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METASCIENCE: ACCELERATING DISCOVERY BY UNDERSTANDING THE SCIENCE OF SCIENCE

(NOVEMBER 13, 2025)

SESSION DESCRIPTION

How can psychological science improve its own practices to advance discovery? Join us for a panel discussion with leading voices in metascience to discuss how studying the scientific process itself can improve rigor, transparency, and innovation in our field.

This webinar is part of APA's [Essential Science Conversations](#) -- where panelists and audience members engage in an open dialogue about emerging topics in psychological science.

Any opinions, findings, and conclusions or recommendations expressed by the presenters in this webinar do not necessarily reflect the views, policies or positions of the American Psychological Association.

UNOFFICIAL TRANSCRIPT

Shandol Hoover: Hello, and welcome. Thank you for joining us today. I am Shandol Hoover, Senior Director of APA Science Special Projects and Implementation. Before we get started with today's session, I want to share a few quick announcements. Today's session is being recorded. About two to three weeks after our live session, everyone who registered will receive a link to the recording, a transcript, and related resources.

Shandol Hoover: Hello, everyone, and welcome. Thank you for joining us today. I am Shandol Hoover, Senior Director of APA Science Special Projects and Implementation. Before we get started with today's session, I want to share a few quick announcements. Today's session is being recorded. About two to three weeks after our live session, everyone who registered will receive a link to the recording, a transcript, and related resources.

Any opinions, findings, and conclusions, or recommendations expressed by the presenters for APA's Essential Science conversations do not necessarily reflect the views, policies, or positions of the American Psychological Association. We hope you'll visit apa.org/science to learn how you can engage with APA science. Learn how APA helps psych scientists by reviewing elevating psych science.

We hope you'll subscribe to our free *Science Spotlight* newsletter for funding and opportunity information, and then you'll also subscribe to our free *Editor's Choice* newsletter, so you can get free articles delivered directly to your inbox. You can also check out the new APA Response Center to navigate recent and proposed policy changes with resources and support from APA.

We have an upcoming webinar opportunity on Monday that we hope that you will check out. You can get more information by going to apa.org/science and checking out our free Science Training session series.

Today's program, Metascience: Accelerating Discovery by Understanding the Science of Science, is part of an APA series called Essential Science Conversations, where panelists and audience

members can engage in an open dialogue about emerging topics in psychological science. Thanks to everyone who submitted questions for today's program when you registered.

You can also ask a question as a program is taking place in real time using the Q&A box. If you experience any technical difficulties, please let us know using the Q&A tool. I'll now turn things over to Dr. Ludmila Nunes, Senior Director for Science, Knowledge, and Expertise. Thank you, Ludmila.

Ludmila Nunes, PhD: Thanks, Shandol. Welcome, everyone. Thank you so much for joining us today. This Essential Science webinar, Metascience: Accelerating Discovery by Understanding the Science of Science, is going to be filled with experts. Today's panel brings together leading voices in psychological science who are helping to shape a more rigorous, transparent, and innovative future for research.

We are very excited to have with us Dr. Fiona Fidler. Fiona is Head of the History and Philosophy of Science Program and Associate Dean for research in the Faculty of Arts at the University of Melbourne, Australia. Her own research investigates the dynamics of methodological change in psychology and other sciences. She was the founding president of the Association for Interdisciplinary Meta-Research and Open Science.

We also have with us Dr. Brian Nosek. Brian is Co-founder and Executive Director of the Center for Open Science, and the Professor of Psychology at the University of Virginia, where he advances research to align behavior with values, enhance scientific rigor, transparency, and reproducibility, and improve research culture. He co-developed the Implicit Association test, co-founded Project Implicit in the Society for the Improvement of Psychological Science and leads applied metascience initiatives that evaluate interventions in bias, replication, and open practices with rigor.

We also have with us Dr. Simine Vazire. Simine is professor of Psychology Ethics & Wellbeing at University of Melbourne, Australia. Simine's research examines whether and how science self-corrects, focusing on psychology. She's the Editor-in-chief of the *Journal of Psychological Science*, and together with Brian, she co-founded the Society for the Improvement of Psychological Science.

Thank you so much for being with us today. Let's get started. I think the first question that we should be asking is, how do you define metascience, and why is it essential for psychological research today? Maybe, Fiona, you can get us started here.

Fiona Fidler, PhD: Yes, thanks. Thanks so much for inviting us to be here. It's really great. How should we define metascience? Well, you've heard already in the introduction that metascience is most often defined as the science of science. That's a definition that's meant to distinguish metascience from what we might consider less systematic, or less representative ways of studying science, like philosophy of science, or history of science, sociology of science.

The science of science definition doesn't quite capture it for me. First of all, I think it's wrong to assume that history and philosophy of science can't be done in a systematic way in their own right. The need to differentiate is unnecessary, I think, in that dimension. Secondly, science of science doesn't capture what's really important about metascience, which is its mission to improve science. To me, metascience is about gathering evidence to improve science at every level of its operation.

