Collaboration in Research

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Welcome to the Ernst Strüngmann Forum podcasts—a series of discussions designed to explore how people collaborate under real-life settings. Joining us in the series are high-profile experts from diverse areas in society, whose experiences will lend insight to what collaboration is, what it requires, and why it might break down. This series is produced in collaboration with the Convergent Science Network.

P. Verschure This is Paul Verschure and together with my colleague, Jenna Bednar, we are talking to Susan Fitzpatrick on the topic of collaboration. Welcome Susan. Could you please give us a short description of your career and what brought you to the point where you are now?

S. Fitzpatrick Like many people who work for private funders of academic research, I started life as an academic researcher. I trained as a biochemist and biophysicist at Cornell Medical College and then at Yale University. During that time, I worked in a lab that used NMR spectroscopy, what is now referred to as MR spectroscopy. It's a big instrument in science and you get a limited amount of time on it. When you're not scheduled for time on the instrument, you either talk with the other people who are in the lab (who do have their time on the instrument) or you look for other things to do. I wound up recording science textbooks for the blind and working with a local high school that was trying to improve its science education, and through this I became really interested in areas where science moves into the public. What happens when we take science out of the lab and try to integrate it? I can tell you, reading science textbooks for blind students was an enormous insight, because it also reinforced for me how much we rely on visual representations of data images. What do you do when you can't see those images? How do you describe so much of what we take for granted in science? The whole communication of science became very interesting to me, and I realized that to continue doing academic, bench research was not really what I wanted to do. I wanted to take science out into the world. That's what motivated me to move into not-for-profit administration. But I haven't moved very much because I've been in the James S. McDonnell Foundation for 28 years. Over this time, the same foundation evolved a lot, and it is a very rewarding and stimulating place to work.

P. Verschure What are the objectives of the foundation and how did it change?

S. Fitzpatrick When I joined the foundation, it wasn't running its own programs in-house. It would outsource. It would come up with a programmatic focus that it wanted to fund, but then the actual management of the program (the getting of the grants and the making of the grant decisions) were outsourced to an academic scientist who would do this primarily from their institution. Recommendations would come back to the foundation's board of directors, and they would make their final funding decisions. When I joined, the foundation wanted to move that aspect of its work in-house. It wanted to be active in shaping the programs and in deciding which areas were going to be funded; in managing the competitions and in bringing our grantees together. We wanted to create a community to some extent, rather than just support individuals. That community aspect – bringing people together – speaks to today's topic – collaboration – because many of the areas that we were trying to fund (this is a philosophical route that runs through private funders of research) are either niche areas (i.e., an area that might be have been overlooked by the larger, more governmental funders) or emerging areas of research that occur at the edges of fields or where several fields are reaching out to each other. We've often called this the informal college: there is no identified academic discipline, neither are there societies or journals around this identity but you can see that there are people who want to move into this area. So, one of our early signature programs was supporting cognitive neuroscience: people from cognitive science and cognitive psychology who work with neuroscientists, linguists, and philosophers. By its very nature, this field requires integrating knowledge from across different disciplines, and you can only do that through collaboration. We would often fund team-based research, center-based research, or projects where people came together. We primarily did this

through the more traditional investigator-initiated research, but it led us to consider whether we shouldn't be explicitly funding collaborative activities. That's when we began to evolve, by asking how we could help identify where these areas are, and what kind of skills, expertise, and knowledge base would be needed to come together around them. These are questions that will not be answered by any one discipline alone. That's how we've been evolving. As knowledge moves, and as other funders come into fields, you're constantly creeping along this edge yourself, trying to stay at the edge of this work.

P. Verschure You mentioned that strategically you wanted to enhance collaboration between certain researchers or disciplines. What do you mean by that? How would you define collaboration?

