

Room 207 Session I  
SMCC Cellular Biology Opportunities for High School students  
Session led by Elizabeth Ehrenfeld

This is the SMCC biotechnology program, first workshop, it's about 1:30 and we're going to fire up and Elizabeth if you would introduce yourself because all of this stuff is going to get transcribed later.

Ok, so my name is Elizabeth Ehrenfeld and I started the biotechnology program at SMCC probably about 8 years ago. I got into science because everyone my family was in science. I went and got a bachelor's, Ph.D. and then went to Switzerland to do postdoctoral work because I like being outside and chocolate and skiing. When I came back to the U.S. I wanted to go to a place where I could still do a lot of fun stuff so I went and got a job at IDEX Labs, developing diagnostics for the food industry because one of the positions I had in Switzerland was working for Nestle. So I worked for IDEX for 7 years running one of the food diagnostic groups, doing diagnostic tests, some really cool ones. We used a bacterial virus to detect whether or not there was salmonella by cloning the ice nucleation gene into a bacterial virus which expresses salmonella. So some pretty cool science stuff. But I decided as I was doing all that, that first we had a hard time recruiting people to work at IDEX. And I think the conference today is really to get more of your students to really want to be in science and then they're more likely to stay in Maine and then companies will come to Maine because there are people they can employ. So I decided to jump ship. For a year I taught at USM and then I went to SMCC because it was more flexible and it just seemed to fit better. And I've been teaching there for 10 years. And we really have a strong science program there, we have about 250 students who are in science which is pretty large for Maine colleges. And we have 4 main programs: biotechnology, which is first because I made the slide, but really probably the most we have is liberal studies biology, which means they're getting their first two years of going to college in biology at SMCC before they transfer to USM or Orono or wherever, we also have liberal studies science and we have marine biology and oceanography which is a really great program, it's been around for a long time, they really do a lot of hands-on, on the boat, getting samples type work. So that's sort of the overview of the program and then I've got some flyers for them, here as well.

Can you tell me your name again?

My name?

Yeah.

Elizabeth Ehrenfeld. So, this biotechnology program started in 2006 and we brought in people from industry. I'm also on the Biosciences Association of Maine board and having worked at IDEX, the year I left IDEX there were 2,000 people and 30% left. There was a lot of turnover. So there's a lot of IDEX people all over Maine which is really good for networking. So we brought in people from all these different companies to tell us what they wanted students to learn. So we came up with a curriculum sort of based on that. It was actually kind of interesting, the number 1 thing they wanted students to be able to be employed as technicians was to be able to work with other people. That was the number 1 skill. The number 2 skill was that they should be able to write in the lab

notebook with the correct color ink. Companies are not looking to hire somebody with great PCR skills or HPLC skills or things like that. They're looking for people who are smart and who want to learn and who will show up and get excited about what they're doing. This is who we, when we ended up pulling together for classes, most of these were offered by SMCC when it was a technical college. Depending on how long you've been in Maine it was SMVTI, SMTC. And we added a cell biology class, a genetics, and introduction to biotechnology. And actually a two semester biology sequence. So there are 62 credit hours, it also includes an internship because the people in the companies really felt that it was important to get students out working in a real lab. And as a scientist who spent quite a number of years in academia for my undergraduate work and when I did postdoc which was more of an academic environment, when you get out into a real company, you're working, there are things like you have to have closed-toe shoes and you can't drink coffee in the lab, you really have to follow all the OSHA rules. So having the students get out into a company and see these types of things is really exciting, good, important. And it's exciting for them too, to really see science being done, get a better idea of what's going on there. So for that internship, they need to spend 120 hours in a laboratory setting. I would say like 2/3 of them get a paid internship. Right now we're doing a lot with Maine Medical Research Institute and those are unpaid. We've had them at various companies around Greater Portland. They work on what they're going to be learning. They get evaluated by their supervisors. Most of the students at SMCC have worked, the average age is 27-28, so they get the idea of being evaluated by a supervisor and things like that. But, it's an important thing for having a real job to do that also. And then at the end they do a presentation to other SMCC students. Of the students who've graduated, and it hasn't been a huge number, about half get a job and half go on to school, to a four-year degree. One student that first year, was an 18 year-old from Mechanics Falls, Maine, and she was the first one in her family to go to college. She went to SMCC, she then went to Smith College and now she's in her second year of her Ph.D. program at the University of Pittsburgh. So I always tell her, "Jen, if you weren't the first one, you know, I might quit." But she's really great. And we obviously have a lot transfer to USM. It's interesting because we have a lot more students who transfer before they graduate, so graduation rates are really abysmal, but, you know, it's success rate if they transfer to USM and get a 4-year degree. So, it's a little bit of an issue with that going on. We've had one student who did two years at SMCC. Did an internship and then got a full-time job at Jackson Labs. She did a summer internship here at Colby. So there are some exceptional students who have done really, really well.