From individual practices like the kinds of measurement and statistics we do, to lab or department level practices that cultivate good data management habits, or value reproducibility, institutional

practices that value real research impact, and not just course metrics, and research evaluations, so peer review and editorial processes. All of those things are metascience.

Why is it essential to psychology? Well, I think it's essential everywhere to every science, but psychology, I guess, is at risk maybe of losing public trust more quickly than some other sciences, and psychology's also very well equipped to contribute to the metascientific endeavor, which is essentially about behavioral and cultural change. It's the bread and butter of psychology.

Ludmila: Connected to this question, I have a question for Brian. Sometimes we see a confusion between open science and metascience, although there is some overlap, they are different things, right? Is this something you can talk about?

Brian Nosek, PhD: Yes, sure. Thank you for having us. I'm delighted to be part of the conversation. Building on what Fiona said, an important thing to distinguish between open science and metascience, is that open science is a particular point of view about how to improve science. It is in this moment, the last decade or plus, a popular place of reform, but it itself, for one, is not the only way to think about how to improve science, and two, may not actually improve science.

Metascience is always looking at how is it that we can improve, advancing different ways to innovate and try new models of doing science, and the ways that Fiona described, and also how funding gets allocated. How institutions are built and designed. Every part of the science as a system are subject to metascience. Whereas open science is a constellation of some particular things.

Improving transparency, improving sharing, improving inclusivity, and some associated practices with those that, at the present moment, people think, "Yes, these are things that we believe will improve science as one activity area in metascience."

Ludmila: Could we say that metascience is trying to understand science and its processes, and trying to improve it, and open science could be one of the tools through which we do this?

Brian: That's right. Imagine that open science just becomes normal practice, then you wouldn't really call metascience, new metascience as being about metascience, or about open science, because that's just what we do. The new metascience would be about, "Well, what can we do better than that? Well, what are ways to innovate beyond just being transparent?"

Ludmila: Yes. What do you think, Simine, are the most pressing challenges in psychological science that metascience can help to address?

Simine Vazire, PhD: Yes, I think that psychology, because of what we've experienced in the last 15 years with the replication crisis, and really it was, I think, much broader than just replication. I think there's a responsibility to self-reflect, and ask ourselves, what can we learn? How could we have avoided it? Or maybe we couldn't have avoided it, but how can we avoid crises in the future? What can other fields learn from our experience?

I think that a big challenge will be to demonstrate that we have taken the lessons seriously from this crisis, or this kind of episode in our field, and not just so, I think, the open science reform movement was one aspect, but also, that we're taking an evidence-based approach. We're not just going to assume that these reforms are good enough, and now we can move on, and there's no problem. Doing evidence-based assessment and accountability of what might have contributed to the problems, whether the solutions are working, whether the solutions have side effects, and so on,

so that when the public asks us, "What did you do? How are you responding to this episode?" We have really concrete answers.

Also, really, I do think as Fiona mentioned that psychology is in a really good position to help other fields. Other fields are going to face these kinds of crises, and we can demonstrate a model for how to respond, and maybe even lessons from our experience that can translate or be adopted in new ways by other fields.

Brian: To build a little on what Simine is saying right there, Fiona's earlier point that a lot of metascience concepts are really psychological questions, culture, how people's behavior, how we get misaligned with our intentions and our actions, how we consider and treat, and understand evidence? Those being psychological questions, really put psychology at the right spot to be a leader in improving itself, and then disseminating those insights to other fields that don't really have the same tool set to think about their research cultures, how it is they operate, how they might change behavior.

Of course, all of that happens in lots of different ways, but we bring, presumably, a set of expertise and knowledge that our own field, being a test bed, provides an opportunity to then extend, and give psychology away in a way that really helps science fields more broadly improve.

Ludmila: We can basically use our science to improve itself?

Brian: That would be an ideal outcome, wouldn't it? That our stuff really matters, and it can help improve our own behavior, not just those other people that need to change their behavior--

Ludmila: There are series of-- Oh, sorry, go ahead, Simine.

Simine: I think it's easy to underestimate how much we have to offer. I remember one time, there was the Editor-in-Chief of *Nature* at the time, it was many years ago. I was speaking at my university, and I asked about the peer review process, and whether they have processes in place to avoid status bias, like authors who are more famous being treated better in the peer review process.

They said, "Oh, we're not susceptible to status bias, because we've rejected papers by Nobel Prize winners, so we don't have a problem with bias." I don't think you would hear a social scientist say that with a straight face, as on its face, I can prove that I'm not engaging in motivated reasoning, because of this or whatever. That reminded me that other fields have stuff that they can learn from us about the psychology of, because science isn't this objective, magical thing. We are humans doing it. If we forget that, and if we get the psychology of humans is fallible, then we can make all kinds of mistakes.

Ludmila: It's something like eliminating the bias but being aware of it.