S. Fitzpatrick I think that there is absolutely nothing in science that is not collaborative. Even though we have this image of the lone wolf genius and the person working in their garage, all of science is, in reality, collaborative because we are always building on the work that has come before us. That's a form of implicit collaboration: we use the knowledge that has been generated by others, we contribute to it, and we hope that others will use ours. That itself is an implicit collaborative process. We don't talk about this enough in science. It has really fallen by the wayside, due to the pressure of branding and marketing. Now a researcher must have their own idea, their own thing, and this must be an original contribution. People do generate original scholarship, but it's not without the context of all the other work that goes on around them.

P. Verschure What would be your working definition, or the features, of this complex process of scientific collaboration?

S. Fitzpatrick We would look for where knowledge from different disciplines needs to be brought together. I like the definition of "synergy" that information science uses: you have to combine knowledge, or information, from different sources, from multiple sources. Let me give you an example of one of the collaborative ideas that we funded. Williams Syndrome is a very well-known syndrome in the neurosciences, a genetic deletion. It's been characterized very highly at the genetic level. But how does that genetic defect end up leading to the syndrome? How does it affect the development of the nervous system? How does it affect the structure of the nervous system? How does that affect the cognitive aspects? How does it ultimately lead to the phenotype and the behavior of individuals who have been diagnosed with Williams Syndrome? Such questions cannot be answered by any one field. Geneticists will tell you about its genetics; a structural MR person will tell you what the brain structure might look like; functional imagers will do some tasks and show you the pictures comparing Williams Syndrome with normal, typically developing children. In addition, you will have some phenotypic description or some behavioral description that often can be quite unrelated to these other issues. The only way that an integrated understanding can be obtained is to bring together people who are interested in this problem, but are working from very different perspectives and using very different tools, and ask: How do we develop a shared understanding of this syndrome? That's the important part. What is it that we all want to know, and what is it that we're trying to understand that we can only accomplish if we agree to work together, and share our knowledge, and build a common understanding? Those are the kinds of questions that we have often sought.

After you have the questions, you need to look for the kind of people who are willing to pursue them, who really want to build a shared understanding. I know that you're trying to push me on this question, but I think what's important is to step through this idea about what do we mean by collaboration? Previously I mentioned implicit collaboration. This is explicit collaboration: people who come together for a particular reason. They're already very busy people, and they're going to take on more work, because it really matters to them that an understanding be created that bridges across their disciplines. That's one example. What you discover is that by constraining each level of analysis by the levels above and below it, people have to sharpen what they think is their knowledge. Going back to Williams Syndrome, people might be familiar with it as being described as the "cocktail party

syndrome"; individuals with Williams Syndrome are supposed to be very loquacious. They will come up to you and they will talk, and they are supposed to be highly social. But if you do a very good linguistic analysis of their verbal output, it's actually impoverished. The idea that affected individuals have this preserved communication in this preserved language ability is not true. To some extent, this had become a cartoon of the syndrome. Outside that level of analysis, you need people who understand the genetic level, who are trying to understand the neural level, who will push and ask what is meant by preserved communication or preserved cognition, who will state that a more careful way of thinking is needed. The willingness to put your own work under a microscope and let others critically examine it is necessary, because if you do, this will lead to better outcomes and more impressive science.

J. Bednar You mentioned earlier the formation of these communities. Could you tell us a little bit more about what happens at those meetings? What does this collaboration process feel like between these scientists when they meet up?