What's Alair and MMCRI? What are those?

Oh, that's Maine Medical Center Research Institute.

Alair is what?

Alair was Bynex, and then it was, it's a diagnostics company. It's actually, so I should probably go through a little bit of these. Obviously Jackson Labs, up in Bar Harbor, and they do a lot of mouse stuff, a lot of basic research. Idex, based in Westbrook, I think it's now like 5,000 people worldwide. And they do lot of, most of the R&D is done in Westbrook. I think now close to 2,000 I think in Maine. And they also do manufacturing of the devices. My students are on a tour of Idex today since I'm not there to teach them. And they're going to talk about R&D, they're going to talk about the different types of tests they develop where mostly are for animals. So, does your dog

have heartworm, does your cat have feline pinna virus, does your herd of cattle have tuberculosis? Things like that. Does mad cow disease? Alair is very similar technology. A lot of the biotech industry in Maine was based on a company called Becton Dickinson that was probably in the 70s, late 70s early 80s and it was a diagnostics company so that sort of fueled biotech development in Maine. People went from there and they started their own companies. The fellow who started Alair was one who had a patent on a diagnostic device, a small lateral flowing assay and most of those tests are for human diseases. So now it's been bought by several larger companies but they still do the R&D and manufacturing in Scarborough. And they do a lot of flu virus so a couple years ago when the avian flu was the big thing they were just cranking stuff out so we had students who would work over Christmas break, because that's the flu season, to produce the tests. And Immuno-Cells, another company that's in Portland, they make a couple cool things, they're more livestock-based and they have one test that takes the milk from nursing cows, so when a cow delivers or gives birth to a calf, the first couple days of milk is where most of the antibody transfers because it doesn't go trans placenta. So if you take that milk and concentrate the antibodies you can make a pill to give to baby calves so they don't get scours or diarrhea. And so they do that. And they also are using a non-antibiotic treatment for mastitis, for the mothers, so you don't have to treat them with antibiotics, stop milking them or throw the milk away, keep milking them but throw the milk away before you can start selling it. It's a small peptide called a bacteriostatin, it's made by bacteria that are used in cheese-making. They take that, they extract it, and they put it either on wipes to wipe down the udder or they actually make a little, now, injectable that just got approval by the FDA to inject into the udder so that you can treat the mastitis and not treat the cow with antibiotics. So there are a bunch of really cool things, there was another one that was based right next to GMRI called Miracow and they were using technology to treat salmon. Salmon start in freshwater and go to saltwater but if you put them in the pens you take them out of the pen in the freshwater and you dump them in the pen in the saltwater and 50% die. So they had a intellectual property about treatment of the salmon in the freshwater pens so when you took them and put them in the saltwater pens they wouldn't die. They have moved to North Carolina or some place where having fish isn't as much of a problem. Salmon farming in Maine is not that popular.