Brian: Right. I've been in several meetings that are very interdisciplinary, talking about these sorts of issues, and bringing something up that's like, "I think we should consider people's motivations for why they are trying to publish that paper." Other people are like, "Oh, man, motivation, that's great idea." Oh, wait a second. [chuckles] This is a very different conversation preparedness for thinking about how the human interacts with their environment, with the incentives, with the cultural constraints. Those are things that flow so naturally in our field in terms of conversation and consideration, and are really exportable in ways that are useful to others.

Ludmila: It would be great if we can do this, if we can use our science to improve science. This will require a series of changes. For example, what cultural shifts do you think are needed in academia to actually embrace failure, replication, and correction as part of the scientific process? Because it's not easy, we know that science is composed of these things, but these things are not rewarded. How should academia change to actually embrace these realities of science, and of the scientific process? Maybe Fiona, I don't know, or Simine.

Simine: I think we ask a lot of researchers, especially with open science movement, we're asking people to be more transparent, and document things more, and so on. I think that's all great, but as Brian just said, researchers respond to-- They're motivated by the incentives, so I think there's a lot we could ask of the gatekeepers about what they could do to change the incentives, so that failures are more acceptable, and things like that.

If journals didn't expect articles to be perfectly coherent, and no random finding that doesn't fit in, and things like that. If we did a more thorough job in peer review, so that the kinds of research that got into the most selective journals was actually the best research, which requires a huge investment in the peer review process, so it's not easy. It would require also everyone, the whole community to accept that things might slow down a bit if we really want to do that.

I think a lot of that power is in the journal editors, the funders, the people who hand out the rewards, if they start saying, "Well, to get these rewards, we're really going to scrutinize, and we're really going to reward not the most beautiful looking science, but the most realistic, and well done, and important science." Then, I think people will accept if there's some side effects, like things slowing down a bit, or different kinds of research getting rewarded. I think researchers want to do that kind of science, it's just a matter of whether they believe, whether they have reason to believe that they can have a career if they do it.

Ludmila: Related to what you just mentioned about the peer review process, do you have more specific ideas, or solutions about how can journals and peer review systems evolve to support metascientific principles?

Simine: I think there's some easy things journals can do to make metascience easier. Right now, I think journals are starting to increase how much transparency they demand of authors, and that helps metascience. If the research is reported more transparently, then we can do more stress testing of it, post publication. We can do more replications, because the methods are reported in greater detail, we can do robustness tests, et cetera.

Just asking for more transparency from authors is a good start, but journals can also be more transparent themselves. For example, some journals have adopted transparent peer review, where they publish the peer review history of the articles, not the identities of the reviewers, unless they choose to identify themselves, but just the content of the reviews, and the editorial decision letters, which metascientists can use then to investigate things, like, is there bias in peer review, or what are the reviewers focusing on?

Are they penalizing research that is rigorous, but has more messy results in it? Or trying to study the peer review process itself, if journals are more transparent. Also, journals could just invest more in stress testing things before they get published. Right now, the peer review process is quite light, I would say. Some of that is just the norms in science, because stuff wasn't reported super transparently before, there's only so much peer review could do. Now that authors are reporting things more thoroughly, we can actually do more checks during peer review, but that requires investment of resources, and acceptance of the costs, time, and money, and so on of that.

Fiona: I don't mean to suggest that change at journals is easy, but I think we have a really big challenge in instituting changes in institutions in our universities, and research institutions. I know many of them have now signed some kind of formal agreement, perhaps DORA or something equivalent, that commits them to valuing real research impact and quality over relying on metrics that prioritize quantity over quality.

In my experience, those high-level agreements don't really have much purchase at local committee level, where people are making decisions about hiring, or the selection, or promotion. At least in Australia, there's no evidence that those signing agreements at that high level have had any impact on our annual performance process, for example, our annual performance review process.

I think institutions need to do a lot more work in ensuring that those high-level principles in those agreements do, in fact, guide what's going on in committee decisions. That's a really difficult thing. I think that's about leadership at a head of department, or a head of program level. I think most researchers as Simine said that have a strong intrinsic motivation to do good research.

When that's not happening, it's usually because of some obstacle, whether overloaded with teaching response responsibilities, and they need to cut corners somewhere, or the threat of some punitive action if they don't produce a certain level of output. In some faculties, in my own institution, that failure to publish a certain number of articles a year can have you reclassified as a teaching specialist, rather than a teaching and research academic.

Policies like that, I think, when they're enacted thoughtlessly, or without proper investigation of the obstacles, can invite academic misconduct. I think institutions need to be a lot more thoughtful about how we get from high-level principles like DORA into action on the ground.

Brian: Yes, I agree with Fiona's point there on the key element of institutions. I'd also say, just going back to the original question, at the most, at the simplest characterization, the change that's needed is to value process more than outcome. Right now, it's almost entirely outcomes-based evaluation system. "Did you get the right kind of results? Are those results publishable? Are they publishable in the right kind of journal?" It's about the results.