S. Fitzpatrick It's interesting because sometimes these people might know each other, and other times not; some people may know some people who are part of the group, or not all. I think it is important to start with a social activity. You have to start with a dinner, or reception, because you have to break bread. You have to establish that we are a group of people coming together for a purpose. I have found that people who skip the opening night (dinner, reception, or exchange) and just arrive in the morning, never get fully integrated into the group. They sit outside of it a bit. Gradually they get pulled in, but their first two days are awkward because they were not there from the beginning. Making these social activities nonoptional is very important, but in the beginning, they're uncomfortable. People come in, look around, and want to know who else is there, and they want to know what this is. To some extent there is a level of concern, particularly if you've asked them not to do their traditional academic thing of giving a talk. Here's who I am, and here's what I do. When you push them beyond that, you can see that there's a certain amount of nervousness until trust begins to emerge. Trust is very important. That's often a role that the foundation plays to some extent. We've asked you to come and be part of this group as a guest. There's a hospitality component to this, but I'm not referring to just serving canapés and a beverage. There's a sense that we've got your back on this; you are not going to be embarrassed. You are not going to be made to feel uncomfortable. We're not going to waste your time. You are here because we know you care about this, and this is an issue that you really want to contribute to, and everyone else is in this room has that same intention. That is building trust. Then there's the gradually getting to know one another. And then there's always the moment where you know whether it's going to work or not. That's when somebody finally says: "I've been listening to these talks for two days, and I don't understand what you're talking about. You're using this phrase that to me means this, but I realize you're using it in a completely different way, and I don't understand it." That's when you know this is going to work. People are now willing to step outside of what they know and begin to look at it as "what don't we know?" That's really important. We're going to find something new here by working together. It's always magical. It's always incredible when that happens because it then changes the whole dynamic of the way people interact with each other. But it takes a certain amount of time, and you must have patience to develop this shared language. Developing shared understanding takes time. In general, when we fund collaborative activity programs, we fund them for fairly long periods of time, some for a decade, because it does take time, and people have to know that they've got that time. They're not going to solve a problem that has been dogging science for decades in a weekend. That's not going to happen.

P. Verschure In your Williams Syndrome example, it started off in a more informal context, and then built up to a collaborative research effort. Was that research effort successful, proportional to the investments that you made?

S. Fitzpatrick Yes, I would say so because it enriched our understanding of Williams Syndrome. There were isolated bits and pieces of information, but it wasn't until you put them together that you could begin to see the gaps and the lacunae in our understanding. By filling those in, a much richer understanding of the syndrome was obtained, which led to a much different understanding of what the actual capacities, skills, and abilities of individuals with Williams Syndrome were, because they now had a filled-out phenotype.

P. Verschure Is there a risk there of setting the bar too low? Because you want a significant increase in understanding and knowledge by virtue of engineering this collaborative effort. In some sense, one could say that if I bring a few scientists together for a workshop on that topic, and they write a volume together then there's more integrated knowledge because they wrote the volume, together. Is that your measure of success in this case?

S. Fitzpatrick No. We would measure how much individual research projects begin to change because of the workshop. That's the weird part of collaboration. There's this part where everyone says, here's my part, here's your part, here's another, we're going to stick all the puzzle pieces together, and it's going to work. That's not collaboration is about. It's about growing a broader understanding, also of your own work. So, yes, we would like there to be this richer understanding, but sometimes identifying the limits is equally important. One of the things that I think we and many of the people involved in the Williams Syndrome Collaborative learned, was how difficult it is to build an integrated understanding that crosses levels of analysis. You can't just stick the pieces together. Gaps in the current knowledge base may make things difficult to solve. We must be honest and forthright about that, instead of wanting to tell neat stories. When this happens, people begin to be more comfortable with the gaps in their knowledge, and with the idea that they don't have to fill these in with a lot of hand waving, broad assumptions, big leaps, or building bridges too far across some of these gaps in their knowledge. Acknowledging that we don't understand how this genetic defect affects the central nervous system in a way that leads to cognitive changes that manifest as this behavior. Can we do that? That's the interesting part for us—when people begin to think how this can be done and can we do it quickly.

P. Verschure There's an interesting aspect that perhaps you could elaborate on, namely: The foundation sees an opportunity and brings scientists together so that they see the same opportunity. This is a very interesting difference in perspective. Thereafter, you measure the outcomes. You said it implicitly. You assess the quality of the collaborative effort with criteria that the scientists themselves don't have because they're not aware that this is even possible. What are those criteria, and how big a proportion of the participants in that process would actually satisfy those criteria?

