to suffer trouble damages and Federal lawsuits, we're going to defend our financial aid policy, Need-Blind admissions. That means that MIT is able to provide access to education for just about anybody. I think it's a terrific thing.

INTERVIEWER: I agree. So we didn't talk about Arthur D. little yet though.

JOHN ESSIGMANN: Oh, let me tell you Arthur D. Little. So, you get a Coop job. In my case, I'd been very interesting in athletics all through growing up, skiing in particular. I always wanted to stay busy. In high school I had a job as an orderly in the emergency room at a local hospital in my senior year and in my first year of college. It's in your second year of college that you get your Coop job. I was a biology major. At that time I was thinking about going into medicine. Every job I've had I've loved. The one when I was a senior in high school and first year in college as an orderly in the emergency room, I got to see -- well, I delivered two babies. It was an accident, but in the middle of the night people come and there's a baby on the way. I had a baby, very sadly, die in my arms. It was what they call a blue baby. And I got to experience an amazing range of things. It told me I could be a doctor and I'd really like it. But there was a problem for me. I noticed that medicine was what I knew.

Everybody knows what a doctor is and what a doctor does. It's a great default option. It is, I think, for a lot of students at MIT today, but there's a bigger world of careers out there. So I thought, well I can do this medicine thing. But one thing that's a little bit of a problem for me is that it's enormous excitement punctuated by these long periods of boredom where you're doing the same thing. How many times can you remove a sebaceous cyst and have it be interesting? Whereas sometimes you're going to see something strange and it might be malignant or something. So you have to stay focused every minute. There was a lot of boring aspects to clinical medicine.

So I learned later that a lot of people go to MIT, they get into more of the diagnostics, and they get into the real specialized stuff, which is not routine medicine that happens in a little local, Lawrence Memorial Hospital. So when it came time to picking a coop job, you have a Coop advisor -- I forget her name, Carol something -- and she sat down, she said, John, you're a biology major. You can keep that job you've got in the hospital, that's good. I said well, what are my other options? She said well this is where advising comes in. She said, I noticed that you do very well in chemistry. We have an opportunity, she said, one of the best Coop jobs in Northeastern is with this company industrial consulting company called Arthur D. Little. You've got a personality such that you're a team player, you've had a lot of work experience for somebody that is 18 and a half. I'm going to send you out, you can interview for that job. They don't take biology majors, only chemistry majors. They may require you to change your major, if you like the job.

So I went, I interviewed, it was amazing. I got offered the job. I didn't have to change my major, which was good. I worked for four years in the analytical chemistry group for Arthur D. Little on projects that literally -- the way I often put it is that the job they first gave me involved weighing something out, diluting it to ten milliliters, making a 1:10 dilution, putting it in a machine, making a measurement. And talk about boring, I mean the hours just flew by. I just knew that lab science, bench science, was the kind of thing that was for me. I couldn't even believe they were paying me $8.75 an hour to do this. It was like amazing. First day I made up my mind, I'm going to be a laboratory scientist. That was interesting because all my friends went to medical school, because I was in the biology class. I was not competing with them at all. I just said I'm going to become a scientist and then I made my career plans based on that.

Let me give you two examples of why Arthur D. Little is a great place to work. It's something that I think contrasts a little bit with the UROP system here. So first of all it's eight hours a day normally, but everybody works 10 to 12. The problems can change on a daily basis or they can be you have some problems that you have to drop everything and work on because something has happened. When I was there, Ted Kennedy's car tragically went off of Chappaquiddick Bridge. Mary Jo Kopechne passed away, and the Kennedy family wanted to know if the brakes were operative on the car. So the day after that, the car was towed into Arthur D. Little. So this was something that everyone needed to drop everything in order to solve a problem because the press was very interested.

Example two, brominated vegetable oil. *New York Times* runs an article in the morning edition that says there's Sprite in his Fresca. Basically brominated vegetable oil might be used in one or the other to stabilize the grapefruit emulsion. Our client -- I'm not going to say who it is -- it was either the makers of Coke or Fresca or Sprite, contacted and they said what we'd like to do is to know is our competitor using brominated vegetable oil, because someone has declared that it causes cancer. We've got to know by noon. As the person at the low end of the food chain who's always available, I was given that job and I had until noon, and at 11:15 I go out to the supermarket to pick up Sprite and Fresca and you bring it back and you do an x-ray analysis and it tells you that there wasn't any bromine there.

So, at 11:59, a 19-year old gets on the phone with our client and says your competitor is not using brominated vegetable oil. Long pause. That cost him a lot of money to find that out. Then I said, but you are. Then long pause. Then they said, how much will it cost us to find out what they're using? We had a grant -- we called it contract at that time. So as a 19-year old, I had a chance to -- everything was about filling out your time card -- as a 19-year old, I had a chance to do business, as well as science, and learn what my time was worth, had access to world-class instrumentation.

Two other stories. One was in 1967 a man at Yale, a chemistry professor, invented high pressure liquid chromatography, which is a separation technique. Every lab has one, my lab has five of these machines. So it was invented in '67. But then after 1967, there's a big push because now someone had invented an academic lab, now it was an engineering problem. How are we going to make a machine? How is this going to become commercially something that you buy for $10,000, $20,000 -- a machine that you'll put into every lab. Picker Nuclear was our client.

They became Varian Aerograph, a major instrument manufacturer, hired Arthur D. Little and said we want to be first to have a product on the market, please drop everything for a year -- so I worked on this for a year -- we would like to have the first commercial HBLC. I was part of the seven-person design team. It was absolutely spectacular. It was so much fun. Imagine your application to MIT that comes after that, that you've got intellectual property. In fact, I had a company providing some of the material that went into these machines. So I got to work with a great group of chemists and chemical engineers on instrument design, and again, thinking about money -- commercial success was important.

Then finally, there was an artificial sweetener that some of you may remember called cyclamate . It was between saccharine and aspartame in history of artificial sweeteners. The Sugar Research Foundation wanted to know if cyclamate were bad for people. There was no evidence of this at the time. But they needed to find out. It was in the Sugar Research Foundation's interest to find out if artificial sweeteners were bad, as compared to sugar, which now we know causes obesity. But it wasn't an issue at the time.

So, this is again, it's in the late '60s. The Environmentalist Movement is afoot. People are concerned about chemicals in our environment and do they cause disease. So my job was to feed people in prisons -- it's not legal anymore -- and in hotels, that lived in hotels, cyclamate at one and three grams per day, and then I would collect their urine and feces and look to see whether the one and three grams of cyclamate that went in also came out. It involved a lot of analysis of feces. That's one of the strongest tests of your stomach for science is to analyze people feces. Again, I thought that was a great job.

So when I chose what I was going to do next, I thought working at the chemistry biology interface, I was really trained for that. And through this instrument design, which had a lot of impact on the life sciences world, and working with patients in clinical trials, and developing the analytical methodology that underpinned the trial was important. But also the fact that our results showed that the stuff was broken down in people. Again, as a responsible scientist, this came out, we published this in the literature. I think it led to the removal cyclamate from the market.

Almost the day I started MIT, cyclamate in 1970 was removed from the market. I felt as though I had a -- you know, scientifically I don't have a view one way or another on whether -- I don't say I'm going to study this because I want it to be removed from the market. But I studied it and we got data that said okay, it's important to get this off the market, and then let nature take its course and the politicians removed it.

INTERVIEWER: Tell me how you wound up going to MIT.

JOHN ESSIGMANN: How did I get to MIT. I mentioned I just sort of stumbled into college -- I applied to one college, I got in, and then just let the eddies of life just sort of guide me, went from one job to another. I've got to say it was really almost the same thing when it came down to coming to MIT. In the fall of my senior year, my boss, a man named John Funkhouser called me into his office at Arthur D. Little, and he said, you know John, we would love to have you stay here and work here. Lots of people make a career working in science doing exactly the kind of thing that I know you love doing. He said that all the department heads have got together, but we want to provide you another option, which is it's time to think about graduate school. It's the fall of your senior year. I hadn't really thought about it. The Vietnam War was going on. I was thinking, like everybody, your student deferment would end and I'd probably get drafted or something else. The late '60s were a very tumultuous time in the United States.

So John Funkhouser, he said, we all went to MIT, he did, said and we've made a few calls. If you really want to go to the chemistry department, that's where we went, we're chemists, and you basically can get in. You've got the credentials for it. They're not going to bend over and lower their bar, but it's the place for you. And I said, geez, my dad went there. It's not something that's been a dream of mine since I was young, but my dad was a real practical guy, I admired my dad a lot, and I'd certainly like to go and interview.

