Jon Lorsch: Hello.

Person: Hi, welcome. Could you make sure to change your name. I know it just says panelist, so if you could name yourself that would be great.

Jon Lorsch: Okay. Want me to share my slides, too? Do you have slides for us, Liza? You're muted, Liza.

Liza Bundesen: Sorry. No, I think you're driving your slides.

Jon Lorsch: Okay, I'll put them up.

Person: Liza, if you would go ahead and rename yourself.

Liza Bundesen: Yeah, doing that right now.

Person: Great, thank you.

Jon Lorsch: Can you see my slides>

Liza Bundesen: Yes.

Person: Yeah.

Jon Lorsch: Cool.

Person: Are there any polls in this?

Jon Lorsch: No.

Person: Or is there any Q and A moderation happening in this session?

Liza Bundesen: I will be watching the Q and A.

Person: Okay, great. To the ASL interpreters, I know Duran mentioned that in his session, instead of switching at 15 minutes they switched at 22, and that way they only had to switch once. Is that how you guys would prefer to do it? Okay, great.

Person: Yep, that's what we'll do. Thank you.

Person: Emily, I just made you host. I mean Emma, I'm sorry.

Person: Okay, great.

Person: I just made you host, so you're good to go. You can take over the controls and make sure you set the captioner up with CC ability so she can type.

Person: Yeah, great. Okay, perfect. Done. Okay, so we're going to go live about 30 seconds prior to the hour because it takes Zoom a while to let all the attendees filter in. So if you're on camera and audio's on, people will be able to hear you for that first 30 seconds as everybody filters in.

Liza Bundesen: Are we able to see how many people have attended?

Person: Yeah, you should be able to see the attendees, the number in the participants.

Liza Bundesen: In the participants? Okay.

Jon Lorsch: There were like 460 last night.

Liza Bundesen: Oh, wow.

Person: Wow.

Liza Bundesen: And then when should I start talking? Should I wait for 30 seconds after the ...

Person: Yeah, I would wait for 30 seconds, and if you kind of keep your eye on the participants number, once you see that slow down that's when I would start talking. Because you'll just see people kind of coming in in clumps, and that's how Zoom kind of brings them in, gradually. Okay, I'm going to go ahead and turn my video off, but I'll let you know before I hit start so that you know when we're going live.

Liza Bundesen: Great, thank you.

Jon Lorsch: That was a good discussion last night, so I hope we get another good discussion.

Liza Bundesen: Which discussion?

Jon Lorsch: It was about unite.

Liza Bundesen: Oh, okay.

Jon Lorsch: With Alfred and Marie and Erica Boon moderated.

Person: Okay, if you guys are cool I'm going to hit start because I think we're about 30 seconds to the hour, so I'm hitting start now.

Liza Bundesen: All right, I think we'll get started. Welcome, everyone, to today's NIH virtual seminar session. A few logistics before we get started, we encourage you to be engaged and ask questions. To ask a presenter a question, please open the Q and A icon at the bottom of your screen. You may want to open it just to see what other questions may have been answered already. And we'll try to answer as many as possible, either live or in a typed response, but we may not get to them all. If you don't get your question answered, please stop by the exhibit hall and talk with our institute incenter staff, available during the seminar via chat or even 20 minute personal appointments. During this session, you are also welcome to use the cheat feature. Also accessible from the bottom of your screen, to share tips, experiences, and information between participants. PowerPoints are currently available for most sessions in advance, and a recording of this session will be posted within 48 hours. Both will be available in the same location where you logged into this presentation. Thank you for joining this session, developing a culture of safety in biomedical research. My name is Liza Bundesen, and I work in the NIH office of extramural research. I'm your moderator for this 45 minute session. Our presenter today is Dr. Jon Lorsch, director of the National Institute of General Medical Sciences, or NIGMS. The format today includes a short presentation, followed by Q and A. So let's get started. Dr Lorsch, you have our attention.

Jon Lorsch: Thank you, Liza, can you hear me?

Liza Bundesen: Yes, perfectly.

