PLENARY 7

Where do we go from here?

Rapporteur remarks delivered during the 2021 SciPEP virtual conference, Communicating the Future: Engaging the Public in Basic Science.

An astrophysicist, a political scientist, and a science journalist turned college dean walk into a public engagement conference, and... what comes next? Three thought leaders reflected on the conference and looked to the future, including identifying research gaps and resource needs for the future of communicating basic science.

The following transcript has been edited for clarity.

Mariette DiChristina

Dean of the College of Communication
Boston University

Welcome to Plenary 7,"How Do We Move Forward from Here?" I'm Mariette DiChristina, Dean of Boston University's College of Communication and a long-time science journalist, most recently at Scientific American as its past editor and chief. During this session, you'll hear from astrophysicist Brian Nord of Fermi National Lab, political scientist Roger Pielke at the University of Colorado Boulder, and me, as two scientists and a journalist, who, like you, care deeply about public engagement with basic research. We've been asked to feel free to be a bit provocative in sharing our perspectives, and I hope we can rise to that challenge.

This session has two goals. First, we will reflect on what the ideas during the conference mean for public engagement and basic discovery and research. And second, we hope to help you all reflect ahead of the brainstorming process that follows

in half an hour. We'll be identifying together a number of research questions to take forward to improve public engagement with basic discovery and research.

Before I begin, I want to thank the Kavli Foundation, the Department of Energy, my fellow panelists, and all the organizers for this awesome SciPEP conference. I know I'm not alone in feeling very energized by the ideas we've heard today. And, as a humble non-expert and journalist, I'm going to share five themes that I heard that resonated especially with me in addition to a couple of questions that each of those themes raised for me.

First, one observation that I wanted to share is that the community attending these sessions at SciPep really want the publics to know an awful lot of things about science. Here are some of the things I heard. Science can be messy, but it produces what Bruce Lewenstein calls reliable knowledge. Ann Bartuska said at one point that science is a way to ask, "Why?" and that the buckets of basic science and applied science may not be constructive because they create silos. Science is curiosity-driven, and that's a benefit in and of itself. Scientists experience and can share their joy of doing science. But science can also have a point, providing hope. Brooke Smith mentioned The Kavli Foundation's desire to advance science for the benefit of humanity, for instance. And Chris Volpe described the sense that science is a vehicle that carries us to a destination.

There's a central tension between these two aspects of science, hope and joy, that they engender in us. But science can also produce awe and wonder, as we learned memorably from Tania Lombrozo, Daniel Silva Luna, and others. We learned how curiosity can begin a journey, that awe is the reward, and that such experiences can create a positive feedback loop.

We also want the publics to know basic science has a value in and of itself. It is worth investing in. And we even want the publics to help make decisions about where to invest in science.

So, a couple of quick questions from me on the first theme: Do we need more focus as a SciComm community? What does basic science do that applied science doesn't, from the public's perspective? And, since we also learned that non-specialists lump basic and applied science together, is it really important to separate the two? Would that perspective help get basic science more investment, for instance? And what types of awe should basic science strive to engender and to generate for what sorts of outcomes?

A second theme I heard is that to best engage the public, scientists have to be trusted messengers. That requires science communicators to be a bit more transparent and

more equitable in our thinking and even embrace radical change in some of our current systems and processes. We generally seem to agree that science communication by scientists is a good skill. Jennifer Doudna told us in her session that scientists need to be able to explain at a high level why we are doing this, you know, provide an elevator pitch. But SciComm is also not for everyone.

Trust in science is intermingled with trust in our various institutions, which is something we need to be aware of. As we heard this morning, our current institutions, unfortunately, are built on a foundation of systemic white supremacy. We have to take a hard look at that, and more than that, we have to take action. Beronda Montgomery pointed out “We can't hold onto what we have and want change. It doesn't work like that anywhere else in the world." So, should we reset the proverbial table or create a new table? We have to watch that we are mindful of ways to equitably put our information out there to different people, but at least we're moving.

We also learned scientists are generally highly regarded by the publics, but the publics don't think scientists are normal people with emotions. Maybe because most non-specialists haven't yet met a scientist. After all, scientists are just a few percent of the global population, and basic research is roughly one-sixth of U.S. funded research.

So, how to connect? Kirsten Ellenbogen suggested, "Vulnerability and transparency go a long way toward transitioning the scientists in the public eye, and sharing personal motivations can help really build that trust." That takes time; scientists already have busy day jobs, as we heard. Mónica Feliú Mójer mentioned that “Partnerships move at the speed of trust,” and that they require effort and intentionality. David Sittenfeld noted that if you give the public the space and environment and trust with a task, they can really provide thoughtful engagement even around controversial topics.