So I came to MIT in the fall of 1969 for an interview. It turned out the chemistry department was just closing out one of its divisions. It was the analytical chemistry that I was interested in. It was the only division that had an interest in making measurements on biological systems. I didn't understand why. I understand today how institutions like MIT make decisions. You know, we're a finite size, if you're going to open something new as a new field's created, you gotta take something away. So MIT was at one of those moments of soul searching of what they should do. So they were basically saying okay, we're cutting off this division. It would be the one that I would want to join.

So I decided okay, this is what I wanted to do, but I can look at other places. On my way walking out, I remembered a family friend I hadn't seen since I think I was 10- years- old, and her name is Emily Wick, and she had received her PhD from MIT. She was an undergraduate at Mount Holyoke. Received her PhD in the chemistry department at MIT. When I was a kid being brought up, my dad who had gone here and Emily Wick were in a social circle of people who loved skiing. Every weekend they would drive up to the White Mountains, they would climb Wildcat Mountain, there was no snow ski lift at the time. Then they would ski down, a group of MIT people -- it would be like the outing club, the MIT Outing Club today. Emily was in that crowd. I remembered that she had worked in industry and then gone back to MIT. I assumed she was in the chemistry department, but it turned out she wasn't. She was in what became the applied biological sciences department.

So I just decided to drop by, though she was a dean at the time -- one of the undergraduate education deans. Her secretary Dottie Bowe, isn't the most friendly person in the world, recently passed away, and I said I doubt that Professor Wick would even remember me. My name is John Essigmann, and I'm just passing by if she happened to have a minute. So Dottie went into Emily's office and I heard this scream, "Johnny!" Which is what I was called when I was a kid. She certainly had remembered me. She sat down and she talked with me, and I told her why I was there, after all the family stuff. Emily said ah, you just applied to the wrong department, that's all. She took me over and she introduced me to the people in what became the applied biological sciences department, than it was called nutrition and food science, and they had a toxicology group. There was just immediate resonance. It was what I wanted to do.

So, moved the application to that department and the rest was history. So that's how I got to MIT.

INTERVIEWER: Do you remember what your first impressions were of MIT, of the culture, and the students, and the faculty.

JOHN ESSIGMANN: Yes. I remember what my first impressions were of MIT. And again, this is somewhat conditioned by the fact that I had been an undergraduate at Northeastern, which was a school that taught allcomers from the neighborhood. Northeastern was men and women and different races, I mean diversity central. Because they had taken away the -- first of all had an education school, and a lot of women at that time were interested in becoming teachers.

The second thing was they had provided access to education. They were taking away some of the financial barrier. But my first impression walking down the Infinite Corridor was this is incredibly white and incredibly male. It was that way for about four or five years after my arrival. I thought this must be a very boring place. Then you'd heard of tech tools -- I don't know if they still use that term or not. I was afraid that this would bore me to death, to tell you the truth. But then again, they had just invented UROP I think the year before.

When Emily took me to visit labs in her other department, there were undergraduates there. While they were all white and male, they had a great time. Almost all of them lived in the Greek- system, they were brothers. They had obviously a culture that went back many, many years with events that were held all the time. Playing hockey in the alley. Things that just were really cool. So I found that I really liked the undergraduates, that while they were a little mono-dimensional, I found that they weren't geeks and nerds, they were real normal people and that I'd liked them. Then, of course, it became better as MIT diversified later. But my first feeling was this is awful white, awful male, and I don't think I'm going to like it here.

INTERVIEWER: During graduate school, did you have any particular mentors or influential professors who stand out?

JOHN ESSIGMANN: Mentors in graduate school, many. I found that coming from Northeastern, everybody has some self-doubt, and everybody has self-esteem issues. My classmates in graduate school had gone to these really elite colleges. A person who became my very, very close friend, who later became the MIT Bursar, Shirley Picardi. Shirley was introduced to us at our first gathering of graduate students as the top Harvard chemistry graduate in 20 years. People, not realizing how that could -- taken and deflate the egos of others. But they were real proud of Shirley, and they should be. For my wife, Ellen and me, and Shirley and Tony Picardi were our closest friends in graduate school.

So it was a little intimidating, and so you needed some support. I think that one of them, one of my things to support my self-esteem came from the fact that all this experience I had as an undergraduate just gave me -- I was like years ahead with regard to be able to design and do experiments. Doing lab work was always easy. Classroom, what I found was that some of my mentors were people like Shirley. I learned what it was like to work in a group of contemporaries, and they had worked in groups as undergraduates. I'd worked with my wife as an undergraduate. We were undergrads at the same place at the same time studying the same thing. This was a big group. I learned that MIT gave you problem sets every week that are harder than an average person can answer. And they expect you to work collaboratively to solve the problems. Some of these other graduate students were really good at this. They just knew how to organize a team and solve a problem and then we would go have fun after that. It was very nice.

My first older adult mentor is a man named Jerry Wogen. He became my thesis advisor.

INTERVIEWER: And a ski buddy.

JOHN ESSIGMANN: Ski buddy, that's right -- I taught him how to ski. It was a reciprocity here to a certain extent. Jerry became my thesis advisor. He's still one of my closest friends. He just turned 80 years old. He has just an incredible style of being able to see the minute details of any complicated problem. But being able to zoom to 30,000 feet and be able instantly to express how it affects the person on the street. That kind of ability to shift perspective. He taught people from his lab, and I think that you'll find a lot of people have gone out and done work of some impact or as perceived as having impact to people only because they're able to communicate with anybody about what they did. Make it understandable. My dad and I were very close, and I look at Jerry as a father figure as well. And since my father passed away, increasingly Jerry has maintained the older adult that you go to in times of trouble when you need wise advice. So, Jerry Wogan.

Then there's our other partner in research, George Buchi, a chemist's chemist. In chemistry, chemistry has more beauty to it, and you're like an artist, you make molecules that haven't been made before. But how you make them sometimes is really important, because at the end of the day you want to sell them. The fewer the steps, the more money you make. It's pure MIT economics. George was really good at keeping the number of steps small. He had probably the most critical, analytical mind that I've ever met. Every time you sat down with him, you have to bring all the data. He would take calipers out of his desk and make his own measurements on the spectra that you brought him. He would find every reason to undermine your conclusions. Then send you back to think of experiments that you would never be asked to do any place else. In the long run he taught you to raise the bar, to have standards that were of this place, I think. So that was George's mentoring role.

Then a third person I'll mention is Steve Tannenbaum. Steve is the ultimate generalist. He was an undergraduate here, graduate student here. What they call a lifer. Actually, I don't know if you've heard that term, but he's an MIT lifer. Steve, pound for pound, is probably the most versatile scientist/engineer that I've ever met. It doesn't matter what the problem is, he's able to pull out of 50 different fields tidbits of information that put together a framework in which you can operate and ask questions. Not always right, but he's right often enough that it's truly inspiring to just sit down with him and say here's a problem for you, Steve. Can you think outside the box? And he's never lived in a box, so he's just able to go like all over the place.

A fourth person might be a man I didn't really know that well but admired a lot, Sam Goldblith, a former vice president of MIT. Sam is perhaps best known in the administration as being a brilliant fundraiser. He, again, was a lifer. He was drafted or enlisted in the military the beginning or World War II. Was part of the Bataan Death March, and both Japanese and westerners have acknowledged over the years that they were able to stay alive because of Sam Goldblith's ability as an engineer to be able to keep them alive. You can imagine you're walking through a jungle and you don't have a lot to eat. You gotta make sure that you're eating stuff that you can eat, but then at the same time, maintain a microbiological standard that will keep you from getting diarrhea or any kind of infectious diseases.

So, Sam received a lot of accolades after the War, not only for helping our side, but the Japanese as well. That began a career in international service that resulted in him winning, I forget, it's whatever Japan's most senior accolade they give to a person who isn't Japanese. So it began a lifelong -- War began a lifelong friendship with your enemy that resulted in a) good comradeship, b) good business, c) good education.

The reason I mentioned Sam as a mentor is because in everybody's career there are bumps in the road. There was a funding glitch at one point in which three of us were without funding. I had come to MIT on a Fellowship and that Fellowship ended and a bookkeeping error had resulted in there being no money for me for my second year. Sam, in a very senior position at MIT said no, we're not going to let you go. He was able to scrape together the money and he kept me here, because I couldn't afford it. Then I got to know him over the years, including when I was a faculty member. We go to lunch once a year and it was just sort of like a wonderful opportunity.