Jon Lorsch: Excellent. Thank you. Well, thank you everyone for joining us for this seminar, and looking forward to your questions. I wanted to tell you a little bit about our thinking recently on how to develop a culture of safety in biomedical research, and why we think this is a critical area for institutions and investigators to be focusing more attention on. So if we were in person, I would ask for a show of hands ,but since we aren't in person, I will just pretend you're showing hands and ask the question of how many of you know the name Sheri Sangji. And normally when I put this up, unfortunately not that many people raise their hands. So Sheri Sangji was a recently graduated student who became a technician in a lab at UCLA in a chemistry lab, at UCLA, and was performing a chemical synthesis step in which she was using a pyrogenic chemical, t-Butyllithium, and she had not actually received proper training in how to use this chemical. She put it into a large plastic syringe in order to transfer it from the bottle into her reaction vessel, and it's a pyrogenic reagent, which means that when it comes in contact with air it can spontaneously ignite, and catch fire. And when she went to transfer the t-Butyllithium the stopper came out of the syringe and it sprayed onto her clothing. She wasn't wearing a lab coat unfortunately, and her clothes and skin caught fire and she was burned over a very significant fraction of her body, and unfortunately a couple of weeks after this happened she succumbed and passed away from her injuries. So this was a terrible tragedy in an academic lab. In addition to her death, which was obviously the worst thing that could've possibly happened, the institution and the PI both had criminal charges filed against them for negligence in this case, and that led to eventually a settlement, but a huge financial cost to the institution and a variety of penalties that were put in place. One of the things that was put in place in response to Sheri Sangji's death was that the University of California Las Angeles started the UC Center for Laboratory Safety, which has become actually one of the foremost centers in the country and possibly the world for focusing on evidence based ways to enhance safety in laboratory settings, and to build cultures of safety at research institutions. And so I would actually commend this website to you as a starting point for anyone wishing to think more about how to improve the culture of safety at their institution. They have quite a lot of resources available, and a number of case studies and reports and other things that will be useful to you in thinking about this. Now in addition to this terrible tragedy of Sheri Sangji's death in the lab, there have been a number of other high profile accidents that make useful case studies in thinking about just how tragic and destructive a lapse in safety can be, and a lapse in safety as we'll talk about is generally caused by deficiencies in institutional culture and institutional policies and procedures. So in 2006, for example, there was at Texas A&M University an accident that luckily, and just really through freak fate did not injure anybody, but could've killed multiple people had it happened at the wrong time. In which a liquid nitrogen tank had been modified to have both of its pressure release valves sealed at some point in the past. This was probably done because those valves were failing, and rather than replace the tank, somebody, and I don't think it was ever ascertained who it was, had sealed one valve and then the other. And because the tank was used fairly frequently, the pressure was vented just by using the tank, but at some point that didn't happen, and in the middle of the night, I think around 3am in the morning, in this chemistry lab, the tank actually failed and it couldn't release the pressure, and thus it exploded. And it basically turned into a missile and the bottom exploded off, it blew a hole in the floor, it rained shrapnel from the tile in the floor in the lab below it and in the room it was in. Completely demolished the room, the walls blew out, the door blew out, and then the tank itself went through the ceiling of the room into the mechanical room that was above it. Went through the water main line in that mechanical room, which then of course flooded the lab and the building. And so again, had this happened when somebody was there, multiple people would've been probably killed if not seriously injured, and just by fate it happened in the middle of the night, thank goodness. But this shows you again, the kind of thing that can happen and happen very quickly if there is not a sufficient culture of safety at the institution. Somewhat more recently in 2016, at the University of Hawaii, researchers doing bioenergy studies were growing bacteria under atmospheres containing hydrogen gas and oxygen gas. The day before this actual disaster took place there had been a small, what we call a sentinel event, in which they were doing the experiment on a smaller scale, and there had been a small detonation that took place. Unfortunately despite the fact that the post doc actually made the PI aware of this event, the decision was made the next day to scale up the experiment and to continue rather than using the sentinel event to bring everything to a halt. And what it turned out appears to have happened is the static electricity built up either on the investigator or on the apparatus or both and ignited the gas mixture, which led the tank to explode. And so you can see the aftermath of that explosion here in this picture. The postdoc miraculously wasn't killed, but lost an arm and suffered other serious injuries during this accident. In addition to that tragedy, then of course the university was fined significant amounts of money and there are ongoing legal issues related to this. The university commission, the University of California Center for Laboratory Safety to write a report on this accident, there were actually two parts to the report that they wrote. But basically in a nutshell the report concluded that the explosion was the ultimate result of systemic safety failures within the organization. They make the point as I'll tell you, that this is not in any way unique to the University of Hawaii. So just to give you a few other examples of tragic lab accidents that have occurred in recent years, at the University of Chicago a researcher was working with an attenuated strain of Yersinia pestis, this is the bacteria that causes bubonic plague, or the black death. It was thought that the strain was not pathogenic because it had been attenuated in its ability to take up iron from the host, and iron is an essential element for the growth and pathogenesis of the bacteria. However, unknown to the researcher working with the strain, he had hemochromatosis, so elevated iron levels in his blood, which apparently compensated for the deficiency of the strain in its ability to take up iron and allowed it to become pathogenic again. The CDC which published a report on this particular event concluded that in addition to that fact, that there was an inconsistent use of gloves in the laboratory, and that was a likely factor in this tragic accident. At Yale, an undergraduate was working in the lab at night by herself, working actually in a machine shop associated with the laboratory, working with a lathe. Which as you may know is a very rapidly spinning machine with a sharp blade for carving things, and her hair got caught in the lathe, and that led to her asphyxiation and death. So these are just unfortunately some examples of the tragedies that have happened over the past decade or so in lab accidents across the country. The UC Center for Lab Safety concluded in the [Indistinct] of the University of Hawaii, their report, that many other institutions also tolerate poor safety cultures and practices, and