Although what is becoming popular is kelp farming, actually is picking up speed like crazy. So, there's a couple labs in Portland right now that are starting up. So farming farming is supposed to.

There's the whole mussel farming and people even get upset about that, having the mussel grafts where they're really getting the pollutants out of the water, you know, doing the filter feeders. The other really cool one for salmon is this woman called Ellen Sawyer who has a company up in Freeport and what she does is, she's the grandmother of aquaculture in Maine and she's done a lot with salmon farming. And she said you can watch the osprey come down, pick up a salmon and drop it and it doesn't bleed to death and some of them even if they get their spine snapped they get regeneration. So two things, she raises salmon and she extracts the blood and extracts the clotting factor from that, because salmon's clotting factor work really, really well and she's done that to make bandages that get used in trauma situations. She came and gave a seminar for us nearly five years ago and she was doing work with the Department of Defense, so if you step on a land mine they could slap one of these things on. The real advantage of the salmon is you're not going to get any, you're not likely to get disease, you know, you're not going to get mad salmon disease because we're so different from them, whereas you would get mad cow if it was using cow clotting factors. And then she was also doing work with these regeneration compounds from around the

spines to try and see if you could help spinal injury. And her comment was, not only can you get all of these pharmaceutical products from the salmon but then you sell the filets at Hannaford's when you're done. And selling salmon to Bristol-Meyers-Squib pharmaceutical company is a lot better than selling the salmon protein to Hannaford's, you get a lot more money per milligram of protein. So there are bunch of really interesting biotech companies in Maine. And I think they tend to be diagnostic companies but I think it's sort of been limited because it's hard to employ people. I think that's one of the reasons the businesses haven't been coming up here. We've been really lucky, or successful, I guess, in collaborating with a number of national granting associations to help support our program. And the first is the money that comes into the state for increasing the biomedical research capacity of the state. And that's the INBRE program. And on one of the forms we got in our packet it talked about that for Colby. The state of Maine got 18.4 or 5 million dollars to increase the biomedical research capacity of the state because we don't do a lot of research here in Maine. It's not like Massachusetts or New York or California, so it's sort of affirmative action for states that don't do a lot of federal research and I think there's going to be a talk on the EPSCoR program which is through the National Science Foundation, this is through the National Institutes of Health. So the Mount Desert Island Biological Labs up in Bar Harbor is the administrator and Colby, Bates, Bowdoin, Orono, Jackson Labs, and a couple others along with SMCC are part of that consortium. So we were really fortunate to be able to get about half a million dollars over five years to support our program. I'll talk a little bit more about that. The two other ones that have come up in the past two years are the collaboration with Cold Spring Harbor Labs DNA Learning Centers there and that's this workshop that we're going to host at SMCC in August. The Cold Spring Harbor got a grant to help teach genomics, biosciences to high school and college teachers from the National Science Foundation. And what their grant was, was to have one-week workshops, four each year, throughout the US to help get technique so that people can actually have something to take back to their classroom, take back to other teachers, and really explain how to, how do you do DNA barcoding, which is, going out, having the students get the samples, grinding it up, doing pulmonary chain reaction, sending the sample off, the end of the week you get your sequence back and you start actually seeing how related, you can draw cladograms, to see how related your sample was to some other plant or insect or whatever it is. Sp students really learn a lot about diversity, and really about biology, going at it from this cool genetics point of view.

Elizabeth, can I ask you a question about this? Is this August workshop for teachers?

Yes.

Ok, so what potentially could we take from this into our classroom? We don't have to talk about that now but I'm just curious.

So, we will actually do three or four different experiments. We'll do this DNA barcoding experiment and you could do it in your classroom, having done it through there. And Cold Spring Harbor's been really good about holding people's hands and getting them going.

And where is Cold Spring Harbor? I forgot.

So Cold Spring Harbor Labs is down on Long Island. That's where, you know, Jim Watson serves as retiring director, Barb McClintock, all the, a lot of the original genetic research in the US was

done down at Cold Spring Harbor.