Then I'm going to say Emily Wick as the last one, because while I never worked with her -- she left around 1973 or '74 to become the provost at Mount Holyoke. I think she felt a little responsible for me in that she had played a role in getting me there, and she wanted to make sure that I was well advised and well mentored. I'll just point out that Jerry Wogan's first high impact publication also had Emily Wick's name on it. So they were good friends, and I believe continue to be to this day. So she was my other mentor.

INTERVIEWER: So how did you become part of the faculty at MIT?

JOHN ESSIGMANN: I got my PhD in 1976. My wife almost immediately started graduate school here. MIT at that time told me that they wanted me to take a faculty position. I wasn't sure it was the right thing for me -- I'll just say that at the outset. But my wife and I had a long talk about it, and we decided that--. I'm sorry, I want to back up for a minute. MIT said we want you to be a member of the faculty, but in order to get a job here we think it's a good idea to go away to do a postdoc and then come back. So you'll have experienced another environment. Increasingly, at the time MIT was -- well, MIT's always been concerned that perhaps we're a little too inbred, and consanguination is not a way to build a strong gene pool.

I think that my department had even picked a laboratory at the University of Wisconsin that they felt would benefit me because I would be the able to come back with the state-of-the-art, most rocket science toxicology and it would be good in cross-fertilization. So I talked with my wife about it, and we decided that we were too much of a couple to be able to want to live apart. She had the opportunity to come to MIT, and that's something you don't turn down. So we decided that I'll take my professional risks and I went and I decided to do postdocs with partly in my parent department, but I went to work in biology with Jonathan Cane, who's still here. World-class molecular biologist. I was at the time what you would call a chemist, and nobody in chemistry at that time did anything in biology, aside from biochemistry. But certainly nobody did anything with bacterial viruses.

During the time that I was a student in a postdoc, I really felt that my passion coming out of industry was for -- as I saw in industry, biology and chemistry work together very well, and particularly in drug development and drug testing and so on. There were large environmental chemicals out there and why are they dangerous? Because they effect biological systems. So just many reasons why biology and chemistry should be working together, but they weren't at MIT.

So, I thought if I'm going to be a chemist working in a biological environment -- I had an undergraduate degree in biology, but that wasn't world-class, and I'd never worked in the field. So I should work at the most basic level, genetics. I went to work in John's lab for a year. He taught me -- again, the most menial things always fascinate me. How to, what they call titer or measure bacterial viruses, growing in bacteria. I learned everything I could about molecular biology, but in particular the field of genetics. Molecular biology is really cool and very sexy and very modern. Genetics is crossing things and being able to correlate the structure of a gene with the function of whatever that gene encodes, be it protein or RNA.

I found genetics was both fascinating, it was quantitative, and it had chemical basis.

So I chose, by working with John Cane, I said, you know what's really interesting to me is chemicals damage DNA, chemicals from the environment. Sometimes that's bad. Aflatoxin can bind to DNA, that DNA can mutate and cause a liver tumor. Sometimes that binding is good. The drug ciplatin can bind to DNA, and somehow that will selectively destroy the DNA of a tumor. But how do you make that bridge between the chemical binding and the biological event of mutation or death. There wasn't really any science that bridged to that. Working in John Cane's lab I realized that the skill sets that I picked up in chemistry and then in genetics, I could really be the person who would initially make that bridge.

So while I had lost a couple of years -- actually I had a very prolonged postdoc that was almost five years, but I picked up a skill set in a new discipline that I was really able to bring in as a very coherent project. The department once again showed an interest in me, and they asked me to apply. But now it wasn't like a slam dunk that I would get a job. I started in '81. I don't know when Affirmative Action came in and the requirement for what they called Serious Search, which I think, of course, is a very good thing. But somehow in that period of time there had been a transition from you want a job, sure. A single individual could offer you a job, a department head, versus a committee that has to go through all kinds of paperwork and so on.

When I applied for the job in 1980 for the job that I started in January of '81, there was a lot of paperwork for you to go through. In fact, there were a lot of applicants, and very excellent women were applying for the job. The woman who was the applicant for the same job as me -- first of all, became a great friend, Marsha Rosner. And then secondly, a phenomenal cell biologist. Thirdly, she was well-known within MIT because she worked in the cancer center -- a very relevant field for toxicology. And a great publication record. So Marsha Rosner and I were basically competing for the same job. We defined roles for the same job.

What MIT decided to do is to offer it to both of us. This is where I think a great department head comes in. It was Jerry Wogan, my thesis mentor. I remember when I joined the faculty, the first thing that he did was he said, I'm no longer your friendly friend from skiing and all these other things. Now, if anything, I'm going to be treating you harder than anyone else, because I feel what they call a conflict of interest. So my starter package was very modest, $12,000. That's considered a joke nowadays. But he said, you're a resourceful guy, John. You know where everything is. You can borrow things and everything. I said yeah, I can do that. I wasn't in any way offended by the low start-up package.

He sat with Marsha and me, and Marsha said, you know I completely understand, this is an awkward situation. But Jerry Wogan, Marsha Rosner, and myself we're all very mature. She said you know, I'm right out of my postdoc, and it would be horrible if John and I have to come up for tenure at the same time. She said how would you feel about me being able to take students and have John start in year one me start in year two. But I'll be able to transition from my postdoc, start building a group, and getting my resources together. John doesn't need to do that. He's already well-established within the department. And that'll set up us not being in competition with another. Because we wouldn't come up for tenure at the same time.

A very mature woman, became a head of a department, and a great one, at the University of Chicago. Her husband, Robby, was in the physics department at Harvard and he went to become the head of Argonne National Laboratory out in Chicago. So they moved. So we never actually did have to come up for tenure and be in competition.

But what I learned was there's a way you can sit down and work out boundary conditions of relationships early on where you're doing anticipatory calculations as to what kind of problems might occur down the road that would affect relationships within a department. Jerry Wogan was very good at being able to deal with that. So the department offered me a job. The start-up package wasn't good. But I was friendly with my contemporaries, and of course, this is MIT. We become collaborators and all to get into the same collective vehicles of grant support and so on.

So MIT offered me the job and I took it. This is something that very few people know, but I almost decided to become a senior research scientist here rather than a professor. We have what we call parallel track where you become a research scientist, principles research scientist and senior research scientist. I was pathologically afraid of public speaking. I never gave a single presentation in college -- it wasn't part of the educational system.

My thesis defense as a graduate student was I think the third public presentation I ever gave. Every time I gave a talk in public I'd get this kind of hyperventilation feeling. I think they call it speaker's anxiety. I could not imagine what it would be like to walk into a classroom with 100 students three, four times a week. It would be agony. I loved working in the lab. This self-doubt dealt with the problem, but this self-doubt with regard to whether or not I could actually do it almost resulted in me saying the easy path for a guy like me is working at a place like MIT where I can get all my own grant support, have complete freedom to choose what I work on and maybe have a lower profile, but for me that's pretty good.

INTERVIEWER: So if that was the easier way and kept you in the lab doing what you wanted to do, why are you a professor?

JOHN ESSIGMANN: Again, it's a mentoring thing. My boss, Jerry Wogan -- I call him my boss -- who's my thesis advisor and then he became department head. This is where I think knowing your colleagues is really good. He knew what my concerns were because we our friends. He called me in one day and he said John, I have a problem, I need a friend. The head of the department, and he was the chairman of an NAH review group. He was always doing that. He was on the National Cancer Advisory Board and various things. So he said I need somebody to give 10 lectures for me, and of course, it's relevant to your background, it was genetic toxicology, and I'd like you to teach with Bill Filling, it's a favor. So this was before I became a faculty member.

So it was 10 two- hour lectures. I think he knew that for, if someone's a first year professor, that's what you would ask them to do is about 10 lectures. It was put as a request from a friend. I still look at it as one of the hardest things I ever did, but I did it, and I discovered I liked it. At the end, he asked how I liked it. I said it was really fun. I learned a lot and stuff. He said, you can do this. So that's how it happened.

INTERVIEWER: Because you do chemistry toxicology, biological engineering, can you talk a little bit about collaboration at MIT?

JOHN ESSIGMANN: Collaboration at MIT is I think one of the things that brings people here and keeps them here, and especially in my field. Again, I think it's very much the way things happen in industry. In industry you've got a goal of success and people working together, people from different backgrounds working together is a great way to solve a problem in a reasonable amount of time.