therefore, there's a direct call to action for researchers and administrators, university health and safety officials at all institutions of higher education to conduct research to take developing better cultures of labs safety much more seriously than it has been done in the past. And then even more recently, you may have seen this actually this year, just in July, there were two cases in France of a fatal prion disease Creutzfeldt-Jakob Disease, and in researchers. At least one of which, possibly both were linked to infections that the researchers likely got while they were working in the laboratory, and that led France to actually issue a moratorium on prion research until they could investigate and improve lab safety practices. So unlike what some people think that this problem of lab safety and significant accidents is limited to chemistry, that's clearly not the case. We have seen cases in biology as well, and a number of different disciplines and fields. And I should say I'm just showing you some of the bigger, more high profile cases, but if you start to dig into it, you will find many, many different smaller cases, what you might even call sentinel events involving all sorts of different kinds of research, different kinds of instruments, different kinds of procedures. I suspect all of you, if you think back on your own careers, can probably come up fairly easily with four or five different examples of accidents of different levels of severity that you have witnessed. I personally have witnessed explosions of ovens, vacuum sealed ovens, of ultra centrifuges. I've put out fires and probably three or four different times of students dipping spreaders into ethanol and then into the flame to sterilize a plate, to spread on a plate, and then dripping the flaming ethanol back into the beaker. I've seen people nearly electrocute themselves on jail boxes. So those are all near misses, those are all sentinel events because none of them led to injury or disaster other than loss of equipment in some cases. But all of them could have become disasters, and all of them tell us something about what we could and should be doing better in developing cultures of safety. So what to do about this situation? NIGMS has been focusing on this in a number of different ways. In all of our training FOAs now we have strength and added language related to safety, and we mean safety very broadly, we mean safety in terms of a safe environment free from harassment, intimidation and incivil behavior, but we also certainly mean safety in terms of the physical laboratory or clinical settings. So for example, in the program consideration section of our training FOAs, it says safety and research training should encompass all of these things, including laboratory and clinical settings where individuals exercise the highest standards of practice for chemical, biological and physical safety, and in which leadership and the research community emphasize safety over competing goals, such as getting that next high profile paper route. We require an institutional letter, and one of the things that has to be in that letter is ensuring that the research and clinical facilities as well as the laboratory and clinical practices promote the safety of trainees. And then the review criteria, they are asked to look at this and review it in terms of what's being taught in the didactic and mentored portions of the curriculum and whether or not that the institutional commitment is sufficient to develop and promote a culture of safety and safety of the trainees. So those are just some examples, but it's propagated throughout the entire funding opportunity announcements. We've done a number of other things in order to try to promote an interest amongst the community, particularly in our training community since NIGMS has such a large footprint in training. We had at our semi-annual or twice every other year, biennial I guess that is, training and workforce development and diversity program director's meeting session a couple of years ago about laboratory safety, in which Craig Merlic, the director of the UC Center for Laboratory Safety spoke. I can say he gave a truly riveting presentation, much better than the one I'm giving to you, so if you get a chance to hear him, I certainly encourage you to hear him. In which he really, I think caught people's attention and gave them something to focus on in terms of how to move forward with trying to improve the cultures of safety at their institutions, and we actually asked everyone in real time to rate the meetings, and his session was by far the highest rated of the entire meeting. We also have over the last few years provided administrative supplements to our training grants to allow institutions to develop new curricular activities that are related to safety and improving the cultures of safety. I have to confess overall I've been disappointed in the number of applications we've gotten in this space. We've gotten a few that really seem to be quite innovative, and the institutions are taking this seriously and doing some really interesting things that I hope will kind of come to fruition and then be disseminated throughout the community. But by in large, the number of applications we've gotten has not been that great, and I think unfortunately it suggests maybe that the community still is not focusing on this issue sufficiently. Despite, as I showed you at the beginning, the extremely high cost in life and eventually in other things as well that could result if it's not taken more seriously. We also have had actual grant proposals, funding opportunities for R25s to develop safety training modules. So shareable, free online modules related to safety, and the opportunity is shown there. It was in fiscal year '20, and hopefully those will be coming out in the next year or so, and can be incorporated into institution's training curriculum, into individual lab's efforts, or in other ways. We have a clearing house that we developed on our website that links to training materials, and will link to those modules once they're developed, and you can see the link for that there. And it provides a number of other links that are useful as well if you're interested in trying to develop and incorporate more teaching about safety protocols, and how to develop a culture of safety into your curriculum. We're also encouraging programs, and this was actually in our funding opportunity announcements as well, to think about teaching not to academic standards in terms of things such as safety, and also in terms of things such as perhaps rigor and reproducibility, but perhaps the industry standards instead. And certainly for safety, industry standards are considerably higher than they are in academia, and although that may seem like an unnecessary burden to incorporate into your teaching and your curriculum, if you think about it, not only will it improve the safety culture at your institution, reducing the risk of somebody getting hurt or god forbid killed, but it will also make your students more marketable when they go on the job market, at least in terms of going to industry, because industry's not going to have to retrain them the way they tell us they have to do now, so that's really something to think about is aim higher than you need to be for where you are and it'll be to everyone's benefit. We're also hoping to partner with professional societies in this regard and to find ways that we can work with them to promote the development of this culture of safety throughout academia, and give people additional resources for trying to do that at their own institutions. One organization I should certainly give a lot of kudos to has been the American Chemical Society, which I think was really galvanized by Sheri Sangji's death, because it was in a chemistry lab, and their journals in 2016 actually enacted new safety