When it's about the results, that creates the atmosphere of all of the things that go up behind the scenes, and actually doing the work, all have to be in service of getting the right kind of results. That creates a lot of the challenges for credibility, for lack of rigor, for things that aren't improving, and errors being made, and errors being very embarrassing. Whereas an orientation to being it about process means that we get rewarded for quality, for rigor, for being transparent, for doing things the best that we can in a world where, as you said, Ludmila, that we recognize that error is pervasive.

Science is hard. We make errors all the time. The object of science is not to make zero errors, because that's not an achievable thing in a world that's trying to push the boundaries of knowledge and take risks, but rather to help root out error, and address those errors in as effectively as possible as a social system, because I'm going to have my orientation to how I do this thing, and my limitations to how I do that thing.

By engaging in the social system of science, ideally, Simine and Fiona will figure out what I did wrong in that thing, point it out. In the current world, I have to feel angry and embarrassed that Simine figured out this error of mine. In the better world, I would say, "Oh, awesome. Thanks. You've just improved my work. You have found something that I did not see, and now my work is

better for it." That would be a much more functional system. As Fiona said, that's easy to say. It's hard to do. That's what a lot of the metascientific experimentation is trying to address.

Ludmila: Yes. Focus on the results only is not comparable, and it's not compatible with the scientific method. That's precisely what metascience is trying to address and put us back on track to actually follow scientific methods, and understand it right. We had some questions, and we are receiving questions on this session. There is one question related to what institutions and the academia can do to incentivize, and reward good research practices.

This question is about what changes would you recommend in graduate training to foster a culture of metascientific thinking? How can we, when we are training students, what should we start by teaching them? I don't know who would like to answer. Simine?

Simine: I'll say a quick answer. Just that I think most of us come into research with the right attitude. We are thinking in a metascientific way. We're thinking about, we get into science because we like that process as a way of knowing, and we think there are important questions in the world that we want to contribute to answering. We understand that it's fallible, and that a negative outcome isn't a reflection on the researcher and so on.

Actually, Nicole Nelson has done some really interesting sociology about early-career researchers who work in labs, where they get negative results, and then they blame themselves, or maybe their supervisor blames them, and it's treated as a reflection on the scientist, and how disillusioning that is. I think a big part of that disillusionment is that we start with the right ideals. Actually, we need to not train those out of people.

I think it's not so hard, actually. That makes our job easier. If most people start with an understanding, fundamental, like the general public understands that science makes mistakes. If you look at the results from Pew surveys, the public does not think that scientists are infallible, and that they don't make mistakes, and things like that. They agree that scientists make mistakes, and that's not a problem for public trust in science.

Then, we train people into thinking that, if they make mistakes, or things don't come out the way they should, then that's bad. We treat their career as if that's what's going to advance their careers, is getting the positive results. I think if we change our practices, we don't have to train the right values in people. People have them to begin with.

Brian: I agree with that. I would just add in terms specifically of metascientific thinking, it's so easy as we get into our graduate work to go very deep and narrow, because we have to, in some ways, from what our earlier experiences might have been, to become expert in a field, to figure out the methods that we use in our particular substantive questions. I think a very useful complement to that gaining in-depth expertise, in particular methodology and approaches, is to also be attentive to the system in which we are individually embedded.

How is it that I do my work? How is it that I approach that work? What is it that I'm doing that I think I'm doing, or I'm trying to do in advancing the research that I'm doing? Those more abstract questions that are reflecting, and looking at ourselves as an object of study, how I'm doing my work, not what the work is, are very productive, I think, in being intentional and deliberate on the kind of researcher we want to be, and adopting that metascientific approach of recognizing that we are embedded in a system, that we're limited by our own skills and perceptions, and those things are important to consider in doing good science.

Fiona: Is our answer to this question of what's needed in graduate training metascience, we should teach metascience? Might be. I think it's probably too self-serving of me to suggest that.

Fiona: A little bit of philosophy of science maybe--

Brian: Here's a paper you should read. Yes.

Ludmila: I was actually going to ask you, Fiona, and Brian, and Simine, if you think that would actually be beneficial to have some metascientific training, or epistemological training, even as undergrads, not only to educate future scientists, but future consumers of science?

Fiona: Absolutely. I really think it would. There's one thing I think you get from that kind of training in epistemology, or philosophy of science is an appreciation of scientific uncertainty. That goes a long way to improving science communication with the public and building tolerance for uncertainty there in the public that helps foster public trust in science when science then changes its mind about what the best recommendation is.

If we've built some kind of tolerance for scientific uncertainty, then we don't get as much backlash against that kind of thing. I think it also helps with the type of thing that Brian was talking about earlier of accepting error. When someone points out your mistakes, you can just say, "Thank you, and you've improved my work," because that's what we understand is the process. We know that nothing was ever certain before, and it won't be. That's the dynamics of scientific change.