So collaboration at MIT. I came here to work and tried to get into the Wogan Lab because it was so collaborative. I mentioned that Jerry Wogan worked collaboratively with George Bushi. He also worked collaboratively with a man named Arnie Demain, who eventually became a biology professor here. Arnie was, before MIT, the director of industrial fermentations at Merck, and a bunch of engineers. Let me give one example of collaboration, both at MIT and how it has to translate into more global collaboration.

Logan discovered the structure of a chemical called aflatoxin B1 in the early 1960s. For every toxicologist it's their dream that there's some toxic chemical out there in the world that a) hasn't been discovered, and b) is toxic by a completely unique mechanism. So aflatoxin was a dream, and it was a wonderful one for him.

He was having trouble identifying the material. It came from what's called pressed peanut cake -- contaminated peanuts that had killed 200,000 turkeys in Britain, and this meal had some toxic principle in it, and Jerry had isolated a blue fluorescent compound. But the structure was so complex that he couldn't do it alone, couldn't solve the structure alone. So he approached Emily Wick, the woman I mentioned earlier, and Emily said this is beyond my ability. You really need to talk with George Bushi. He's the fellow sitting over there, in Walker at the time is my understanding. So Jerry went over and sat down with George, and it was the beginning of a career-long collaboration.

So, Jerry gave this blue fluorescent material to George and it was one of the milestones, really, in structure analysis. One of the first really good uses of something called nuclear magnetic resonance spectroscopy for determining a tough stereochemical problem in chemistry. They have the structure and they beat out their competition by just a matter of weeks in a classic paper published in the *Journal of American Chemical Society*.

So, the biological team and the chemical team worked together in a true MIT fashion to solve the problem. But then the problem became one of our people. Are we exposed to this, a), and b) is it really as dangerous as we think? Why did these 200,000 turkeys die in England after they ate this stuff, it was obviously a potent toxin. So, it turned out the turkeys that survived got liver cancer. When they fed this feed, it looks like peanuts in a bottle, messed up peanuts in a bottle, to rats, all of them died of liver cancer. Of course, we don't have a lot of liver cancer in this country, but there's liver cancer in a lot of areas in the world - Africa, Southeast Asia, China.

So, there were two problems. These were addressed before my time, but again through collaboration. So Jerry said okay, let's get a feeling for how dangerous this toxin is to a bunch of different animal species -- we'll call them surrogates for humans. So we got together with a veterinarian here, Paul Newberne, and they defined the quantitative nature of the toxicity of this material, both as an acute toxin and as an inducer of liver cancer. The numbers were very telling. It was the most powerful liver carcinogen ever seen. Then the question is are people exposed to enough of this stuff so that this might actually be what's causing liver cancer in areas of the world where liver cancer is a big problem. I can't remember the exact numbers, but I think liver cancer's probably the third leading cause of cancer death. So this set up the deal.

So Jerry Wogan, they said well I've got to work with epidemiologists. This was John Gordon who was the epidemiologist, again, partnerships. So I just to put this in a little bit of flash- forward. I went into an environment in which collaboration was necessary and it was what I was looking for. Not narrow, mono-dimensional science, but the ability to work in a network with people. So the epidemiology was set up. Then they needed to say okay, where are the places that there is a lot of liver cancer. Africa, and if you remember Africa in the '60s, governments changed on an annual basis. If you're dealing epidemiology you really need five years. You've got to study a population over a period of time. If the governments change, you're at risk because you may not be able to continue your study.

India, again, there were problems of governments changing over, but also they didn't have as much of the problem, possibly because of a vegetarian diet, more vegetarianism. So there may be some benefits to that diet. China had the problem. It was incredible, but it was politically inaccessible. Southeast Asia, we had the Vietnam War going on, so we had all kinds of basically infrastructure in Southeast Asia. The jets flew out of, some of them came off of airplanes, but most of the jets flew out of Thailand. Thailand is a constitutional monarchy. The royal family wanted to encourage anything that would benefit the Thai people. There was a bunch of MIT people who were looking for a place to do science.

A very ethical person, Jerry Wogan, who sat down with the head of the medical school there and said, we don't just come in and go away. We form collaborations, we form research partnerships.

So they began what's called the MITHAI Program. For every American that went there, because we had access to populations. In science, if you do medical science, access to population is absolutely critical. If you don't have people to study, you can't do it. You do your work on rats but you can't work on people. So Thailand gives us access to populations. So then Jerry brought a cohort of students back to MIT from Thailand, and they got their degrees, undergraduate and graduate degrees, from MIT. It was educating people who now are the basically the leaders of Thai science, so it was a real reciprocity. They represent people that we work with closely today. They're people who are our classmates. So, Mike Materofershowat was my classmate and started the same day as I did in 1970, and we still talk on the phone once a week. This is a good thing.

So, collaboration was absolutely critical. I came to MIT in 1970 into a network in which whenever there's a problem it's going to be interesting, and we'll put together a network of people that will work with you to help solve it. So they discovered that this aflatoxin was indeed, along with Hepatitis B virus, they were synergistically to cause most of liver cancer in the world. Then the next question was how? My job as a faculty member was to work out a way to figure out mechanistically how do chemicals that damage DNA go on to cause the mutations that cause the conversion of normal cells into cancer cells. So the chemical basis for genetic change as it results in cancer development. So that's what my work was as a faculty member. Again, highly collaborative.

INTERVIEWER: Can you talk a little bit more about your area of research?

JOHN ESSIGMANN: So, my area of research involves how cells respond to DNA damage. So DNA is our information storage macromolecule. Anything that disrupts our archive almost always will be bad. Sometimes it can be good, I'll say in a minute. In that chemicals from the environment damage DNA. In my early career, back when I was a chemist, I worked out methodology for being able to tell you what the structures were of things from the environment, both environmental carcinogens and drugs, that were stuck on to DNA, what were the structures. In my faculty career, I was able to say if you've got 10 different structures, which ones cause genetic change, which ones are mutagenic, and which ones are cytotoxic. Then going to a little bit deeper we have defense systems against, and they're called DNA repair systems, against these -- we call them adducts, these covalently bound chemicals from the environment on our DNA. We have repair systems that will take them out.

Sometimes the chemical mechanisms by which nature takes the damage out of DNA is absolutely fascinating from a basic chemistry point of view. It's just fun to figure out new chemical mechanisms. The other thing is that these repair systems evolved. You can't work on a beautiful chemical reaction without trying to think how nature, how she worked it out, starting from our ancestors that were little creepy crawly things in puddles being irradiated by solar radiation without an ozone layer. There was just all this damage happening and somehow life survived, first of all, by developing these systems that counter the damage. But then as time went on, I realized that this damage is all bad and it's the driving force revolution. That's where the bioengineering department comes in.

Chemistry is beautiful. It's the synthesis and properties of matter, but there's a lot of math in that. What engineers do is they like to measure, mine, model, and manipulate, as they say. But imagine that you can, you know with engineering, they put everything in a very quantitative basis. So interacting with and networking with engineers through collaborative arrangement, they say well, you know, you've got a chemical, it's causing mutation at a certain rate, and the environment changes at a certain rate.

So because you get mutations at a certain rate, that means that you create diversity. If you create diversity, that means when the environment changes it happens suddenly -- you know, some kind of thing from outer space, *Armageddon* that movie, it happens -- something will survive. It's because of this diversity. Climate change, whatever. There's shifting of the equilibria of life all the time. Engineers find it fascinating to model those processes because they can be -- that math will provide you the accessibility tool to be able to do that modeling. So as time went on I became as much interested in chemicals causing DNA damage that cause genetic disease. You know, the tumors that appear in us over time.

The evolutionary process, in other words, we're exposed to these DNA damaging agents, and the upside is that it drives evolution. It creates diversity, and then it's fun to understand evolution. You feel like you're in the intellectual lineage from Darwin and Wallace. But also people are learning that you can leverage the understanding of evolution to push it fast forward such that you can evolve drugs. Use the principles of Darwinian evolution to come up with new ways of discovering drugs. Create a lot of diversity in molecules and then have a natural selection process for the ones that work for your defined goal.

INTERVIEWER: That sounds like a good transition to talk about KP-1461.

JOHN ESSIGMANN: KP-1461 is a drug candidate by a company called Koronis Pharmaceuticals -- that's what the KP is Koronis Pharmaceuticals. I am a co-founder of Koronis. It originally started as a company called Darwin, which I thought was a better name. This was a company that began at a scientific meeting in California. It was originally myself and a University of Washington professor named Larry Loeb. Then later joined by another University of Washington professor, Jim Mullins. Larry is one of my closest friends and one of my fiercest competitors in the mutagenesis field. He's a physician, and he thinks more biologically about my field I think. I'm the chemical conscious of the field, he's the medical biological conscious. Jim Mullins is a virologist, specializing in HIV/AIDS.