S. Fitzpatrick That's interesting because there isn't yet a good science of collaboration. I would love to say that we had a metric of successful collaboration, but there isn't one. You hit on the question, the word, that we've focused on, which is this satisfying question: What do you feel is satisfying? When do you feel like this has been worth your time? That's one metric that we have used. Who stays involved? Who continues to come back, meeting after meeting, year after year, week after week? Who continues to share information to push their own work in new directions? What are the people who were training during this time look like? Each of these labs has postdocs and graduate students in them. How did they come out of this process? Has it changed them? What does their work look like? We've done some network analysis and looked at, e.g., the spread of information. But it's more this feel for the human characteristics that I think, from the foundation's perspective, we would find more satisfying. I do think that it is important to examine whether this new way of looking is having any influence on the field. Are our papers being cited? Is it changing the way discussions are going? Are there now sessions at professional society meetings that are representing this kind of work? Is it spreading throughout the community? We certainly look at all those aspects of it. But from the foundation's perspective, it's more this slightly intangible aspect: Does it really change the people who are involved?

P. Verschure Now things become interesting because we have criteria. You could argue that the more explicitly criteria are defined, the more unidimensional they become. That means to adhere to criteria in some sense will then pull you away from a multidisciplinary collaboration. The alternative might be that you relax your criteria, and that means that the quality of the science is going to suffer, or the funder ends up in some self-fulfilling prophecy of confirmation bias, like: "Oh, it's all very great what we're doing." How do you balance that?

S. Fitzpatrick Yes, this is the hard part. And, yes, one of the things that you, as the funder, must be very careful of is your own confirmation bias. In fact, there's an old cartoon from *The New Yorker* where one character is reading another character and it says, "Welcome to the Ford Foundation, you'll never eat a bad meal or hear an honest word." As a metric, we rarely use people telling us this is the most exciting thing they've ever been part of. You can get a sense of that, again, from the commitment. No one is going to commit to years of working with somebody if they did not feel like this was improving their own scholarship and making their work better. Then you can begin to see the spread of these ideas, which in the beginning might have been quite radical. You begin to see more of this work ongoing. It comes back to this: Who do you have in the room at the beginning? To some extent, you need some individuals who are quite prominent in their field. Then you need junior people, who have the energy; you need a good mix of men and women; you need a good mix of diversity of ideas. And you also need to have what I call "the friendly naysayers"—people who are not quite sure this is a good idea but are open minded enough to become involved, at least initially. Naysayers serve two roles. One is that they put this little check sometimes on the enthusiasm. But when you begin to see that they get engaged in the discussions and might even change their own minds about the work, that, to me is another metric. This is the expertise of a foundation program officer. This is what we do; this is what we know. I'm not willing to be too self-congratulatory about these things because they're fragile, and you won't know for 20, 30 years whether they were successful or not. You can have your short-term measures. The long-term measures, whether it has altered the way the field might be talking about some of these questions, takes a longer. You may have to wait until the second generation, the children and grandchildren of the collaborative, come along to see how much of an impact it has had.

P. Verschure For the sufferers of Williams Syndrome, this is a very long time window.

S. Fitzpatrick Yes, but if you have a better understanding of the condition, then short-term progress is made: better characterization of the genetics, better characterization of the cognition. If you're working on a very limited understanding of the phenotype, it's also very difficult to understand what the best way is to support these individuals as they pursue their lives. What is the best way? Are you going to fix Williams Syndrome by understanding the genetic defect? Or do you need to understand the developmental trajectory, the interacting unfolding over time? This is one of the issues that came out of that collaborative: if you really understand and have a deep respect for the developmental process, the idea that you're going to fix something by going back to its initial cause is probably unlikely. We're going to have to look for interventions that interact with this unfolding developmental trajectory, and that might be a better way. And again, to be better supported, individuals with developmental syndromes don't need to be fixed. They need to be enabled to live their lives in the world.