policies, and authors are required to address any novel or significant hazards in the work they describe, and I think that's something that they're to be commended for, and maybe other journals and other societies that have journals should think about how they can do something similar in their journals. We, for our part, have been trying to use our bully pulpit, and as I told you in terms of our funding opportunities also our policies and the money we distribute to the community to support research and training. We have had feedback loop, this is our blog post that we put out to inform the community of what is going on, and at GMS we had a blog post about safety training resources, and these issues in general. And we also actually wrote a paper. We were invited by the American Society for Cell Biology to write a paper about the subject in the molecular biology of the cell. And that's shown on the right, and there's a link to it on the bottom, and actually they were very kind and made this an open access paper so that anyone can get it without actually subscribing to NBOC. So I encourage you to take a look at that, it has additional information in it that may be useful. So some more specific things than the institutions can do as they're thinking about how they're going to train students and teach students in the classroom, in the labs and in other places, one thing that became clear from reading the literature, that should definitely be incorporated into teaching students about experimental design, which is something that we're strongly encouraging every training program to be teaching students explicitly in their course work, experimental design. Is how to do a hazard assessment, and this, I won't go through it all, but this shows the steps of a hazard assessment, where you educate yourself on what sorts of hazards there can be, and how to mitigate them. As you're developing the protocol and the experimental design, you're thinking about where at each step the concerns could arise. You incorporate any information you have about actions that actually happened or near misses, you look at literature that's available. You conduct a what if analysis, and brain storm a what could go wrong and what you will do if it does go wrong, and then you write out what to do and what not to do at each step in order to minimize the risks. And if there is a problem, what to do about it. And so by explicitly incorporating this into student's thinking and how they learn to design an experiment, you can dramatically reduce the risk of something going wrong, and you will begin to develop this culture where everybody is thinking about how do we prevent disasters and accidents from happening. I think it's really also important to teach students to question their assumptions. You can assume that everything's fine, this experiment's going to go right and I'll just do it because somebody told me to do it this way, or it was written up this way in a paper. But making people really think, again, going along with the experimental design about is that really true? Is it true that this is safe? Is it true that I can do it this way without something bad happening? And just one example, I'm showing these pictures because in doing research on this area I learned something I did not know, which is the white lab coats that most of us have used throughout our careers are neither flame resistant nor solvent and chemical resistant. So they can catch fire easily, and if you spill a chemical on them, say phenol, it will go through them and into your skin. And therefore, not only that, if you think about them, they all have open cuffs, and so going back to the issue I was mentioning before, I have certainly seen people take their open cuffs and accidentally go through a Bunsen burner with them. Of course you can see what can happen there. So I made everyone in my lab replace the white coats we had with these kinds of blue coats where the cuffs are elasticized so they're not open and they're resistant both to flame and to solvents and chemical spills. And it costs more money, but not that much more money, and if you think about the terrible tragedy you could prevent by having a coat like this, you know, I think it certainly was worth it. And so again, that's an assumption. I assume white lab coats, everyone used them, they were fine, they were the best thing you could get. It turns out not really true. And so you can certainly learn something by questioning your assumptions. Now another area we're interested in, facilitating more and getting institutions to think about is how to bring their core facilities into the teaching mission of the institution, and this can have a variety of benefits, including to help build this culture of safety. So for instance, you could bring your core facilities into the lecture based part of your curriculum. You certainly could incorporate them into active learning courses where students are actually doing things to learn new skills, learn how to interpret data, learn how to conduct an experiment, how to design an experiment. They could be an essential part of that activity. Because they spend all their time doing certain kinds of procedures with certain kinds of equipment, they should be the people that know what the best practices are, both in terms of safety, and also in terms of rig and reproducibility. So they could do things like introduce ... So doing this, incorporating cores into teaching could introduce students to those cores that were available for the research, which could benefit them when they get into the labs because they'll know what's out there and what techniques and approaches are available on site or elsewhere nearby. They could help promote safety practices, as I said. They could teach students about standard operating procedures, and how to use them and how to write them. How to use the equipment as rigorously as possible and how to do the data interpretation as rigorously as possible, and this could happen all at the same time if they're incorporated into your didactic curriculum. The other benefit of it for any of you who are core facility directors, who are vice presidents of researchers and think about the dollars and cents and the worth to the mission, is that by doing this it gives the cores an additional value to the institution. They're now not just a part of the research infrastructure, but they're a part of the educational infrastructure. And I think that double win may further increase their value. So this is a figure, final figure from our paper, and it shows what institutions can do, or some of the things institutions can do to enhance their cultures of safety, and what NIGMS has been doing to help them do that. So I won't go through all the things because I've talked about most of them already, but they start with the top, the leaders of the institution need to have the values and behaviors to emphasize safety both in the laboratory and the clinical setting, as well as safety in terms of safety from harassment, civility, lack of intimidation, et cetera. And that will cascade downwards, so that if the deans, the provosts, et cetera make clear that this is a priority for them, that will get to the department chairs, it will get to the PIs, and then they will help teach their students to operate in that sort of a culture, and it cascades from there into more concrete things. On our part I told you about the things we're doing in terms of funding, in terms of the policies within our funding announcements, in terms of the new funding programs that we have to try to help institutions develop these cultures of safety, but any additional thoughts that people have on what institutions could do, how NIH and NIGMS could help them do it, I think would be very valuable to discuss. So with that, I'd like to open it to questions or comments, and I will end the show there, and stop sharing.