In the 1980s, Ronald Reagan was the president. Ronald Reagan was not a friend to the gay community. There was a lot of emotion associated with the Reagan presidency, and I think you can pick a lot of it up if you look at the movie called *And The Band Played On* in dealing with the tension between the centers and disease control and other arms of the government in terms of trying to keep HIV from getting out of control, which it did. One could argue that if we had gotten the jump on this problem, we could have contained it early on. We didn't. The Reagan administration didn't want to fund research in AIDS directly until there was public pressure because of contamination of the blood supply. People started being concerned. Okay, now there's enough of the virus out there that heterosexuals will get it, and now it's a moral imperative that we address this.

So the Reagan administration, so there's the AIDS activist community, which is I think one arm. But then there's the cancer community in the other. I've always worked on cancer research. In a Republican administration, typically the rate of funding increase for disease doesn't go up as fast as under a Democratic administration. The Reagan administration was trying to keep the funding for science to be about the same -- try to keep it at the same level. So AIDS became a problem. In order to fund something new, they had to take something off the table. Cancer was the most lavishly funded disease. So they took the funding for AIDS out of the cancer budget. There were a lot of good reasons why they did this too. For example, we used to think that viruses cause most cancers. Now we believe that they actually caused a minority of cancers. It's mostly chemicals and genetics that cause cancer but not viruses.

Nevertheless because people thought that viruses cause cancer there had been a major investment on the government toward understanding how RNA viruses work. It turns out HIV turned out to be caused by an RNA virus. So it made a lot of sense to shift a lot of the funding from the cancer research that I did toward other areas. Now I wasn't having a problem, but I was a vocal advocate of my community at that time. I was the chairman of NIH study section and had the opportunity to debate the head of the NIH and the director of the National Cancer Institute who were trying to explain to our community at a meeting in Tiburon, California, why this shift was going to happen.

As part of that discussion, and perhaps a moment of frustration because I was making my point very hard. The head of the National Cancer Institute said, you know John, you're exactly the reason why we want to take the strategy we're having, which is not to increase but to budget for studying AIDS. He said, you're a good scientist, I'd like you to work on HIV. If I don't make you hungry financially by cutting your budget for cancer research, then you're not going to have the incentive to want to change fields. You'll just keep going down the path you're going, cancer.

Larry Loeb, he was also at the meeting and we got together, and Larary is one of the most imaginative and diplomatic people that I've ever met. He was calming me down, we had a glass of wine. He said, well let's just think for a few minutes. What if you and I were to -- you know we've always talked about collaboration -- what if we were to do something, what would it look like? But we'll just have a glass of wine and then we've given it some token thought. It was during that very brief discussion that we had the idea that became Koronis. It's as follows. HIV we know, everybody knows, it has a high mutation rate.

As a consequence, within a few days almost every mutation that can be created in a person is created. That means if you apply a drug, then there's going to be drug resistant mutants there, so you'll see a drop in the number of viruses but then they'll come back, and then once they repopulate the system will be drug resistant. Our innate immune system, our interferon system, our immune system is not defenseless. It'll be brought down, but of course, this is a disease that cuts out our T cells, so it rips away one important arm of our immune system. So the immune system is not that effective. So it's a virus that it laughs at us using this ability to create through rapid evolution diversity.

Now, Larry and I were talking about a field of evolutionary biology. It's led by a man named Manfred Eigen who got the Nobel Prize for discovering how to measure very, very, very, very fast chemical reactions. We call these equilibrium reactions. Equilibrium constants that were four or five orders of magnitude faster than had been seen before. But he doesn't just think about chemicals reacting and solutions, he thinks about biological systems. You know, if a meteor hits and all the people with red hair die, then they'll be a re-shifting in life and a distribution of life that comes out of that.

Eigen and a man named Leslie Orgel, a molecular biologist, said you know, life has all kinds of different error rates, different living things. So let's say that our error rate is very low. But let's imagine that we could increase it a little bit by turning some kind of a dial and get higher and higher error rate. At some point we'd hit a ceiling, and it's called the error catastrophe limit where the number of mistakes that you make in copying your DNA is so high that you can't produce a functional protein. Because the code that's in DNA translate to the code that's in protein. That's a hard bar, is a hard, hard ceiling, and you can't go above it and be alive. HIV is a little below that ceiling. So a lot of its offspring are dead. But it's got a huge variety in the offspring that it produces.

So our thought was what if we were able to contaminate the pool of nucleatides in the T cell, other cells in which HIV is trying to replicate with these mutagenic things that Essigmann Lab had been working with over the years. Such we just pushed up maybe two or three fold the error rate of the virus. So then the virus would create more and more and more of these non-viable offspring. So would cause the population collapse which causes extinction. It was a lot of fun.

So we got together, I think it was 1990 we published a paper that got a lot of interest, because we did, indeed, push the error frequency of HIV up above its error catastrophe limit. A surprise to us, the virus couldn't come back. In other words, we couldn't evolve resistance to it. That, of course, caught the attention of a lot of people because a resistant-proof therapy would be good. I'm going to be very direct, it was the theoretical community that explained this, not us. They said resistance, evolution, you don't come back.

So pushing evolution over the error catastrophe limit, the theorists feel may be a way of developing a therapy from which resistance couldn't emerge. So that was enough to make it a company, a small company. Always wanted to stay small. We learned a lot about big in companies meaning that commercial success will drive you always toward business goals and not necessarily toward a drug. We all gave up a lot with regard to our equity position within the company because we wanted to see it play out in the clinic. The company went through a molecular diversification strategy. Came up with this KP-1461 that looks very good -- it's certainly safe in the clinic.

What we know is looking at the RNA of the viruses in patients that have been on the drug for four months, that we actually see the mutations that we programmed into the drug, accumulating in real patients. So the patients, there's a trajectory, there's an error catastrophe limit, and there's a trajectory. We're now raising the money that it takes to try to do the last stage clinical trial to see if we can, in patients, actually hit this error catastrophe limit. From my perspective it's kind of nice because we've studied genetic change.

It was never considered to be something that you could -- preventing disease was never something that was considered to be a big industry. But out of that through the external pressure brought on by a reduction in the NCI funding, it's almost like evolutionary thinking, you have to think outside the box and come up with something else. So that's the story on Koronis.

INTERVIEWER: So, the guy who insulted you and made you angry actually was correct? Is that how I understand this story?

JOHN ESSIGMANN: Yeah. As I grow older, I learned that almost every experience in life is a learning opportunity. Yes, it was good.

INTERVIEWER: Let me go back to a minute, when after you did the series of 10 lectures and you decided that you actually enjoyed teaching, can you talk a little bit more about what it was or what it is that makes you like teaching? What do you get from it?

JOHN ESSIGMANN: What do I get from teaching? There's two things. One is eternal youth. I think working with young people really is something I enjoy a lot, and it's just wonderful to throw out ideas and get feedback from students. The second thing that I like is the challenge of communication, and, in fact, communication with talk. I like reading the literature, trying to update my material, but then as more and more is learned you got more and more to teach. It's fun for me to try to figure out what I take out in order to put new stuff in. Then through artwork, how am I going to be able to present that at a rate that the audience can pick up? So you don't go too slow, don't go too fast, punctuate with funny stories or whatever, but kind of get it done. It's the challenge. I like that about teaching.

The other thing is that I think that everything about MIT is a laboratory experience. So the way I've just described teaching is I study how it works, I reflect upon it, and I try to make it better. That's the way you do research. And you have a goal and the scientific method we learned in the seventh grade really is sort of the way it works in professional science. I'll say my wife and I work in a residence hall. It's really the same thing. The problems dealing with people and resources and things like that. But you've got a goal and you try to figure out how to get to that goal -- a lot of ways you could do it, but you formulate a path and then you implement. So MIT's a big laboratory, and research and teaching and life use the same laboratory science approach.

INTERVIEWER: So unlike most professors here, you get to know the students in the classroom, but you also get to live with them. So, talk to me about what the appeal is or being, you're like officially a housemaster? Is that what your title is?

JOHN ESSIGMANN: I'm a housemaster along with my wife in Simmons Hall. We've done that for seven years. And for seven years before that we were the housemasters in New House -- a very different but equally wonderful place. So housemasters are members of the faculty who have decided that they find it fascinating to learn more about the undergraduate or now graduate students -- there are graduate housemasters as well -- and to work with them, to help them--. Let me start again.