The DNA LCE website for secretaries, the resources are phenomenal, it's amazing. Just the wealth of stuff that's up there on that website.

So, and that's how I got, I mean I was playing around on the website and I filled out some form and all of a sudden I get a phone call, "Would you like to host a workshop?" "Would you like to come down and help us plan the workshop?" So I said, "Yeah, cool, that'll be fun." But they do have a lot out there and their goal is to increase the science education of the entire country and they're doing it by trying to target as many high school and college professors to do that.

What do you, just from a postsecondary point of view, what is it, to do this stuff in a class it takes a lot of work and practice to get results that are...

No, I mean, my students, my students, you need the equipment to do it. And that can be expensive, or you can borrow it too. The Maine Medical Center Research Institute and the Foundation for Blood Research, both in Scarborough, they really try and get equipment out to people. The other good resource would be Charlie Ray up at Mount Desert Island Biological Labs, he's trying to get more equipment exchanged. But, I mean, what I've been doing, I've used a lot of kits for pulmonary chain reaction, and they're geared towards high school students. As long as they put the right thing in the right tube it's very non-technique dependent. It's surprising how, I remember *back* in the day...

I've done some gels with the kids and it's like, it's almost hard to see what you want to see and it took some time and I always wondered, did this do what I wanted it to do with kids, I mean there's some lab experience but the data was always a little...

The data's, yeah, but I mean that's an important part too because one of the things that, and I'll just jump ahead to what that gave us is that this INBRE grants is, it gave us funds for training students. Here it gave funds for supporting a couple of professors who were doing research but for it was just training. And a big part of is the summer fellowship. And then we take 12 students up to Mount Desert Island Biological Labs every year in January. And the first two years...

Your students?

My students. So, the first two years we were doing fish population genetics on live or dead fish, but they were actual flesh samples. And so we gave them the samples, they ground them up, and the only requirement was one semester of biology, so it's not as though these are really more experienced than, certainly they're below AP biology students, put it that way. And, they PCR'd up the DNA for certain regions, certain micro-satellite regions, that will show you whether or not the fish are related. So you're trying to see population genetics. Are the fish that were isolated from Casco Bay the same as, the same species of fish from Sebago Lake. And so they did that. It all worked really well. But then they get into the population genetics but it worked really well. The first two years we did that on cod samples. And then this year we did samples from the other professor who does this with me from his masters thesis and he's even older than me so these fish samples were 30+ years old. And they didn't work that well. We didn't get as much implication,

the students got so much more out of it this year, because they had to do troubleshooting. And the key that's I've really seen is not so much doing something to them but when it goes wrong, well what went wrong? What would you do? How would you figure it out? What's your control? So, and that's really, more what science is anyway, getting them to think analytically. They should be able to follow directions but, you know, even when they do things go wrong, like you're saying. So, it was interesting. This year I think they learned more than other two years when they cranked out data. So we have gotten a lot of great things from this grant. The last thing here is, also came about through the network of INBRE schools. Some of us applied to the Howard Hughes Medical Institute, they were spending a lot, Howard Hughes, obviously a lot of money spent, they were spending on science education and they selected schools from across the country. It was the fourth or fifth year they were doing it when we got in and we were I think the fourth community college in the country to get selected so it was a pretty big deal. But what it is is real biology. So in this project every student is supposed go out and be able to find a new virus, and isolate it, and characterize it, and then start doing DNA analysis. So there ended up being 10 or 12 students in the class, they're looking for viruses, and here's a electron-micrograph of one of them, that affect a soil bacterium. To grow up the soil bacterium they go out and they get some soil samples and see, and try and isolate a virus that would affect this bacterium. They did. They spent a lot of time isolating theirs out. So they were doing the same thing over and over and over again but trying to figure out how could I do it a little better. What went wrong. So it was really geared towards learning science. At the, by November, they got to take their samples to USM and did electron-micrographs of them. And here's a picture, here's the bacteria phage, the little head, the little tail. So you know, this is like the original work that was done in genetics was done on bacteria phage, it's like they're isolating their own is really cool. Then over break they sent off one of them to be sequenced and now they're sitting on computers trying to do analysis of the genome, which, where is a gene, what's an open reading frame, what's going on. So they're really learning biology and diversity and how things work through their own phage. So it's a pretty cool opportunity. Next year this Brian Tarbucks who teaches a class he's done a lot of marine things so he's trying to isolate a bacteria to be the host from lobsters and then work with the phage. And I have a friend out in California who's done a lot of work with marine bacteria phage. Their just numbers are huge. He's always pushing me, like, you should do more with phage. Phage are so interesting, they're so simple, they're all out there.