Liza Bundesen: Great, thank you, Jon, for that compelling presentation. So as a reminder, please enter your questions in the Q and A box at the bottom of your screen, and we already have a few for you. So one attendee asks does NIH evaluate in any way the safety and security in the labs that NIH funds?

Jon Lorsch: So again, in NIGMS' training grants, the applicants, the institutions are asked to provide a significant amount of information related to this, and that's then evaluated by reviewers, so that's one place that it happens. It is an expectation of all NIH grants that the research be conducted in a safe environment, but in general, we don't go and do site visits at every institution to check, it's more when something goes wrong, that that would happen. Although in some of the bigger awards during site visits that could be something that could come up.

Liza Bundesen: Thank you. For small businesses, how much additional training does NIH recommend once the available NIH lab safety training modules have been completed?

Jon Lorsch: Well, so businesses are generally covered under different regulations and laws than an academic institution because OSHA's involved in those cases. And it's actually a complication of this space that OSHA does not have jurisdiction in general over students in academic institutions, which makes it a little more difficult there, but for small businesses they are covered and therefore you would have to comply with what their requirements are as well.

Liza Bundesen: Thank you. Another attendee asks, do you know of similar safety institutes like UCLA, devoted to safety protocols or standards for other research environments. On an individual note, we've had to develop for example, our own safety protocols for field research workers in south Asian urban environments. Perhaps there's a market for these additional research settings, such as epidemiology, field trials as well.

