Sloan Career Cornerstone Center

Profiles of Chemical Engineers

Todd Edgington

Systems Engineer
Genentech
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Education:
B.S. - Chemical Engineering, University of California, San Diego

Job Description:
Automation Engineer

Advice to Students:
"Learn how to write clearly. Also, public speaking is something you'll need to learn how to do."

Video Transcript:
"What an automation engineer does is the design of those computer systems to control manufacturing process. I spend most of my time documenting requirements. You have to put in words how a certain system works. You have to write down you should do this at this time; you should open this valve at this time. When the temperature hits this point, you should open this valve and begin cool down and you need to transfer products to this vessel."

Interview:

Edgington: My name is Todd Edgington. I'm an automation engineer at Genentech Incorporated.

Q: What is an automation engineer?

Edgington: At Genentech, we tend to automate our manufacturing processes, to a large degree, to enhance consistency and yields. What an automation engineer does is the design of those computer systems to control the manufacturing process.

Q: How is a chemical engineer involved in all this?

Edgington: What makes good control is determined by the process. So an understanding of the process is necessary to design a good control system.

Q: How did you get interested in chemical engineering?

Edgington: I took my first chemistry class when I was a junior in high school and I enjoyed it. I wanted a degree that was in engineering and that involved chemistry. So, naturally, when I looked through the catalog, I chose chemical engineering.

Q: What classes did you take in college that help you the most now?

Edgington: I have a bachelor's in chemical engineering. The classes I took in college that I'm using now are fluid dynamics-because how you pump fluids around is basically most of what Genentech does-as well as mass transfer, heat transfer, and a little bit of thermodynamics. On the electronic side, more towards electrical engineering processes would be C programming, real-time programming and concurrency, and basic electronics. Probably the most important classes I use right now are my philosophy classes. I took a lot of philosophy in school. The thing it teaches you to do is write well, and that's very important for engineers. Too many engineers I know do not write well. It makes interpreting their ideas somewhat challenging.

Q: How did you get into this work with automation?

Edgington: When I was an undergraduate, I got a part-time job with a company in San Diego. And I was working as, essentially, a dishwasher. But they had an engineer who was working in their manufacturing department and, after I got to know the company, I got to know her and she actually transferred me over from dish washing to being her assistant. I started doing engineering; the first project I ever did was programming, and I just fell in love with it. From then on I pursued controls, writing software, and doing more programming as a career path.

Q: Are there any similarities between chemical engineering and software programming?

Edgington: Yes. When you're automating a manufacturing process, because what makes good engineering documentation and what makes good engineering is pretty well established. There are common practices in software engineering and chemical engineering. It helps to be a chemical engineer because it helps you to understand the process. I don't think software engineers from Silicon Valley could come in and automate our processes. They just wouldn't understand what it was doing since we manufacture human proteins, which are relatively delicate and the controls are a little complex. So you have to understand the physics of chromatography columns, tangential flow, and filtration.

Q: What do you do in a typical day?

Edgington: I spend most of my time documenting requirements. You have to put in words how a certain system works. You have to write down, `You should do this at this time, open this valve at this time, when the temperature hits this point, open this valve and begin cool down, and transfer products to this vessel.' It all has to be documented in words, graphs, and pictures. That is really where it relates to my classes-developing how that system is going to work. Not only how a specific system works, but how a single system is going to communicate with other systems that are downstream that it has to talk to. The architecture will allow the communication and the passing of product without losing or damaging it, and without dumping it down the drain. Here at Genentech, we're pushing around a couple million dollars worth of

product in each batch, so it's not a good thing to dump it down the drain. You really have to think about what you're doing, when you're doing it, and how to do it.

Q: What experience have you had with mentors?