J. Bednar As someone who is not in your field, I'm not really sure what the Williams Syndrome is, but I get a sense that there is some need for expediency. It would be great if you could have results sooner rather than later because people's lives depend on, and the quality of their lives rest on, the progress of this science. You've been talking a lot about the structure of these communities, and how deliberately you as a foundation think about who should be in that room. How do you structure what happens inside that room to encourage the building of that trust which you spoke about earlier? That's the necessary ingredient. How much are you thinking about the rate of progress of this project?

S. Fitzpatrick Williams Syndrome is not a life-threatening developmental disability. There is certainly a need for better understanding, better support, better educational systems, and these kinds of things, but it does not require immediate intervention. To use a very contemporary example, if you want to understand why the Miami condominium complex collapsed—there is an immediacy to that. This is the kind of question where you're going to need a group of experts to come together and analyze this problem very quickly, and you're going to find that there wasn't a single cause. There were all kinds of things: from the engineering perspective all the way up to social governance issues. But if we want this to be better in the future, we're going to have to bring that kind of information together, and it's going to have to happen relatively quickly. There is some place where you need to foster that kind of dialogue. How do you do that? It's very different, depending on the question. Every one of our collaborative activity awards—we have had 30 or 40 of them now—look very different in their structure. Some are what I would call a "hub and spoke" structure—there is a central core group of people, and then connections to them, where people are contributing to a different extent on different points. Then there is a highly networked piece where these people come together. Getting back to Paul's earlier question, you can do some scholarship because when they initially come in, they have very few connections among each other. They might have read a paper, or maybe cited somebody one time, and over time you can see how their connections and their networks grow. The hub and spoke structure and the network structure require different kinds of support, both financially and socially. With the hub and spoke, it involves keeping the outlying groups engaged all the time when they're not part of the core center. You must think about how you are going to pull those people in. Is it going to be through an annual meeting? Is it going to be through regular dialogue? Is it by creating strong links between each one with the core? Or do you begin to think about how you could build little links between them that will keep them linked. A lot depends on the question that's being asked and the kind of experts that are engaged. I don't mean to be vague about this; it is highly unique to each. There's no magic formula. I've heard a few other foundations who have said, "Here's how we do it: you get this number of people, and they have to represent this many different disciplines, and they have to meet this number of times." I'm not sure that any of that would hold up to scrutiny, because every single one of these has its own dynamic, has its own personality, so you have to be willing, as the funder, to let that structure emerge. There are times that you may want to come in and say, "All right, this is going sideways a little bit now." I had one collaborative group where it was co-led, and each of the co-leaders was emailing me almost simultaneously telling me why they didn't feel like they wanted to work with the other person. It was based on this issue of trust; they didn't trust one another. To some extent you have to say this is not going to work, and ask: How do we salvage this? Do we then just accept that this is not going to work, and you let them go off in their own directions and hope that there's some other way that you can bring this back together again. Sometimes it just doesn't work even if you have all the right ingredients. You could have all your checklist items checked off, and it's still not going to work, because of the personalities, or the trust, or individuals' prior experience intrudes. But you won't know that until you try.

J. Bednar This is fascinating. You're anticipating exactly where I was hoping to go next, which is to explore the failures of collaboration, which is a very real thing. You've laid out an explanation that is based on personalities, which, of course, happens. But you've also been talking about trust, and about how structure contributes to the building trust. To what extent do you think that structure might be related to failure as well?

S. Fitzpatrick There are different ways that the foundation has supported collaboratives. Sometimes we have gone out tried and put a group together around a problem. Sometimes someone brings us an idea. They really want to build a collaboration around a certain project. What you find out later is that that person really just wants to build their own science, and what they really want from their collaborators is that the collaborators are going to give him or her what they need. That often turns into a disaster, because that undermines every aspect of what you're

trying to do with collaboration: a shared common knowledge, a shared problem, contribution, the learning from one another, the change that's going to occur within each person. Sometimes you don't know that until they've started working. Invariably that's a complete and utter failure. Somebody just wants something, and they need to get it from other people. That's not going to work as a collaborative process.