What are the best ways to create inclusive, inviting engagement around basic research with those publics? What are the best ways to get institutions to move faster in rewarding public communications of science through things like career advancement and other incentives for scientists? This is a real institutional challenge. And, to use words we heard earlier today, how could we make that equitability urgent?

A third theme from me is that the publics are visitors to science, and scientists don't always remember that when communicating. We agree there are many publics with many perspectives, and we can't treat them all as a monolith as Shobita Parthasarathy crystallized for us. We need a sharper focus on who are our target audiences, and we need more inviting approaches. Scientists need to be mindful about meeting people where they are, as Leslie Krohn said, for more effective connections. Be humble, added Shobita, especially when it comes to limitations and uncertainties of science. Scientists need to respect other forms of knowledge. Ann Bartuska added at one point, "One of

the hardest things [to convey when communicating] is the nature of uncertainty in science. I don't know how to get over that."

Context is important in all communication of course, and the context of the lives of your audience is also important to what they care about. As Paula Croxson put it, "People don't just come for a bit of science in a vacuum. They come from their lives, and they go back to their lives," which is important to acknowledge and to understand. John Besley said, "Acquisition of scientific knowledge itself is a narrow objective." A good question to ask around science events and other activities is "Did people have a good experience?"

A couple of questions I have around this third theme is, we joke that nobody should see sausage being made in lawmaking, but why do we sometimes think everybody should see the science sausage? Celeste Frazier Barthel mentioned that too much detail can be a turnoff for nonscientists. How can we find the right level? Are there approaches that can help the publics deal with uncertainties of basic research and see those uncertainties as valuable parts of the journey to knowledge? Why don't we ask members of the publics to join us at sessions like SciPep? I'm looking forward to when we do.

A fourth theme that I hadn't heard a lot about until today, but I was really glad to hear, is that we really need to acknowledge that most communication is mediated with a lot of noise-to-signal. I was really glad this came up in the conversation with Jennifer Doudna and Joe Palca about the media landscape. Communication about basic research occurs in a very busy and fractured media ecosystem. And as Jennifer would advise her younger self, one needs to brace oneself when dealing with that.

Most of the publics actually get their news from social media, but studies show the more people use social media the less informed they are, especially around topics that become controversial. Influencers can drown out experts. And for a variety of reasons, news organizations are struggling just when reliable information is needed most. So, context is really important to understanding and the journal publishing system of embargoes can create a staccato, “he-said, she-said” impression of basic science findings.

In such a busy ecosystem, I wonder what qualifies as good engagement? And what are the sorts of messages and approaches about basic science that can break through - even go viral? Do we even want them to go viral when we're talking about basic research? And traditional media is still very influential in setting the agenda: what's the role for them now in a changed ecosystem? And is the embargo system on papers serving SciComm goals very well anymore?

Lastly and super briefly, I've seen a lot of great energy around science communication, which I applaud, but we need to focus harder on impact and assessment of that impact. I was so glad to see a parallel session on that. And I wonder, how will we know what success looks like?

At the start of this conference, Rick Borchelt asked, “Why do we engage the public in the first place, and what do we do? And what should we be doing going forward?” I feel we need a lot of attention on that first one, and that will really inform the rest.

Thanks so much, and now I'd like to pass the virtual baton over to the awesome Brian Nord.

Brian Nord

Scientist
Fermi National Accelerator Laboratory

Thank you to the awesome Mariette for getting us started here and thank you to the organizers for offering this opportunity to learn and share. Thanks to everyone for being here still and for listening. At Fermilab near Chicago, I am a scientist and I currently work on AI cosmology and self-driving experiments. In the education sphere, I lead the Space Explorers program at University of Chicago, and, in all spaces, I work for justice.

I was asked to remind us that the goal of the conference is to find out what we don't know in the space of public engagement and basic science and develop questions for further inquiry, for ourselves as individuals and for this whole community. Over the last day and a half, I've learned a great deal about this community and its efforts to generate interest, action, and inclusion in basic science. So, I would like to share first some of my observations and reflections and then, separately, some of my resulting questions.

I've noted that there is a significant history and modern effort in building creativity into science communication programs, and this includes a shift toward more rigorous training in science communication and, some of it, embracing cultural awareness. I witness people working hard to impart their joy and excitement for science to people who don't do science for their jobs. Please see Todd Newman's talk from the pre-conference webinar where he shows a chart regarding how joy and hope are used in communicating science and how those are prioritized also by publics.