Jon Lorsch: I think that's an excellent point, and I think there's a big opportunity to increase the resources that are available in this space, and that's why we have this funding opportunity announcement for the R25s. What I would encourage you to do actually is to contact the UC Center and discuss where the holes are. I know that Craig Merlic, he's not limited by any means just to chemistry, they're broadly thinking about safety within all the research conducted at the University of California, which of course encompasses just about everything. And in his talk he talks about field work as well, particularly a case where researchers were studying monkeys, and they were collecting samples ... I can't remember exactly what it was from the monkeys, but the monkeys were urinating on them from the trees and they were not properly protected from that. So this is a problem that he has recognized for sure, so I would encourage you to talk to him about what more can be done as well.

Liza Bundesen: Thank you. Does NIH require biosafety approval at the pre-award stage?

Jon Lorsch: That's an interest question. At the pre-award stage. I think the university has to comply with appropriate regulations. As a general issue, each grant is not assessed independently each time, but the institution itself has to be in compliance for safety. And if there are special things like higher biosafety levels, that would have to be appropriately approved.

Liza Bundesen: And how likely is it that NIH could provide supplements to research grants to improve safety?

Jon Lorsch: So for the training grants, as I mentioned at NIGMS we have done that for a couple of years, and the reason we chose the training grants was because we have a very large footprint, and because we think that they provide us a significant lever within an institution. They affect a lot of people within an institution, and therefore it's a way to get the attention of an institution and help change it's culture, by giving them some additional resources. Individual grants I think an RO1, that would be a little challenging, because that would be very piecemeal to be so many of them, but perhaps this could be expanded to larger center grants, for example at institutions. So I think that would be something to explore.

Liza Bundesen: So you provided a number of ideas for what institutions could do. If there one or two of your top that could be the most impactful, what do you think they would be?

Jon Lorsch: So I think that's an excellent question. I think two things, I would say. One, this cascades from the top. So it really needs to be something that the vice president for research, the dean, makes clear that the department chairs are going to be assessed on. I would actually put in people's assessments, their performance plans, and that will help build a culture, and then they will ensure since they're going to be assessed on it in terms of their performance, they will want to make sure the laboratories in their department are at the cutting edge of safety. One of my former counsel members used to be at Merck, a vice president at Merck, and he was in charge of their safety program, and he said that he personally did rounds once a month through all their labs for safety, to do safety inspections, and that really sent a message that vice president is coming with a team to check all the labs for safety. The other thing I would say as the second one, again gets back to that education and training piece, that this shouldn't be ... Safety should not be something that students get a two hour session on from the environmental health and safety group their first day in graduate school and then that's the end of it, right? Which is unfortunately what it is at most places. It should be incorporated throughout the curriculum, just like rigor and reproducibility should be incorporated throughout the curriculum. It should not be separated from how to plan a good experiment, it should be absolutely integral to planning a good experiment, just like rigor and reproducibility should be. It should be reinforced continually, so they should come back to it again and again in the first year in different settings, in different ways. And then in the mentor phase of the research, there should be checks in place to make sure that the mentors are reinforcing this, because even if you teach them it in the first year, you can unlearn it all again later if the older graduate students and the postdocs are saying oh, yeah, they said wear a lab coat, but who needs to do that, or they said to wear safety glasses, who needs to ... These kinds of things. But that's again, getting to an overarching issue of it's about the culture. It's about developing a culture of safety, not just a single point safety. I'll just say one other thing, in terms of environmental health and safety, these people are often viewed as kind of the enemy. They're going to come to our lab and fine us or shut us down or whatever. In general they're just trying to make sure that nothing bad happens to everybody can continue doing their research. And so I would really encourage you to bring them into the education training program, don't have them as a separate thing. Again, bring them in, incorporate them. Get their advice, have them give a lecture, have them helping teach something in the course. So I think that's a really important point as well.

Liza Bundesen: That's excellent. Thank you. Well it looks like we don't have any more questions in the Q and A, so I think we can wrap up. Thank you, Jon, for such an informative session.

Jon Lorsch: Thank you.

Liza Bundesen: Yeah, it was wonderful. And to the attendees, if you do have additional questions, please visit our exhibit hall staffer chat and one-on-one opportunities, or you can always find contact information in the help section of our grants.NIH.gov website. And also your feedback is very important to us, so please take a moment to let us know what you thought clicking on the session feedback button located within the description and presenters on the auditorium list of sessions. When you're completely finished with the seminar, please also complete the overall survey form in the navigation bar at the top of the page. So thank you again, and everyone, have a great day.