J. Bednar Is there a way to mitigate that? Is there a way for you to recognize that before you get involved in it?

S. Fitzpatrick It can be hard unless you know the person very well. For instance, someone might say: "I really want to put this collaborative group together and I want to involve X because that's the big name in the field and it would be wonderful to get them involved." And I would say, "If you have X in the room then you have nobody else in the room, because that person does not want to collaborate. They don't want to be part of a collaborative process." Sometimes you can mitigate it if you know the field well enough, if you know the different actors that are involved. If we don't know the field well enough to know all that, then it's a risk. You have to say, "let's hope this is going to work." And you've talked about it enough: What does it have to have? Who's in there? We will ask for proposals and plans as part of this. We'll get external advice on this from people who will say: "This is a great idea, and this is exactly what needs to happen. They just don't have the right people at the table." Then you can rethink things and mitigate it to some extent by asking whether some of those people might join the effort. Are they open?

P. Verschure If we speak of success or failure, that's not binary. You spoke about 30+ collaborative projects that you have supported. Of those 30, how many were failures?

S. Fitzpatrick You're acting like one of my board members now, Paul. They always want to hear about the failures. In reality, I don't think any of them fail.

P. Verschure But that's exactly the point we want to arrive at: What is failure in this context?

S. Fitzpatrick It's less successful. Failure to me would mean that it fell apart completely. Nothing got learned. And in fact, a lot of bridges got burned. That to me would be a failure. You can usually mitigate the situation so that this does not happen, because invariably, you live to go for another day, and this whole opportunity may resurface at a different point. You don't want everyone leaving.

P. Verschure This was my premise: to see the dimensions that underlie success or failure. We have highlighted a psychological one (personality and needs), but maybe there are other aspects that influence how you scale your project on a continuous dimension of success.

S. Fitzpatrick You can ask: Did it succeed scientifically? Is new research and scholarship that enlarge the problem of interest having an impact on the field? Is it changing the way people are thinking about this problem? You can look at the scientific aspects of that. What we also look for is: Are we moving beyond the metaphor? Someone says: "Brain tumors spread just like forest fires." Do they really? It's nice to have that idea, and people can get very excited about it, but you have to push back on the metaphor. Then, like the scientific, linguistic, shared language approach, there's a social-generational aspect. I think this is an important metric. How does it change the field going forward? Does it open new opportunities for junior scholars? Is it opening new ground? Is it creating new opportunities? Can you see the next generation of scholars move much more comfortably into this interstitial space that was between two or three disciplines? At each of those levels you must use a different metric, and some are going to be more successful than others. Some might be really successful at the intergenerational aspect but may not have really pressed enough on the metaphorical language and that will have to happen in the future. The most important part is the scientific depth. That it doesn't stay at the surface. That the science really was deep.

P. Verschure This is the other thing I want to unpack, because as you said earlier, once we get the proposal from a community, or group of researchers, we will have experts look at it. But these are

other researchers. Now we have another form of collaboration because there are two groups of researchers: one proposes something, the other assesses its quality. How do you work with that? How do you structure it?

S. Fitzpatrick The way that we interpret those results, for example, is as follows. Somebody will say, "This is going to be a difficult problem. There are some good people involved, but I'm not convinced they're going to be able to pull it off." That's not a reason for us to withhold support. That's a reviewer doing their due diligence. What's interesting is when you have a reviewer who says "Wow, I really want to be a part of this" or "I don't want to get involved in this thing." Both can help. They can help because they can identify whether the question is interesting, whether you've got the right expertise, and whether you've got the right mix of personalities to make something a success, because they often know the individuals better. So even how you pick reviewers is part of the process. You want people who are familiar with the foundation, familiar with what we're trying to do. I don't just go out and pick a name out of the phone book. I have trusted advisers that I use to help me make these kinds of decisions.

P. Verschure But that also constrains your room to maneuver because, for your own credibility and the trust people place in you, you must make sure that you stay roughly within the realms of what these experts would find tolerable.