Edgington: Through my career I've actually been kind of lucky. I've had a mentor at every step. In San Diego, it was my boss. She was a chemical engineer, and she brought me along, taught me, and gave me my first taste of programming PLCs, which are programmable logic controllers. In my second job, I worked for a 17-year veteran in instrumentation and controls, and he was fantastic. He taught me quite a lot about what makes very good Level I control, PID loops, and things like that. Now here at Genentech, fortunately, I have another great boss who is very competent at the actual software engineering. He also has a strong HVAC background, which is heating, ventilation, and air conditioning. The systems that control those are all automated, and we're getting into the design of that software as well.

Q: What do you find most satisfying about your job?

Edgington: I feel fortunate that I work for a company like Genentech because it's what I call a `feel good company.' We make products that save lives. My best friend's dad recently had a stroke and they administered one of Genentech's products. Today he's doing fine. He has no side effects from the stroke and he's back to normal. You hear stuff like that and you walk a little taller, you work a little harder, and the political stuff you have to deal with day-to-day is a little more trivial. So that's extremely satisfying about working for a company like Genentech.

Q: What kind of politics might an engineer have to be aware of?

Edgington: Politics are part of life when you get a job. If there are more than two people in the company, there's going to be politics, personality conflicts. Some people just won't like you no matter how hard you try, and that's something you have to learn how to deal with, because unless you plan on leaving the company, you're going to have to deal with these people. Also, every once in a while, you find out that people have a better idea than you, or you are wrong, and you have to put your pride in your back pocket and accept their advice and go on. You have to be able to accept being told that you're wrong, and that's hard for some people. Another little bit of politics you're going to have to learn how to deal with is that you're going to have to tell people that they're wrong, and you're not going to be able to back down. So that's the type of politics that can happen in engineering.

Q: What other technologies do you use at work?

Edgington: The whole company has e-mail and we communicate through that. A good understanding of basic office software is a prerequisite now. You can't get by without knowing a word processor and a spreadsheet, even some relational database stuff is very important and very useful. The automation engineering group at Genentech is getting a little more involved in what are called the Level II systems, manufacturing execution systems that are basically paperless documentation. We also have very high-level data acquisition and what we call `imaging pools,' which are actual real process data that you put into a relational database that allows you to do analysis, presentation graphics, and historical comparisons of different

batches to make sure the batches are within spec. So the automation engineering group is getting into much higher level systems than just the Level I control.

Q: Who do you work with on a daily basis?

Edgington: As an automation engineer, I interface with almost all groups in Genentech. For the low-level controls, you're designing operator interfaces where the operators are going to have to actually do their work. So you talk to the manufacturing personnel and technical services about how things should look, what buttons do go where, what data needs to be shown and recorded, and how reports should be printed. You interface a lot with the users who are the manufacturing personnel, and the process scientists, because they're the people that develop the process and know how it runs. We also work with validation and regulatory. The FDA is very big into software, we call it software validation now. They want to know that you designed your software well and you followed accepted industry standards for designing software, and that it repeatedly runs the process the way it should and it won't have errant conditions. Basically you ensure that it won't mix products, clean inappropriately, or put sterile product into an unsterile situation. That's all the responsibility of the control system. So we work hand-in-hand with regulatory to make sure that we keep the FDA happy when we do our validation.

Q: What advice would you offer to someone who was interested in chemical engineering?

Edgington: Learn how to write clearly. Also, public speaking is something you'll need to learn how to do. A lot of people get very nervous doing it, but I can guarantee that at some point in your career you're going to have to get up in front of 50 people and explain why what you did worked, or why what you did didn't work. That's really hard if you're not a good public speaker.

Q: Is there anything you would have done differently in college?

Edgington: Off the top of my head I would have to say no, because I took a couple of classes outside of chemical engineering that I enjoyed immensely like electrical engineering, philosophy, and physics. Those are all extremely valuable in what I do today. The only thing I guess I don't have enough of is biochemistry.

Q: Any final thoughts for potential chemical engineer

Edgington: Stick to it. Chemical engineering is not impossible. If I can do it, anybody can get their master's. It wasn't easy, but just loose a little sleep-you'll make it.