So this is really something you could do with your students?

Yeah.

Really? Huh. Ok.

Yeah.

And is it something you would do in your own classroom, or do you have open invitations to come to SMCC, I assume not just because of numbers and stuff.

Well, I mean, you could register for the class, and there is a high school student in the class.

Really?

Yeah, because you can do that if you, they have to come to class. Instead of having a regular Biology I lab, this is an alternative Biology I lab. So they're doing biology, as opposed to doing, you know, as opposed to memorizing biology they're *doing* biology. And it really gets them excited. The University of Maine Machias, University of Maine Orono, and who was the other? Oh, Fort Kent are all in the same, they're all doing the same program, we all got in together. And, so there's a hope that at the Maine Biological and Biomedical Science Symposium which is held at the Mount Desert Island Biological Labs each year in April that each of those four groups of students will get together and sort of talk about their phage.

That's great, little point of order, it's one o'clock, this session ends at 1:15, and then there's a second session. In about five minutes I'm going to stop us and ask three questions that I'm going to need to ask that we discuss.

Ok, so this is, I just kind of, there's not really too much that I have to do here. I think the fact that we have these three programs at the community college, you know I'm really just working part-time and kind of cobbled this all together. There are the opportunities around in Maine, and you know, getting more students to be able to come and take advantage of them is really great. They, go in the community colleges, you know, they're smaller classes, they're 30 students max in a lecture, as opposed to when I took intro bio there were 15 hundred of us, so, it's kind of nice that way. And they do go on to very good schools. You know, Smith, Clarkson, you know really, very impressive programs. This was I talked about the INBRE money, this is just a poster presentation that our students did last year on the data that, the population genetics they did from the cod research they did at that one week short course, and then presented at the symposium up in Bar Harbor. And that's something I think that's open to high school students too, so if there's a way of getting them up there and see that students are actually doing stuff. I mean, the student do the research here at Colby, and the resources they have at some of the other schools, it's really impressive what they do and how they do their presentation but it's...

It doesn't have to be that way though.

No, and the thing is that they take students from Maine. When I was looking at the applications for the summer fellowship at Mount Desert Island Biological Labs, you know the ones from Colby, or from Bates, kids that grew up in Lewiston or grown up in Waterville. So there are great opportunities right here. So what they were doing is looking at different regions in the Gulf of Maine to see are the cod populations intermixing, or is it some guys here and some guys here and they're not talking to each other. So this is more, you know like a...

Are there distinct genetic populations? Or do they mix? Or, you know, do they, the other thing is do they go maybe to a bank and then kind of infer through spawning.

...Two colored areas, they get the red and the green...

That was the concept, are these two different areas distinct populations? And for me, again being a bacterial geneticist, the concept that when you look under the water, that a valley over here and a valley over here and they may not talk to each other, I never thought about that.

So is that what the case is?

In this case there's some mixing, there's not, they didn't have enough samples, etc. But it was pretty interesting. And what they did was they looked at one, two, three, four, five, six different regions, George's Bank, Nantucket Shoals, and looked at which leals they had and these are regions that rapidly change and don't have a phenotypic effect. So it's not as though the ones living down here where it's colder will have one leal and the ones living where it's warmer will have a different one. The concept is that these don't have phenotypic markers, they're in non-coding regions.