S. Fitzpatrick Yes. You pick the experts who have a track record of being open to new ideas, who have taken risks in their own career, who are not overly narrow, so it's a good balance. Oftentimes we don't call them reviewers; we call them advisers. They're giving us their advice and yes, if you go against the advice of your advisers all the time, you won't have very many after a while. Sometimes it's also an iterative process. We've taken some of the comments from the advisers and gone back to the group and said, "Here's some of the feedback that we're getting. What do you think?" To get to the point where we're going to launch a project is in itself a collaborative process. I don't know if we're going to have time, but I want to talk about one other thing that we have done professionally, which I find interesting, and that's collaborating with other funders.

This is something that can be done deliberately, and it raises many of the same issues. Private foundations, by nature, are idiosyncratic and individual. So how do you get more than one private funder to work together? We've done it several times. We had a long-running program with the Pew Charitable Trusts that was called the McDonnell-Pew Program in Cognitive Neuroscience. We had a joint effort with the MacArthur Foundation that lasted a number of years, and currently we're part of the Brain Tumor Funders' Collaborative, which is a six-funder virtual organization—it has no real structure—that works collaboratively. The Brain Tumor Funders' Collaborative was a deliberate, intentional coming together because many of the funders involved felt there needed to be more collaboration among brain tumor researchers. We asked ourselves, why we (as funders) weren't collaborating, if we're asking researchers to collaborate. You've got a bunch of small independent funders giving out piecemeal grants. What if we worked together? Well, we found that collaboration is not that easy. It takes time, it takes this building of trust, it takes mutual respect, and it takes a willingness to recognize other ways of knowing. For instance, I come at Brain Tumor from my neuroscience perspective; others come because they've lost a family member to a brain tumor. What they see as important or interesting and what I see is important and interesting required us to learn from one another. I've often found that collaboration among funders does not work when, e.g., I have an idea or project that I want funded and I shop it around and say, "This is too expensive for the James S. McDonnell Foundation. Do you want to kick in a million?" Invariably that does not interest anyone.

J. Bednar Why doesn't that work? What if it's a great idea? Why wouldn't that work?

S. Fitzpatrick I think it's because of distributed decision making, this idiosyncratic nature, this sense that something isn't ours; this is yours, and we're going to fund it. What works much better is to

reach out to a funder that has a shared interest in the areas that we're interested in and say: "We're thinking about trying to do something in this field, but it's going to take more resources than what we can do alone. Is this something you would be interested in? We can go through the exploratory process together."

J. Bednar You're saying that the process of defining even the project's ambitions needs to be inclusive.

S. Fitzpatrick Ye, it does. It's very rare that you're going to come up with a project that fits your foundation's mission and vision and will map perfectly onto somebody else's mission and vision. Does doing this enrich your original vision? Or is this something that's going to dilute your original vision? That gave us a lot of insight into the research collaboratives that we're funding: each researcher in the collaborative has to have their own interests and work enriched and not diluted by the process.

P. Verschure This speaks to what you mentioned at the beginning: that a common goal has really to be a shared goal, not an adopted goal. This is what you're articulating here. This vehicle with added value for the recipient. Have you found collaborations with other institutions and foundations so far successful enough, or is this still in a process of becoming?

S. Fitzpatrick I would say the McDonald-Pew program, which ran for a little over a decade, was a successful collaboration because both the Pew Charitable Trusts and the McDonnell Foundation had been looking at the possibility of doing something in this emerging field of cognitive neuroscience. What was interesting is that we had very different goals. The McDonnell Foundation wants to understand the mind–brain problem. That's our interest. Pew is interested in how unique academic discipline emerge and become solidified. They are much more interested in the structure of things: Should there be a summer institute? Should this have its own journal? Does it have a society? Once those institutions were in place, they declared victory and moved on. We said, wait a minute, do we now understand the mind–brain model? No, we know of a field that's explicitly focused on studying this problem. But I'd say we're no closer to answering it than we were ten years ago, despite all the research that has been done. That's why the foundation has stayed in that field. We're interested in the scientific question, not the structures around it. So this collaboration worked because we had a shared interest, even though we pursued different outcome goals. The MacArthur Foundation had a very different agenda than the McDonnell Foundation and the collaborative never really gelled. The underlying philosophies of the two foundations were just too different. It was not as successful, though the work that got done—this was one of their networks and early experiences in child development—was quite good, really excellent science. But I would say the collaboration between the two funders was less than successful. The Brain Tumor Funders' Collaborative is amazing. We've been working together now for almost 20 years, even though except for myself, almost every other partner has rotated out. We are sustaining, we are working. It has changed the nature of how funders, disease-specific funders, and advocacy groups interact with the scientific community. It has created a new model of collaboration because we consider the Brain Tumor Funders' Collaborative to be the funders, the researchers, the advocates, the patients. It's a very different approach.