The housemasters, graduate and undergraduate, like the challenge of working with undergraduate and graduate students to help them solve the kind of problems that undergraduates and graduates have. Now those problems could be academic, so you gotta know your way around the academic landscape. My wife is a graduate student here, she's an alum. The second is the personal bumps in the road that everybody runs into. Hopefully life experience can help with the easy problems. For the hard problems, Student Support Services, the medical department -- we have them on speed dial.

Then the third thing is these are young people who are learning, and not just the stuff we teach them in the classroom. But also they're independent of their parents, or whoever supervised them in being brought up, and they're put into this bubble of 18 to 22- year- olds, in the case of the undergraduates here. Part of the job is to teach them how to get along in life and interacting with others and solve problems as a group or individually. This is something the housemasters try to do.

So we've got a role as older adults. I've often said that it helps being a parent, it's a lot easier to be a housemaster than it is the parent of your own child because you can give advice and you're not as personally connected with it. But giving that advice I think is something that has impacted the lives and trajectories of a lot of people.

At MIT I think it's really important to have housemasters. The reason is that -- there are two reasons. One is that our undergraduates don't have a lot of limits on them in terms of course work. That makes them very busy. Perhaps they don't have as much time to seek advising as perhaps if they would if they would have a lesser load. So knowing personally, on a first name basis, your housemaster is I think a very good thing.

The second thing is that our undergraduates tend to be a little bit more socially reserved. And approaching somebody they don't know, a teacher in a classroom, even their academic advisor, it might be a little bit -- actually there is an energy barrier there. If you know somebody in a social context, in a fun context, then that lowers the energy barrier for interactions. Then the undergraduates find out that these older adults are not really that different from parents and others that can help them along the way. Then they talk with you about their career goals, their relationship problems, and the problems with 801, and 802 TIEL I've got a real serious problem with that. If you understand the jargon, then you can understand what TIEL is.

You're wondering what TIEL is, but what is TIEL, and why are the students so either excited about it or not? Then you can say this is interesting, let's bring the people who teach with this TIEL technology over here. Let's have an evening of discussion so that everybody can kind of come to understand what the issues are of those who don't like TIEL and those representing TIEL to try to make TIEL better. It's a Teaching Enabled Laboratories. But it's basically the students sit around in a circle, they each have a computer in front of them, but if you could see through the computer they'd all be facing one another. It's a group way of learning physics with a computer in front of you. I know it sounds a little bit strange but it's the modern generation.

INTERVIEWER: Sounds like MIT.

JOHN ESSIGMANN: Yeah, it is. Talk to your friends through a computer.

If I could say one other thing, though. Every once in a while a real crisis comes up. This is when I think the housemasters really shine, and that having some older adults working, who are known to the entire student population, working to help communicate that things are happening, there are a lot of people who are busy in the medical department, in the dean's office or wherever. We can maintain confidentiality and so on, but to maintain an information flow and counseling in case of true tragedies, and make sure that those affected can get the help that they need. So it's a community helping role that I think the housemasters have. So this is a very healthy thing.

INTERVIEWER: What do you think you've learned about the student body from being a housemaster that maybe teachers here would not know?

JOHN ESSIGMANN: What I've learned from being a housemaster is enormous in a lot of ways. First of all, I think I've become a better parent. I think the key thing is this. I've taught large classes at MIT in the hundreds, and you don't get to know the students real well. I would say that the faculty who are perhaps as socially reserved, in some cases, as the students themselves, get the feeling that the students are grade- grubbers, they're taking too many things. I've even had a student come up to me and say I fell asleep at this part of your class. I want you to explain it to me, but only if it's going to be on the test, because I'm a premed, and therefore, my time is really valuable. I've had another one come to me and say I sit down with every professor after every exam and go over every question to see how many more points I can get. My parents work very hard for the tuition that they pay at this place, and therefore, they and I believe that I have a right and it's everyone's best interest that I argue for every point. That happened to me.

So that stereotype doesn't exist in real life. You could see the same person over in the living group where you see them as a gifted pianist, as a person who can weigh in on a difficult decision. There's a dining debate that's going on right now on campus. What's the future of campus dining going to be? The person who may be saying things that you judge as a faculty member could be completely inappropriate on the east- side of Mass Ave. From the west- side you get to see the other side of that person who is a person that you love having as a neighbor. I think that one of the reasons that the housemasters exist is to communicate exactly this point. These people that you look as grade grubbers on one side of Mass Ave are the most wonderful, talented people that you would just feel so proud having as your child is very important. That's part of the communications arm of MIT.

INTERVIEWER: Let's talk a little bit about MIT because you're now close to a lifer. What is it that's kept you here all these years?

JOHN ESSIGMANN: What's kept me at MIT? I've had the opportunity to go other places, and I think most people have. I think a lot of people in the administration would say if you haven't got other job offers, then we probably made a mistake in giving you tenure. But what keeps me here is really a couple of things. One is this collaborative network that I've mentioned earlier. It's very easy to find somebody who's going to help you with your problem. That means you're able to take on more complex problems.

One of my best papers is on -- it's a purely toxicological problem that everybody in pharmacology has, which is trying to understand how to provide quantitative information on, if you've got a drug, on how toxic it is or how effective it is. It took an hour to do this calculation when I was a student. I never could figure out why. So I got an MIT undergraduate, because they're smart. They know more math than me. He said okay, let me watch you do it. You had to do something, you had to do something called a nomograph twice. I didn't really understand why.

He said okay, here's what the story is. You use a nomograph when there's a differential equation that you can't solve, you have to approximate. So the undergraduate said, follow me. We just walked to the math department, we went to the first open door -- it was on a Saturday afternoon. We walked in and he said ah -- he explained in undergraduate terms what the problem was. The math guy said, yeah. He just wrote some things down, the undergraduate. We took it back.

Within I'd say a couple of days, the undergraduate had reduced this to computer code and we wrote a paper on how to determine a median lethal dose and its error -- the error was the hard part -- using a small computer. The solution to this differential equation was so simple for the undergrad and for the postdoc in the math department who became a co-author. The undergrad knew what we needed to do, but basically that little team that just formed lightning fast on a Saturday afternoon, brought on by open doors resulted in something that it's one of the most quoted papers that I have. People started selling the program. We should have copyrighted it. It was amazing. So this collaborative environment keeps me here.

The second thing is that I think that MIT is a small shop, a 1,000 faculty. Somebody told me once that's about the same number of players there are in the NBA. So I'm just putting it -- it's not this huge number. Hopefully playing at the same level as the NBA in science and engineering and management. The political science and the other areas we play, we hope we play at that level. Everybody can be very entrepreneurial, and at the same time we'll work as teams in order to attain our entrepreneurial objectives. So it's a small place, and I think I'd get lost at Berkeley, or University of and fill in the blank state school where they have 30,000 undergraduates and many, many, many, many faculty members. So it's basically a place you enjoy coming to work because you get to work in a collaborative way with others.

INTERVIEWER: What do you think are the great strengths of MIT?

JOHN ESSIGMANN: Well, the people. The great strengths of MIT include the people. I mean I think that this place has a unique knack for being able to identify people who are going to work well in our meritocracy. We reward in certain ways and we admit to it. It's just ironic we're having this interview on the first day of campus preview weekend when the next generation of lifers perhaps -- well, actually they're going to be lifer. Most of them are going to graduate from MIT and they'll have a lifelong connection to this institution.

I have a lot of admiration for our people in admissions, because I've never met a student that didn't deserve to be here. Not every one of them will make it -- for whatever reason, some will leave voluntarily and so on -- the bumps in the road thing will come up. But I think that the people here are matched to the historical boundary conditions set up by William Barton Rogers who said, we want people to come here who are going to solve problems. They're going to be the things that are associated with our roots as something that succeeded the industrial revolution. So we defined a biological phenotype as to what we wanted, and we defined something that didn't exist at many places at that time, and people are going to have their fingertips on the pulse of what society needs. And in a blue collar kind of way, go out there and solve those problems and not try to have a big fanfare about it, but to just solve problems one right after another that people need solved. It's a good thing. That's what I like about MIT.

INTERVIEWER: So I came across this very long and impressive list of awards thank you've won. Any of them have a particular deeper meaning for you than others maybe?