The discussion of specific goals appears to exist, but it is focused on short and intermediate time frames. I've heard discussion of general goals of building critical-

thinking skills, affecting policy, increasing diversity, but I hadn't heard a lot about specific goals, nor ones which are built with the publics as equal stakeholders. Again, in the pre-conference webinar, John Besley discussed that in the literature, there is also not a lot of discussion of long-term goals, and I witnessed this gap during the conference as well.

As my mom says, "I know the gift I give you but not the gift you receive." The mutuality of public engagement work is clearly growing, and while it is part of the definition, I found it operationally to be significantly limited in important axes during our discussions. Most of the discussion I witnessed still seemed to focus on delivering basic science to people, where we begin with the ansatz that it's what they need or what we believe that they need or that they even believe that they need it. It's also the professional scientists' version of basic science. There have been small explicit-implicit discussions of power also. Early on, there was a discussion of democratization of science and how that is potentially threatening to the scientific community. There's also the question raised during a parallel session asking, how do scientists handle ceding power in the context of citizen science? I think this shows that our professional scientist culture acknowledges that we have power, but we don't want to “give it away or feel like we're giving it away to people we are seeking to help.”

I see tensions. I see a lot of our discussions sit at points of tension or solutions are developed in the context of zero-sum games. For example, balancing learning science with cultural practices or getting as much knowledge into people as we can with limited time. This seems like somewhat of an unnecessary framing, and maybe we can imagine something new.

We talk a lot about meeting people where we are but our colonialist tendencies make it so that we bring our own table and structures to these conversations, to those meetings instead of building something new with pure stakeholders. We don't know a lot about many of the communities to whom we seek to deliver science. Many of the studies and the efforts being conducted don't appear to have data regarding race, ethnicity, LGBTQ status, and other socioeconomic indicators and factors. There was a little bit of discussion of belonging, but not much as far as I can recall.

There's a trend towards solidifying the effective practice of building programs of stakeholders equitably, but it doesn't seem to be occurring in the majority of practices. I didn't witness it being foregrounded in most efforts. It's not clear to me if we know which media formats and communication venues are the most valuable for the continuum of engagement that is needed, especially when we haven't studied mutual engagement across the demographic spectrum.

Finally, despite being at a conference in which we are discussing how we want publics to acknowledge reality, evidence, a scientific way of thinking, we also witnessed this

community’s discomfort with acknowledging realities that they are not familiar with. We tend to ask publics to be comfortable with realities related to science while we tend to shy away from the phrases that make us less comfortable regarding peoples’ everyday lives.

Dr. Goldstein asked on the first day in the chat why we use increasingly loaded terms and phrases like equity, diversity, and inclusion instead of justice, colonialism, white supremacy? The latter are more specific and deeply rooted, while the former are superficial and make us feel better. For example, understanding white supremacy as a part of a valid reality that people live is essential for the work of engagement. It is no longer extra, it's required knowledge for anyone working in any part of this engagement space, lest you bring more harm to the communities you'd like to interact with. Here, there are multiple reasons to acknowledge this. It's the right thing to do. It's what many of the publics experience, whose lives it's actively destroying, and it's one of the reasons that we're facing world-changing events, like climate change, in scientific contexts.

Here are some questions, and I will try not to contextualize them too much so that I don't bias people more than the questions themselves:

What boundaries are we drawing between professional science work and publics? I wonder if our framing of engaging publics, even that phrase, still represents an unnecessary separateness between those who do science for a job and those who don't.

It's also well-understood and well-known that the idea of inclusion and at least how it is most often used is a request for assimilation. When do we consider ourselves part of a given public? Do the publics want to be referred to in the way that we are referring to them? Just as we encourage ourselves to not artificially draw lines between different kinds of physics, are we unnecessarily drawing lines here? How much self-reflection are we doing about the origin of our own identity as professionals in science? What would it look like to aim for a world where that boundary between those who do science for money and not for money has disintegrated?

Whose definition of basic science are we foregrounding or plainly saying is the best one? Polynesians have developed a precise navigation system that uses the celestial sphere to travel the Pacific Ocean. Harriet Tubman used the night sky to navigate the Underground Railroad. Those seem like pretty direct applications of basic science that matter to people.