As you're talking I had an interesting thought, we at the Gulf of Maine Research Institute, we have 5<sup>th</sup> and 6<sup>th</sup> graders that come in to a program, and this next program is going to be called Complex Systems and it's hot lobster haring people and the interactions between them. It's a big NSF grant that we we're working with about researchers we're working with. And it would be so call to have high school students that have done some degree of research, come in and present their research to the 5<sup>th</sup> and 6<sup>th</sup> graders. Typically it'd be like five or 10 minutes. It wouldn't be more because, you know, programs are limited. But that would be from college-level to high school to middle schools, would be an amazing leap, even, you know, forget what we're doing, just going to a middle school and presenting that generally. That would be incredible.

I think that would be really great. What has surprised me in teaching in Maine is that, like my father was a scientist, you know a lot of people in my family are scientists, so I knew I could go out and do it. But the first year I taught at USM I was teaching a microbiology class. It was a 400 level class, there were a lot of people going into teaching, another one's going into science. I took them to Nordex, the big hospital lab, as a field trip and also to Fresh Samantha, which was still local, to their lab as a field trip. And they were blown away, the fact that you could get a job, and wearing a lab coat, working in a lab in Maine. They didn't know. And I even have kids in my introduction to biotechnology class that want to go into biotechnology don't think they can get jobs in Maine.

It's cool when students come into our lab just to see scientists not in lab coats. That blows them away, to that their twentysomethings and female blows them away. Just to go into a real lab is worth it.

Yeah, and just they don't have the exposure, and they don't think they can do it. It's like, well Joe here, you know he's done whatever, and he's doing this. And it's really great to see the reaction. It just totally surprised me. It never crossed my mind that that was a barrier.

Most of the science fields that I've seen students going into, and I just picked up an anatomy class because of this, we have nursing and then we have pharmacy and that's obviously the only thing that science offers. And then they don't stay in the state. Or they're going to KVCC for a two year nursing program and then they leave, you know, for a four year program afterwards. But, they're not looking at the biotech stuff or the research stuff. It's just a neat program.

So, can I interrupt us to ask Anita's three questions and then maybe we can continue the conversation if it makes sense. We're officially supposed to switch at quarter after but the next



session doesn't start until 10:30. Is that alright if we do that? Those are our marching orders but we can defect.

Let's see what the questions are before we decide to defect.

Alright, here we go. Question number one is, How does this conversation inform our understanding of what it looks like when we do STEM teaching and learning well? So what does good STEM teaching and learning look like with respect to this conversation?

It exposes what the possibilities are. Because kids don't know beyond the nursing and pharmacy is all of sudden a big deal but before that nursing was the only clear possibility.

But also that they can leave a community college and get a good job at a place locally. I mean Portland isn't that far away for a lot of these kids that have never been out of state either. So I think it's important to expose them to the things that can keep them in the place that they've grown up and to make a positive contribution.

There are biotech companies up here too.

But there's also the fish one in Richmond. They do fish vaccines in Richmond. They have a new name which I don't remember.

Fishnet just moved to Portland as well.

Second question, What do partnerships that support students look like? I guess an obvious one is SMCC and workshops for teachers and potentially classes for students, but what else based on this discussion? What partnerships that support students, what do those look like?

A couple of the names that you threw out, that loan equipment would be huge. We have a huge biotech research project that we have our students do and then they go down to the middle school and present the projects. It's either genetic disease or some sort of stem cell research or something like that. But then to be able to bring in something like a PCR equipment that we could never get.

So do you have some sort of lab experience that goes with that? Or is that purely research?

No, it's just a purely research thing, but that's another level of exposure that they could actually go do that stuff after a two-year program.