JOHN ESSIGMANN: One was this one called Outstanding Investigator Award, which was a nine- year grant from the National Cancer Institute. It was a few pages, but what it said was we're going to take all the money that you've got now, we're going to add, I think, 10 percent to that, and you can work on anything you want for nine years. You don't have to worry about competitive review of your work. It was at a time in my life when I was probably at my creative peak. For example, the work on lethal mutagenesis, which became Koronis Pharmaceuticals, which became KP-1461. The origins were really in the freedom that I had to do whatever I wanted. It would be something very similar to these Macarthur grants that they give now where those just come right out of the blue. I mean that's great. But somebody tapped me on the shoulder and said, here's a million bucks. Good luck.

I think the second one that I'm very proud of is last year I got a Martin Luther King Leadership Award. It made this adrenaline feeling when they told me I got this. I mean I just felt warm. Because my wife and I were, for seven years, the housemasters in New House. Anything in this area, is more important than me. New House is more than 50 percent underrepresented minority students. It was an amazing experience for us, and in particular, our children to grow up in that kind of diversity. And to understand the problems, and particular, socioeconomic. Financial aid issues and so on that we became specialists in by working there. Understanding that for a Mexican American student, that their financial aid is really important because they were sending a lot of it home. These were things we never realized, faculty didn't realize that this is -- your financial aid is not that much, you're sending it home. But that makes a lot of difference, the $1,000 or something that you send home. So we learned a lot.

There's just one short story from my daughter. Amy went to Dartmouth. The desk workers at New House were mostly Hispanic and African American students working as part of their earnings expectation for their financial aid, working a desk. My daughter would, whenever she had trouble with math or science, anything, she'd go out and ask the desk worker. Invariably get a terrific response. That person probably had a much higher SAT score in math then her teachers in school did, so she's getting high quality tutoring for free. My daughter grew up associating minority status with intellectual superiority. She carried that with her to Dartmouth and there's just kind of this -- that I think is good, is really good.

So that Martin Luther King Award, we did some programming things that I'm very proud of.

Then the third one is this gold medal from the Thai Royal Family. It's really a continuation of the work that was started by the MIT group over 40 years ago in Thailand where -- that was the place where the clinical trials were done -- the epidemiological studies I should say were done. MIT had a longstanding association with Thailand. As I became more senior at MIT and in my field, I was able to do things that helped Thailand and others -- there are 14 countries in the developing world in a program that is based in Thailand, and through my colleagues they were able to do something that had what I believe was a real tasteable impact on education in that area of the world. The kind of education you get out of MIT is the kind of education that allows you to create industry. Creating industry will take care of poverty.

I do what I can, I can teach. I can help people learn how to be better researchers, and that's what the Chulabhorn medal was from Thailand was for helping to create an educational program. But then in addition, if you got a school you gotta actually create industry. You gotta train people, you gotta provide jobs for them later. So we had the opportunity to go in and create industry that would go along with the academic program that we actually transported from MIT and brought to Thailand.

INTERVIEWER: Since you and your wife are both involved in taking the MIT students to Thailand -- it's every year you've been doing it, right?

JOHN ESSIGMANN: Um-hmm.

INTERVIEWER: Can you talk a little bit about that program and the value that you see it gives to the students who participate?

JOHN ESSIGMANN: The program that my wife runs in Thailand is parallel to my program, which is the one training Thai students there. So, again, it's out of the spirit of reciprocity that I think is really important. In other words, I go to Thailand to teach Thais and students from 13 other countries in the developing world, and I have research there. As a reciprocity, Thailand hosts my wife and between 7 and 10 MIT undergraduates where they get an international experience. The international experience is extraordinarily important. Susan Hockfield at a faculty meeting last year said something that I found actually that impressed me a lot. That our undergraduates participate and get an international experience at only half the rate of the students at our peer institutions.

Now, Ellen and I are contributing to that half the rate, but our undergraduates are not getting the global experiences that are probably going to be necessary in the modern world. So Susan is very interested in trying to double -- to get us up at least to the industry standard. So the THAIROP, which is a Thailand Research Opportunities Program, had been there before MIT's recent interest, but it has benefited by Susan Hockfield putting a spotlight on international experiences and creating a Global Education Office and so on. But to increase the resources, so we're able to bring not just a couple a year, but bring between 5 and 10.

One of the things is that my wife is a very convincing woman, and she convinces on our end for getting the salary support for the THAIROPs, but also on the Thai end. Thailand is a developing world nation, but she has housing and room and board. Room and board is basically paid for, along with all the travel is paid for by the Thias, so the international airplane travel. So it's a very good program. I don't like asymmetry. I don't like a program where all the money comes out of MIT, or all the money comes out of someplace else. I don't see that there's real commitment on both sides in that way. I love the THAIROP Program because it's reciprocal. Each side benefits.

One story about THAIROP, one of the students, his name is Matt Gathers, a bioengineering student. He'd never really been very many places. But THAIROP changed his view of his future. Matt is African American, gifted intellectually, would probably have taken a traditional path, maybe medical school. But through THAIROP, at the end of the summer -- Ram Sasisekharan, he's the head of HST, so he's very influential, both at MIT and in Thailand.

He was kind of going around the table with the THAIROPs and asking them what was the importance of the program to them. And Matt thought about it a lot. And there was a big pause, and he said, you know I think that it may not be the exact people that I'm interacting with on a daily basis here right now, but I believe that the people that I'm interacting with here in Thailand are people that I'm going to be working with the rest of my career. If I set up a company, I'm going to have in mind the colleague, the friends that I have here in thinking about a Thai base of operations. I'm thinking a lot more about international development and how, if I set something up in the United States, I've got to think about marketing issues and so on in order to make a profit and so on. But how do I restructure my thinking to think about the fact that the people in Thailand will have the same needs, medicine or whatever, but how do I provide access to them. This opened my mind.

So Matt went on to win a Rhodes, he's there now, and he's going to go into bioengineering as a field. But in the Rhodes he's looking at literally the international development side of things. So his mind was turned onto this bigger opportunity that comes out of his MIT education through a global experience. Alvin Chen, Getza Goldwater, Ruben Alonzo was not part of THAIROP but he was there last summer in Thailand teaching at a kindergarten through twelfth grade school. He's the fellow who just recently got a Truman. So I think the international experiences in the right environment just have a transforming effect on some of the brightest minds in America and it makes them better world citizens.

INTERVIEWER: That's a good quote to go on whatever the brochure that Susan Hockfield is creating to try to--. Let me go back for a second to your Martin Luther King Leadership Award. Can you talk a little bit about what you think leadership at MIT means?

JOHN ESSIGMANN: What does leadership at MIT mean? I think leadership begins with being able to listen. Then to be able to formulate a view that doesn't necessarily represent a consensus, but represents the right thing to do.

My wife and I were living on campus at the time that the Scott Krueger tragedy happened. This is a young fellow who in a binge drinking tragedy died within I think a month of arriving at MIT. Chuck Vest's instinct was that all freshmen should live on campus. There were lawsuits that came out of this. Every day is a learning experience for me, and people said we should fight this, we'll fight this out. You know, kids make their own decisions on drinking and other things. Why settle a lawsuit? It's the right thing to do. I think it was leadership.

As a consequence, freshman living on campus, it's my understanding, made it much more difficult for Chuck to raise money from alumni. Remember most of our alumni are white males who lived in the Greek system. He was willing to -- because the principle was right -- he was right. He was willing to not get the money from grateful alumni. He was willing to sacrifice that because he was doing the right thing. I believe freshman living on campus, mandatory dining, other things are the right thing to do. I think leadership is being able a) to listen, b) formulate your own opinions based upon your understanding of the culture and the goals of that culture and then stick to them. So I think that's what leadership is.

If I could say one more thing about that. How do we teach the younger members of our community, you know, the undergraduates and the graduate students how to do that? So my wife and I live in Simmons Hall, and as I said before, an equally robust community as New House and any other dorm. One of the things that I like about Simmons is the fact that it was created during the time that we were here. In order to help develop leadership, the students had a lot to do with creating the community, and not just creating a community, but creating a set of rules that the community lives by. How are they going to work out governance?

I remember very clearly sitting in and listening to the students saying--. One of the students, his name is Jeff Roberts. He's an alumnus, he was the dormitory council president at the time. Saying that from his perspective, the purist form of democracy for a small group is a New England town meeting. That, he said, could be a way we could run a dorm where everyone has an equal vote, and everyone is invited to a meeting where they can speak their mind and influence others.