Is justice ever really a starting point for any of our conversations? Is justice an explicit goal? It's an established fact that the majority of educational efforts in the west, and

particularly the white west, colonize knowledge by ignoring the knowledge creation structures of non-western, non-white folks. This has everyday impacts on many of the communities that public engagement efforts seek to work with. The second day of the conference featured the largest and deepest conversation on equity. Is that prioritizing this enough?

Why were joy and equity posed as somewhat opposing frames or opposing feelings in that discussion? Do we know, either through quantitative or anecdotal means, anything about the marginalized communities that we are seeking to interact with? Have we considered the privilege of curiosity as it sits in our hierarchy of needs? How much is this discussed or even foregrounded?

Do we know who are at conferences like this one? How many people who are not in professional science are here? Who are we missing? If they're not here, why? And do we listen to stakeholders when we invite them to spaces and other decision-making processes? When we're planning workshops and conferences like these, do we treat justice as an add-on? Who do we ask to do the work to make it a part of the conference? Do we welcome the uncomfortable conversation, or do we veer away from it or even resist it?

What if we wanted to build a scientific community in which everyone felt they belonged? And what if we did it because it's the right thing to do, rather than as a hidden commodification of people into productivity mechanisms of professional science processes?

Second-to-last big question, did we hear much about the future world we actually envision? When will we start with the human condition in considering the definition of basic science or its engagement on it? Do we have all the appropriate stakeholders here? Are there enough science journalists? Are there enough community leaders? Are there enough non academicians when we establish these visions? Can we imagine new systems of engaging in the plurality of scientific endeavors and systems that don't pit good goals against one another?

And my last question is, what hard conversations are we not having? I don't think that we're necessarily that far from addressing a lot of these questions, but I don't think we really face them squarely. I think that we don't always deal with fear in ourselves or fear amongst each other when we have opportunities to discuss these things. And now is a moment to move over these barriers and these hurdles and acknowledge the realities that we're not familiar with.

Thank you.

Roger Pielke Jr.

Professor
University of Colorado

Thanks, Brian. Thanks, Mariette. Great comments. Thanks to Kavli and DOE for a stimulating, fun conference. I've really enjoyed it.

I want to start by acknowledging that the most extramural, basic research funded by the federal government takes place at R1 universities[1] like mine, the University of Colorado Boulder, that are largely inaccessible to large numbers of students and researchers. And this isn't just a basic research issue. This is an issue for universities, for society, for science. It's one I've been working on at my university, but the conversations we're having, as Brian just noted, don't always include people that it should. So, we have a lot of work to do.

Let me start by raising the issue of where the phrase ‘basic research’ actually came from. This was a subject of a research project of mine about a decade ago. It actually comes from the U.S. Department of Agriculture in 1920. The Department, in its annual report, said that research is the basic work of the department. The New York Times took that phrase and shortened it to, "The U.S. Department of Agriculture does basic research." But as everyone knows, USDA doesn't do much basic research. It's pretty applied research because they deal with food and commodities. And so right from the start, the notion of ‘basic research’ was conflicted, confused. It meant different things. When it was originally used, it meant what we call today applied research.

We heard from Bruce Lewenstein that [in 1945] Vannevar Bush and "Science, the Endless Frontier" brought the phrase to prominence. If you take a look at Bush's autobiography, "Pieces of the Action," he explains that when he was writing "Science, the Endless Frontier," he said, it is better to use *basic* than *fundamental* or *pure* because we have to go talk to Congress, and we don't want them thinking we're doing pure research which has no application.

We have these dual meanings. For members of Congress basic science means basic to the technology that drives the economy and economic growth. For scientists, it often means pure research. So, we have these dual, contested meanings.

Tania Lombrozo reminded us of William Proxmire's Golden Fleece Award from the 1970s, making fun of pure research. And, of course, scientists do the same thing-

[1] A category in the Carnegie Classification of Institutions of Higher Education for doctorate-granting universities with the highest level of research activity.

making fun of policy makers who don't understand the joy in actually discovering knowledge. I would argue that this tension between intrinsic and instrumental values of science is just unresolvable. It's fundamental to this issue, and we have to embrace it, understand it.

The late innovation scholar Benoit Godin, who passed away recently, has written that organizations like the OECD, even the U.S. government, have pretty much given up on using basic and applied as categories for accounting because it doesn't work. And we see that tension throughout this entire conference, and I think it's a healthy tension, but we have to surface it and talk about it.

Another point is that basic does not mean noncontroversial or nonpolitical. Just two examples, a long time ago, 15 or 20 years ago, Brookhaven National Lab was doing some fundamental physics research that they had some concern that it might end the universe. So, they put together an ethics committee to see if that was worth doing. They went forward. The universe didn't end. We're still here, but basic research doesn't mean it has no effect. We've also seen just in the last week, controversy over basic research doing so-called gain of function research in viruses. We won't get into the definition of that term but basic research can be every bit as political as any other type of research.