Simine: Yes. I think it can be worked into research methods classes that already exist. When I teach research methods, most textbooks have a chapter on the scientific method, or things like that. A lot of that is, I think, quite outdated by philosophical points of view. We could instead replace it with a more realistic understanding of what scientists actually do, and how common it is for things not to work out, and things like that.

Brian: I think a lot of these types of issues are most productively interrogated when they're embedded in the work that people are doing. I do like the-- I like taking classes. I spent five and a half years as an undergrad until my parents made me graduate, because I just wanted to keep taking classes. It's also abstracted to some extent from the work as we do it. There is some real value in the laboratory context with your colleagues who are wrestling with the substantive work to be looking at this at a broader way. How is it that-- What are the assumptions we're making about how we're extracting evidence from this? How are we making inferences? Having that discussion be rooted in the work itself.

Ludmila: One thing that I-- I think you mentioned is, Brian, the importance of metascience to fostering even collaborations. For example, you do something, and Fiona and Simine look over your work, and help you improve your process and methods, and catch any errors. Do you think that metascience can also be integrated into interdisciplinary collaborations, and this way make, accelerate discovery?

Brian: Yes, in fact, I think it's often the most productive way for interdisciplinary collaborations to actually work. I think one of the real challenges of interdisciplinary work is the precise fact that they're interdisciplinary. People come with different backgrounds, different assumptions, different approaches, different knowledge bases, and you can get productive collaborations by getting clarity on a shared question that those interdisciplinary approaches are examining.

Embracing the ecumenical characterization of what that interdisciplinary collaboration is itself can be productive in trying to understand how are we going to make progress on this question. It's adopting the opportunity to say, we do have a different way of knowing based on the origins of our work, we do have different assumptions about what good evidence is.

We should be talking about that, in order to facilitate a productive collaboration, not that we have to then get aligned, and convince one of ourselves that who is right, but rather to figure out how it is we're going to interrogate and make progress together.

Simine: Yes. Sometimes I think that if psychology had been better at communicating with other sciences that the replication crisis would have been a lot less bad. I think about that very often if a discipline-- Part of the problem is that psychology is so strong on its own that it doesn't have to work that much with other sciences. We're so big physically, the sizes of the departments in universities.

If you look at network citation maps or a hub, we don't necessarily need to sell our work outside of our own discipline, but that can mean that we have developed these blind spots.

I had the experience when I was in sabbatical at a disciplinary center, and have lunch with people from other disciplines every day, and once we got familiar enough with each other, and they would start teasing me about some of their impressions of psychology like all of our researches on college students in America, and things like that, which that was before MTurk.

At first, I was defensive, and it took maybe two months of becoming friends with these people. Before, I was like, "I think they have a point." Interestingly, going back to one of my earlier points, it's also the same criticisms that first year students, when they join your lab, and they join lab meetings, they'll raise the same criticisms about our work, and we become blinded, we have blinders on to those problems, because we train ourselves out of those instinctive criticisms that, I think, that our colleagues in other disciplines do a really important service in holding that mirror up to ourselves, and we can do the same for them.

It's interesting finding areas where I think psychology's much, much better than other disciplines in areas where we look really naive to people in other disciplines that are more advanced on some of these dimensions. I think there's a lot we could learn in that.

Ludmila: Fiona, do you have any thoughts about this question of interdisciplinarity, collaboration?

Fiona: Yes. I've been thinking about this a lot, actually about interdisciplinarity. I think my own-

Ludmila: I thought so.

Fiona: -career has been pathologically interdisciplinary. It is a difficult thing to learn the language of another discipline to a sufficient standard to be able to really do productive work together, but Simine says it's very important. I think what metascience can do, in that, as Brian was saying, is built-in self-reflection on practices and processes on what constitutes evidence.

It builds in a safeguard, I think? It builds in a quality control measure within the collaboration itself. You see that in big team collaborations in physics as well, that are triangulation within the process, and I think metascience type of reflection that metascientists invite, facilitates that triangulation of evidence. I think it's a built-in quality control process within the collaboration.

Ludmila: I was looking at the Q&A box here, and they have some questions that might be interesting to answer live. One of them, "What do you think are the biggest deviations between how science is done today, and the traditional scientific method? Do you think this is a reflection of limitations of the scientific method, or our contemporary processes?"

Fiona: I might take a stab at this and start by saying that I don't that there is, or has ever been, something that we could refer to as a singular, the scientific method. This idea of a singular method that unites all of the very diverse practices of science that, for example, unites a kind of field work that ecologist do with the type of stuff that physicist do in the lab. There has never been a single scientific method.

The only thing that we could, perhaps, what we think of when we use that term is something very high level like a hypothetico-deductive process. Well, once we start talking about that level, that's not really enough to distinguish what we call science from things that are systematic study that we wouldn't call history, lore, whatever. "What are we doing now that's different to the traditional scientific method?" Well, science has always been changing, and there's never been a single method. I think what we're doing with metascience is just really acknowledging that, and systematically investigating how that change works, and evaluating whether that change is going in the direction we want it to.

Ludmila: We might want to change the process if it's not serving science anymore, right?