I've seen a lot of leaders emerge from the New England town meeting format that Simmons has. It isn't always pretty. Some of the proposals are outrageous, inappropriate, illegal. But the bottom line is they're argued out in a forum, and students learn from that in a way that isn't covalently connected to the rest of their life. They're not saying things that will go on the internet and then become part of the history of mankind. So they have the opportunity to make mistakes and to argue things out, but to learn and become leaders.

INTERVIEWER: How do you think you and your wife, or just you, how have you changed from your experience of living with MIT students?

JOHN ESSIGMANN: How has living with MIT students changed me? Number one, when a student comes to me in a classroom situation and tells me that they were sick, the dog ate my homework, I tend to believe them and not to be suspicious of their motives. Secondly, I understand that when a student comes to me and they tell me about a problem, it could be much deeper, and I'm aware of what the resources are to get them the help that they need. Thirdly, from the perspective of my wife and me, it's like life in fast- forward. If you think about it, everybody has a problem on the average that they want to talk with someone else about it once a year, significant problem.

So we have 350 students in Simmons, and that's about equal to the number of days in a year. They don't all come to us, but the significant ones certainly do. Every two or three days we are given a really interesting, sometimes unique, problem. Sometimes it can become a little bit formulaic, relationship issues, girlfriend-girlfriend, boyfriend-boyfriend, girlfriend-boyfriend, all combinations are possible in this day and age. Then we learned how to be better citizens of the world, citizens of the Institute and so on.

With just our own kids, we would see far fewer problems. So I think that we become better parents, better able to advise our friends by living with so many undergraduates. Maybe a psychiatrist might say yeah, I get to see every possible problem that can come up, and therefore, I'm really well-equipped to be able to deal with them. It's a little bit like that, but we get to see a lot of the really good things, too.

INTERVIEWER: Since you've been here for 30 years, 40 years.

JOHN ESSIGMANN: 40 years, yeah.

INTERVIEWER: What changes have you seen in the students and the culture and the faculty, the administration?

JOHN ESSIGMANN: So the changes over the last 40 years in the students, the faculty, the administration. In the students, it's really been the demographic mix, going from white male to a very diverse population and a little bit excessive, 20 percent underrepresented minority. I mean we have a tremendously robust diverse environment. So I think that's one thing that I've seen. Over time, I came to MIT in the era of the '60s. I was part of that protest movements. Don't trust anybody over 30.

Then you went through generation X, and the millennials now. And these students, they're qualitatively very different, you know, the ones that have always had a seat belt and had parents that drove them to ballet, then to their SAT class, and then wherever. But things have changed with regard to the students that we have in the classroom. Of course, during this entire time I've grown older. I can just sort of stay the same, so some of my perception may be a little bit distorted. But what I think I saw was the following.

In the '70s you saw leaders. People that went off and you could see them starting companies. In the '80s, it became more me-centered, and that continued into the '90s. I would say now in the 2000s, I see a very needy population, students who have been given so many privileges growing up. I think now the meritocracy has perhaps broken down a little bit. But so many students that come to MIT now actually studied for their SATs, and I think that's the key thing.

They arrive here, and I think there's something I can't put into words, but they don't have automatic leadership built in as I saw back in the '70s and '80s to a certain extent. So that's an educational objective for us. I think that we invest heavily in the classroom and in the residential system to help develop that leadership. But I think that that's one change that it's a little bit more passive.

For example, there is a war in some place in the world. When you show this there will be a war some place in the world -- Afghanistan, Iraq, wherever. In the '60s, because there was a draft perhaps, but also there was something different, something else, there would be protests. Someone could hold a protest rally here for the war, and I'd be surprised if a lot of people showed up as back then. So there has been a change in the ability of our students today to sort of accept what's out there. I'd like to see more activism, personally.

INTERVIEWER: I think some of that lack of leadership is maybe a consequence of the loss of a lot of autonomy. I think children growing up who are so scheduled in activities and taken from place to place really don't have a lot of autonomy about deciding how to spend their time, and I think they make fewer decisions for themselves.

JOHN ESSIGMANN: I think you're really exactly right.

INTERVIEWER: So, I think that's why often when they get to college they're almost a little bit lost because suddenly they're having to make decisions about themselves for the first time.

JOHN ESSIGMANN: It is a bit strange. It's always been this way. You rip kids away from their parents at the age of 18 and you put them into a bubble that consists of 18 to 22- year- olds.

INTERVIEWER: It's dangerous.

JOHN ESSIGMANN: They feel like they're immortal at that age, too. It's probably, there's some kind of covalent connections happening in their neurons that's critical to development all over the world, and maybe something at that age that we do, there's a reason for, we don't understand we're doing it, but some social scientist could explain it. But it is a strange thing. INTERVIEWER: Do you have any advice for other faculty members, for students entering MIT, for graduate students just starting at MIT?

JOHN ESSIGMANN: I think it's really important to seize the day. I think that this passivity that we've just mentioned with regard to something that we all see in the undergraduate population -- remember, the undergraduate population becomes the graduate population becomes the faculty population. It's important not to just take what our leaders, our administrators tell us is the right thing to do. This will be something that will probably be edited out.

But just as an example, top-down doesn't work at MIT, bottom-up does. Why does THAIROP and this Thailand Program succeed? How can you have 10 MIT Faculty going to Thailand to teaching in the developing world for no money, as volunteers, and is it just because we get access to populations and we're treated well? No, it isn't that at all. Because it's our idea. Bottom-up.

I contrast that with programs like Singapore. Singapore has four million people. There must be 50, 70 MIT Faculty that are associated with it. Not because the problems are interesting, because they're problems that are well-funded. It's the easy path. There's only so much bandwidth at MIT. I think that every student, graduate student, undergraduate and faculty member should be told, we are a national or a global resource. There's only so much bandwidth.

We're like the internet, we have so much bandwidth. Can we afford to use such a large percentage of our bandwidth on such a small number of people and such a narrow range of problems? Or, and this is where leadership from the administration comes, should we encourage this very small shop, 1,000 faculty, a community of 10,000 students? Shouldn't we be encouraging that community from the bottom-up to find the greatest problems that are going to have the most impact, regardless of whether somebody's going to be willing to pay?

I think that in the '60s and '70s and '80s, people were getting out and trying to find the problems that were the most interesting, that would have the maximum impact. No one's ever come to MIT to work here because you're going to get rich working here. I don't think that's what it's all about. But I think a lot of people are here and we stay here because of the impact that the work can have.

My concern is, looking ahead I think is something that's very important, is to put MIT back in a track where looking a gift horse in the mouth and picking the problems as being ones that deal with true global problems. If Singapore, for example, is interested in water, which they are, that becomes justified in my mind. Because if I go to McDonalds with three friends and we each get a quarter pounder, there's 1,800 gallons of water involved in the production of that pound of food. I'd like to see MIT people think in those terms, not in terms of let's come up with bottled water to serve to one particular client. We have to think about it in terms of bottled water to help the people in Africa where wives and children will walk up to five hours in order to get the water for that family for a day. So I think there's this -- why we do these things is very important.

What my advice to incoming people would be, as my boss, Jerry Wogan did, be able to understand the details at the highly granual level, the size that you're doing, but then be able to go very quickly to 30,000 feet and to ask why am I doing, and is this the best use of my time, because I represent 0.01 percent of the MIT bandwidth as one of the 1,000 faculty.

INTERVIEWER: So we've covered a lot of ground. I didn't get around to asking you about the GEM4 or Woods Hole. So there are a couple of holes still, but are there things that we haven't talked about that you think are important to include in the interview that you want to say?

JOHN ESSIGMANN: Yes, I have one thing to say. This goes back to the very beginning. I mentioned that my dad was a part of a group that skied on weekends with Emily Wick, who was a student here at MIT. My daughter went to Dartmouth where they have the Dartmouth Outing Club. I feel very strongly that everybody has to build into their life the time to do things like go skiing, and not just work all the time. I think that one of the messages that I would like to get through that I've been pounding on for a long time is that as part of our undergraduates education to say don't do too much. Go out on a date. Go skiing. Just go for a walk.

I think that something about the way the current generation has been driven, driven, driven, either by somebody else or, as you said, by themselves, that they're joyless in a lot of ways. I'd like to see some kind -- I'm not wise enough to know how to project it, but I can identify the problem. MIT is I think great because people work hard and they can play hard. Sometimes when they're playing, it's forming relationships with other MIT people or people at other places, or with their families, that are just so important keeping them from burning out.

That's my last message.

INTERVIEWER: Thank you so much. You have been so interesting.

JOHN ESSIGMANN: Oh, thank you.