Christopher Volpe highlighted different values that the public and scientists have. And it's really important to understand that it's not just values about science. If we look at the values of the research, the scientific community, particularly the government and the academic community, it doesn't map onto the values of the United States public as a whole, and that creates some tensions that we have to grapple with.

One of the most important questions that I heard this week, and it came up in a number of contexts, was when Celeste Frazier Barthel asked, "What are we trying to do? What are we thinking about when we're trying to do communication?" I'd argue from one standpoint that science communication is impossible. We've taken on a task that just can't be done. David Kirby introduced a phrase I hadn't heard before, but I think it's fantastic, “wonder overload”. I mean think about it; collectively, we produce millions of peer-reviewed papers every year. We say to every PhD student, every postdoc, every full professor, "Get out there and communicate it."

Well, guess what? If we're all successful in communicating science, all we get is noise because you have thousands of people talking about millions of papers that people can't understand. Science communication can't succeed on the basis that it's often advertised.

Now, there's an old model of communication that goes something like this: it's who says what to whom, how, through what channels, and with what effects? And I would add to

that why. And Shobita Parthasarathy reminded us this week of equity issues in communication and their consequences. But I think that the old one-sentence model of communication provides a pretty fantastic framework for thinking through a research agenda on how to understand expert scientists communicating with the public and policy makers.

So, maybe the phrase science communication is too imprecise. You know, after all, I had never seen or been to a conference on history communication or accounting communication. What is it that we think is so special about science? The late Steve Rayner, a good friend and mentor of mine, said maybe what we really should be talking about is appreciation. Maybe we're thinking ‘science appreciation,’ but then that gets complicated too. We think about respect and deference. Emily Howell reviewed research today suggesting that deference can be associated with authoritarianism. That's not particularly good. But trust and belief do not have that association. That brings into the conversation issues such as democracy, which I think we need to talk about more.

But maybe it's not science or scientists that we want people to appreciate. Maybe it's reality. To have the wonder and awe about the fact that we have tools to understand this world we live in, and it's not us or the work that we do. It's this world, this universe that we inhabit that we want people to understand and appreciate.

But we've also heard perspectives that people want science to be instrumental, so we focus on the consequences or outcomes of communication. Joe Palca talked in his discussion with Jennifer Doudna today, and I admit, I cringed a little when he said, "Well, do you have some tricks to try to get people to do what you want them to do?" I'm not sure that's a good message we want the public to hear about what scientists are up to.

Maybe what we want to do is society communication, not science communication. Maybe the direction of communication has to go from the outside world to us experts. Maybe we should be having conferences on *society* communication. Then, I think, and this is one of my pet issues, we experts need to grapple more seriously and openly with the roles and responsibilities of experts in a democracy.

We're in this crazy world where, for society to work, we need experts. We need vaccines. We need people to run nuclear power plants and so on and so forth. But at the same time, we have this longstanding idea that everyone gets to participate in the governance of the country at some level. How to balance out expertise and democracy is something that I think every expert needs to deal with.

We were asked to recommend some thoughts on our going-forward research agenda so here are mine.

I think we should spend some time thinking about: How do we better train experts, not just scientists, but experts to be communicators? Recognizing that communication is all the things that have been said - it's two-way, it's part of society, it's reflective of shared goals and ambitions recognizing that some people aren't at the table and should be. What's our responsibility not just to communicate, but to build up better systems in which communication takes place?

Second, how do we evaluate success and failure in communication as a process and its outcomes? I'm leading a 19-country comparative case study on science advice and COVID right now, and I can tell you, there's a lot of lessons that are positive and negative about communication and engagement by basic researchers, by applied researchers, by governments, and we need to do a better job of being able to say, "No. That's not very good communication," or "That's fantastic, good job."

And finally, how might we better understand our responsibilities as experts in democratic governance? We do have an outsized role in society. We have a lot of authority for better or worse. Although there are ups and down on different issues, in general the public sees scientists up there with doctors and the military as the most authoritative, respected institutions across society. That gives us a lot of responsibilities. We should talk about those responsibilities and we should have that as part of our curriculum. Every PhD student in any discipline, as they're becoming narrower and narrower in their own field of expertise, should become broader and broader in understanding where they fit in the broader society.

Thank you for the opportunity to participate, to share some views.