Well the other thing for me is we've got articulation agreements with a couple of high schools so that, it doesn't really seem to make a difference because when the students come in they'll take the classes that they kind of got out of, like they can get out of biology I or introduction to biotechnology and they end up taking them but the fact that they know they're being drawn in by the community college I think gives them some level of comfort.

Well and your comment that the community colleges around the state of Maine can take in high school students and show them a path, a potential career path, is brilliant.

There are a number of home school students but also like in the summer we've had students come and just take classes.

I think just, you know, from postsecondary or some of these companies, just to know that you're interested in high school students and perhaps there's an invitation there to come and learn more about you is actually very tempting. We're taking two of our classes up to Orono and we're doing lab tours all day long tomorrow. It took a lot of planning to work it out but I think the kids are excited and we're hopefully going to see a lot of biotechs and other engineering kind of stuff.

That's what I really love about the GMRI thing, is bringing them in and having them do science. When I was at Idexx, the hardest thing was even getting like the Portland schools to come because they couldn't afford the bus. And so when you guys started lessons in a bus I'm like, Oh, that was smart.

Yeah, it's a big deal paying for a bus to go all around Maine, to bring all the students.

Every couple years I'll Jackson Labs and say, So, you guys open for a field trip? But they never seem to be.

When we went there to Mount Desert Island Biological Labs the first year I was like, I want to take my students to Jackson, because I really want to go around, and they brought you to a room kind of like this and they didn't really show you the mice or anything. But, you know, Mount Desert Island Biological Labs is a lot more engaged and they have summer programs for high school students, they have a week-long program in the end of August where a high school student can come and work.

I think Jackson Labs too has some internships up but not for groups of students.

I'm sorry, I'm just...

Ok, your third question.

Well yeah, before our third question I have a comment as well, when we first opened the Gulf of Maine Research Institute we had this brilliant idea of you know, we have a wing of scientists who were specifically hired because they were interested in interfacing with kids, not just college level but all levels, K-12 as well. And then even our very open researchers eventually got down to, Ho hum, I don't want to have, you know, I don't want to be in a glass. If you put a window into my lab I'm going to put up posters. So I think it's exactly what you said, it's hard work to make a specific connection with a specific scientist.

How I got into teaching was I always was one who got dragged out of the lab to talk to the students when they brought them into Idexx, you know, because, Gee, get a Ph.D. in science and you can go to Switzerland and work for the world's largest chocolate company and they thought that was a good sign and it was really kind of fun so I decided, Gee, I'd rather be doing that.

So third question I think is related, it's given our different roles what specific steps can we take to support STEM in Maine?

What support would you guys want to get more students fully engaged so that they stay in science?

I think what limits me in terms of doing like long-term, something that looks like long-term research projects where there's collecting data is we're taught to whatever standard or whatever, making sure we're covering it and yet at some point you have to say, Ok, what am I going to do? Am I going to keep plugging through these standards, does that mean something gets cut out?

So it's a real discussion about what is the \*\*\* really want? Do they want to dot all I's and cross all their t's in terms of the standards or do we just purely want to have a pure science experience for the kids and not be so tied to whatever the standard is? I think that makes it really confusing for us.

Yeah, we were talking about, because we only have a two-year science requirement so we have to meet all the requirements by 10<sup>th</sup> grade essentially. And if we were going to do something like the wind turbine project we would have to make it an after-school club because we can't add it into the curriculum. Or add on an elective where that was a course. So to add in any of that engineering stuff, and have an engineering by design course, it's a semester and they meet every other day. So it's really difficult to just, it's the time thing and the resources and the ability to put some of the other stuff aside because it seems like that's what it would take.

Like I have all of this mercury data that I need to sort through that we've collected in sets and I'm trying to weed out the time to do the analysis and the kids can look at it and I don't know when it's going to happen because we still have to cover a lot of stuff. But I think I'm going to blow off other stuff so we can weed through this.

This is where we can jump to the workshop about informal education after school. Our workshop is officially done in 45 seconds.