Brian: Yes. That's the underlying assumption of metascience as a concept, which is, we can always do better than we're doing today, and one hopes that the "scientific method" is an exercise in constant improvement of how we acquire and interpret evidence, in order to come to generalizable knowledge. Is it actually improving? Are we better than Galileo was at acquiring evidence? I don't know.

We know that we're better at seeing further away than Galileo was, so there's been incredible technological and ethological advancement in areas of study that allow us to do more, see more, gather more evidence more effectively, more efficiently with higher quality than we ever have. It is not as clear, and I think that's part of the current movement, that our intellectual process of approaching the gathering of evidence, interpretation of that evidence, that that has been improving as much.

Many of the challenges that are discussed about research credibility, and the open science movement, the reform movement as it is, are about things that we may have created, structures, or cultures, or processes that actually undermine, as Simine was saying, what we might do even with less training, because of the strength of the culture in posing. This is the expectations of what you're doing.

Simine: Yes. I'd say also there's the real philosophy of the scientific method, and all that, and then there's what's presented in psychology textbooks, which is an unfair straw man version of that, but I would say when I teach research methods sometimes the textbooks would say this very idealistic picture of the scientific method. I would tell students, it doesn't work like that.

Just because something is published in a peer review journal, or even if it makes it into a textbook, or even if the most famous person at the most prestigious university says it's true, that doesn't mean you have to believe it. You're allowed to question it, you're allowed to critique it, and I would give examples of things that turned out to be wrong. Not just turned out to be wrong through innocent means, but actually researchers misrepresenting things.

A really good example in psychology is, at least in my area, it was very common for researchers to write up, "As we predicted," blah, blah, blah, when, in fact, they had not predicted that at all. In fact, Daryl Bem's paper on how to write a research article basically told us to do that, and I would teach that article. Then, when you tell students-- We weren't sitting there being sinister and evil, but we let ourselves to believe it was okay to say we predicted this, when in fact we didn't, and everyone reading it knew.

We taught undergrads that, and I think it makes them feel like, "Okay, I didn't--," I've had students come up to me before and say, "My other teachers in other science classes made it sound like we have to believe things if they pass certain criteria of the scientific method." They know that's not true. They see in the news and stuff that scientific findings turn out to be wrong, and even that scientists do bad things sometimes.

Saying, "Yes, that is part of what happens," is reaffirming for them that they're not imagining things, but also then we have a responsibility to say, and here's the processes we've put in place, so that we don't let that happen too much, or we catch it when it happens.

Ludmila: How can we conciliate this idea that, yes, we know that some results might seem that they were obtained by the best processes, by very scientific processes, but we don't have-- We are not certain. How can we conciliate these with anti-science sentiment, with distrust in scientific findings?

Simine: I think the easy answer is, because we don't trust ourselves is why the public should trust us more, so because we can point to specific steps we're taking to catch ourselves when we're biased, when we make errors, and so on, that's what makes us more trustworthy. In a way, the fact that you can hear about all of our mistakes, and all of the-- That's the process. That's what's valuable about science.

Brian: I also like to point or raise the point compared to what in these sorts of discussions. Science is showing all these errors, all these limitations of how it does its business. It's saying it's uncertain about this. Okay, what is the alternative way in which you're coming to believe the claim that you're believing? Well, it's because the president said that I should believe it.

Is this a good basis of evidence? A challenge is to get collective understanding in how hard it is to get to a fact. It's really hard to get to a fact. In fact, scientists shiver at the notion of claiming something is a fact of any of their evidence, because they recognize there may be variations that are as yet unobserved, but we want facts in living our lives. We want to make decisions based on facts.

The part of the messaging challenged to deal with the conflict is to not just communicate the uncertainty, but help all of us embrace the fact that there is uncertainty, and that we have to make decisions under uncertainty, and that's just part of life. We don't know what's going to happen next, for all the decisions that we need to make. We have to use the best available evidence, not the assumed correct evidence.

Fiona: Yes, I completely agree. I think this idea of building tolerance for scientific uncertainty, this is the core of building public trust, of not pretending that our best evidence means is certain, and acknowledging exactly as you said, Brian, that we're all making decisions under uncertainty all the time, and that's all we can do.

Ludmila: I feel that we deviated a little bit from metascience, but still an interesting conversation. Let's get us back on track a little bit. What does the future of metascience look like in psychological

science over the next decade? This was a question someone submitted too. I'm curious about how do you envision metascience?

Brian: I guess my answer would be, I hope that I can't. If metascience is really doing what it's intended to do, which is pushing the boundaries on the ways in which we could do science, and then testing new possibilities, and then evaluating their effectiveness, then metascience 10 years from now, should be totally foreign to what it is today. That will be a win. That we will have addressed the questions that are dominating metascience today, as you said earlier.

Open science types of questions are very prominent in the metascience space right now, but there are lots and lots of other interesting questions that are metascientific questions.

How do you spur creativity? What should a university look like to foster knowledge building? Can we do away with grant applications, and fund in another way that would be more effective and waive distributing resources? There's bits and pieces of those types of investigations, but a real interesting metascience in a decade will embrace a lot of new things that we haven't thought of today.

Simine: I have a more practical answer which is that, if we want metascience and psychology to continue to exist in 10 years, we need to hire metascientists in psychology departments.

Brian: That's great.

Simine: I think that's a tricky thing right now. If there are any department chairs in the room, or people on search committees in the room, I would really strongly encourage you to consider. Many psychology departments have a quantitative psychology area, or at least one or two people who help teach and train statistics, and maybe they don't have their own substantive area of research.

Mostly their role is to be a co-investigator on other people's projects and help with the stats and so on. I think metascientists can serve a really, really similar role, and maybe they can even fit into that slot of quantitative psychologists, although they're not always quantitative, and they're not always statistical. Those people who work on epistemology, or on sociological processes in science, or will use qualitative methods, or lots of other things, but their role is often to make everyone else's research better.

Industry has roles like that. I gave a talk at Uber once, and they were talking about their own internal research. They have a red team for their research branch, who pokes holes and tries to improve the research there. Why don't academic departments have a team of 10% or 5% of the department would be experts who help make other people's research better.

There's ways to measure their performance too. We can evaluate them on many of the same metrics.

It wouldn't be like they're the PI on the grants, or the first author on the paper, but we can recognize their roles and their contributions, and measure how much they're doing just like we do for everyone else. It's a solvable problem, but right now, I don't think there's much of a theme for that in most psychology departments. That would need to change if we want to continue to support metaresearch in psychology.

Brian: Another way to promote the point that Simine is making is to recognize that metascience, in many aspects of it, is a psychological application in a domain, which is how science works. We are

already prepared in psychology departments to accept that people pick particular domains. I study health behavior, and how that works in public health context, or I study this particular culture and how different psychological processes operate in that cultural context. Science is just another context, and should be perceived, and accepted as psychological research, as it is when it's thought that way.

Simine: It can make people uncomfortable. You're hiring someone to study you. It's like you're saying your expertise--

Brian: Psychology should be the most comfortable with this, come on.

Simine: Yes, we should be, but it can--

Brian: Free therapy.

Simine: Yes.

Fiona: A shortcut could be to collaborate with philosophers. Have philosophers of science on the team.

Ludmila: Anything you have to add for how metascience will look like in 10 years, Fiona?

Fiona: No, I think I agree with Brian on this one that, if it's working, it's impossible to--

Ludmila: To predict.

Fiona: -imagine what it would be.

Ludmila: I have another question related to the future. What do you see as the next major methodological innovation in metascience that could improve reproducibility, for example?

Fiona: I've got a controversial answer to this. [chuckles] I think a typical answer would be to say something about AI, but-- In fact, this might link up with another question that's in the Q&A box as list at the moment. I think that we need more careful, in-depth qualitative work in psychology. One form that that could take in metascience would be qualitative study of what effective teams and projects look like. What are the little steps?

What are the little interpersonal dynamics, or little acts that people engage in that make those groups particularly successful, or produce particularly high-quality work, or particularly reproducible work? How can we unpack those little steps, little actions to help other people get started, and to know what to advocate for in building our academic workload models as well? What do we need to leave more time for, or add space in people's workload for?

Brian: I like that answer. I have a different one, which is, I think an area that is in desperate need of more investment, and there are some groups starting to do interesting things. Is to really embrace and push some innovation in research assessment, and in particular, to compare how we search for, understand, decide what to read, decide what to publish in the literature now, versus what we would say are the characteristics of what we think makes research trustworthy. If you list out the types of things that you would say make research trustworthy, they're not the types of things that are in a search engine, or are visible easily on a paper, or discoverable quickly, or even necessarily

used in the evaluation, or assessment of a researcher, or a research paper, or a grant proposal, or otherwise.

I think there is a real, substantial opportunity for innovation to try to both identify different characteristics of trustworthiness, create a taxonomy or a framework for understanding what trustworthy research looks like, and then develop and advance measures of those components of trustworthiness. I don't know how far we can get on measuring some types of things that are what we consider trustworthy work, but I think it's an area that's worth pushing as hard as we can.

Simine: My answer builds on both of those. This is not necessarily what I think is the next big thing in Metascience, but what I think should be, maybe one of the next big areas of focus, which is evidence synthesis, and in psychology, that usually means meta-analysis. I've been thinking about it more because, seeing the inside of the peer review process and how fallible it is, a lot of work gets published that isn't solid, and shouldn't necessarily be.

Things should be published that are preliminary if they're framed as such, and so on. One reaction to the replication crisis in psychology was, "Well, yes, of course, some things don't replicate." These are the individual building blocks we never thought they were definitive. It's the evidence synthesis conclusion that we treat as more definitive. Then, when you look at evidence synthesis practices in psychology, and I think it varies a bit by subfield, and the subfields closer to medicine might have more rigorous practices, but many areas of psych, it's very common in evidence synthesis like metanalysis to take the findings at face value.

Maybe you do a cursory quality assessment, but very rarely do you do an in-depth assessment of the trustworthiness of the individual finding, and actually exclude many findings, which you should. The primary literature is not going to be all gold nuggets. There's going to be a lot of stuff that, on closer inspection, should be excluded from a synthesis. It turns out not to hold up to the best methods or whatever.

To connect to Fiona's answer, I think that there's no way around those assessments, and those judgments being fairly qualitative. I don't think we're going to get there with a checklist. I don't think we're going to get there with automated algorithms, or things like that. I think those could help, but in the end, you need critical thinking, and you need human judgment, and subjective calls about whether this is a good test of the meta-analytic question and whether it's an unbiased estimate, et cetera.

If we can do more qualitative evaluation, and better filtering of findings post-publication in the context of evidence synthesis, I think we can reach much more solid conclusions. Those are the ones that really matter. That the public is going to adopt for public policy, or for their own lives, and so on, and that would allow the messy primary results that we talked about earlier, that we need messiness in there.

We need some of those results to turn out to be wrong, and that's okay, but then we need a filter somewhere after publication to make sure that when we're synthesizing things and delivering them to the public, there's some real quality control in there. It's not going to be simple, and it's not going to be a checklist.

Brian: To build a little on Simine's point, I think this is a perfect area for metascientific work, because inevitably, almost all of our consumption of science as researchers, as people just living their lives, is via testimony. Someone else told me to trust this. I read a tiny, tiny, tiny proportion of

the research literature, and I read it in depth enough, a tiny, tiny proportion of that to actually come up with the qualitative conclusions myself that Simine is describing.

The types of research assessments, the types of indicators, the ways in which we communicate trustworthiness will have to build on those things. They will have to provide ways for people that are pulling in this information via testimony to be able to understand, appreciate, assess whether this is trustworthy, more so, or less so, because there's just no way to demand that everybody read everything in depth to come to their own conclusions.

There's a whole vast space of assessment and communication of those assessments that's basically right now just journal title, and it's been peer reviewed or not. That's way overly simplistic for actually assessing trustworthiness.

Ludmila: We are almost at time, but I have one final question that I think it's very important, because we talked about a lot of things that need to be done, and should be done to improve our science. Where does the funding and support for this type of work need to come from? How can we get this type of work funded?

Brian: If you know the answer, I would like to hear it.

Ludmila: I would love to know the answer.

Brian: Right now, it is mostly funded via private foundations. There are some mechanisms for metascience support that have emerged in federal funders. Obviously, the resources available for academic research are largely from federal sources worldwide compared to private sources. Both, I think, are essential, and the money doesn't get generated itself. There's one additional opportunity I think that metascience has, that some other areas of work don't, and some areas in psychology do, which is from industry.

Industry is a potential consumer of good research. There is a self-interest that different parts of industry have of how can the research that we are consuming be better evidence for us to use, and try to commercialize, or whatever we're going to do with it. There could be pathways from industry to provide additional support if it aligns with their interests, too.

Simine: Then, an ironic thing about metaresearch, I think, is that it's not valued on paper. The psychology departments don't want to hire someone who does it, but actually, meta research tends to perform pretty well on the metrics that universities care about, like the stuff that Fiona was saying we shouldn't [chuckles] care about, but it can get cited.

It's actually fairly fundable if you don't need big grants. These private foundations are fairly willing to give small grants for it. It gets a lot of attention. A lot of methods work, gets a lot of attention. It should be fundable. It hits many of the metrics that universities and funders care about, but it doesn't fit into any box. We have to have a field of research code with our grants, and there's just no good field of research code, so you get reviewers from random other fields.

Fiona: I don't think the funding for metascience has-- I think there's been more of it lately, actually, that it has become recognized by mainstream funders. We've built up this picture for ourselves that it's impossible to get this work funded by mainstream funders, but I think that there's good evidence that that's changing.

Ludmila: Well, and I think we are at time. I would love to continue the conversation, maybe one next session, but I would like to thank you for talking about metascience. I think it's a very important topic for the future of science. Thank you, and thanks everyone for attending. I'm going to pass it to Shandol for some final remarks. Thank you.

Shandol: Well, first of all, thank you, Ludmila, Simine, Fiona, and Brian, for a fabulous conversation. We really appreciate your time and your expertise. Thanks for everyone who attended for your questions, and everyone who registered. You sent some fabulous questions to launch this conversation.

You should receive a one-minute survey to complete after today's broadcast. We value your feedback. A lot of our topics come directly from you on what you want to hear about. We also invite you to email us at science@apa.org with recommendations. Last, we invite you to subscribe to *Science Spotlight*, your source for the most relevant news information for psychological scientists. It's free. It'll be sent to your inbox every two weeks. Please be sure to check that out, and we hope to see you at future events. Thanks so much and have a wonderful day.