P. Verschure Given this long experience you have with collaboration in the research community between funding organizations, what do you see as the critical questions that you will have to answer to yourself and your organization to further improve your ability to instill collaboration. What are the critical issues right now?

S. Fitzpatrick Collaborative science is in some ways the way of the future right now. Almost all funders are looking at how to get teams of people working together. And this whole team science is emerging. So, the challenge for the field is exactly the questions that you've been asking: What are we going to use to determine whether these approaches are getting us better science? There's this implicit—and we're as guilty of it as anyone—sense that for some of the kinds of questions that we're asking, you really must have information from multiple

sources. But how will we know if that is true? This deeper understanding of collaboration that you are pursuing is exactly the challenge going forward, because now collaboration is everywhere. And when something is everywhere, it's nowhere. To some extent, we must now begin to think about collaboration for collaboration's sake, whatever that is, which gets us back to everyone just shoving their puzzle piece together, versus this true building of a shared understanding around a common problem.

P. Verschure There have been massively ambitious initiatives (the European brain project, the American brain project) and huge investments in building industrial-scale collaboration in the field of neuroscience. After about eight to ten years of that, we cannot really say whether these were successful. Perhaps this raises the question whether humans can collaborate on a significant scale. Do you think that humans will ultimately be able, under ideal circumstances, to really, truly collaborate as we wish they would?

S. Fitzpatrick Well, again, I think it depends. I would call most of the work that we've done small-scale collaborations. I don't think you can have more than 18 people because that's how many people you can sit around a table and have everybody see one another when you're having a conversation. That's the maximum. You can't have more than that. I think clearly there have been wonderful large-scale collaborations. CERN is an example of one. Most high-energy physics has thousands of collaborators. The space program. There's a difference between when you don't know what you're trying to answer, versus when you're trying to answer something. I think that's part of the problem with some of these enormous brain initiatives, which I'm on the record of being very much against. These are very top-down, large-scale initiatives where it's not quite clear what you want to know. They're very good at some things. They've generated a lot of tools. We now have a lot of different ways to acquire and analyze data. But have they answered any basic, important questions? To a large extent they've been a failure, but that's because it is not clear what they're studying. They keep saying the brain, but what brain? Whose brain? Whose brain when? Whose brain in which context? The brain doing what? I mean, they act as though there's some static brain that we're going to understand. It's just the wrong question. Perhaps around the "right" question, humans might be able to collaborate because there's this need to create a shared understanding. People collaborated to build giant cathedrals because they really wanted to, even though it took generations. But is there enough in these kinds of things to make anyone really want to contribute? We'll learn a lot from these large-scale collaborations. Perhaps what we will get is a better taxonomy of the kinds of questions for which they're suitable and the kinds of questions for which they're not. That might be a part of the learning.

P. Verschure In some sense, this is undefined. The last question that I would like us to look at is, say I give you access to the latest CRISPR technology. You can genetically reengineer humans. What's the one thing you would change in humans so we would be better able to collaborate?

S. Fitzpatrick I don't know. In my experience, and maybe I live a very sheltered existence, most humans do want to collaborate with one another. In fact, I'm always, in many ways, amazed that people will come to a workshop because they're invited and contribute as good citizens who come in goodwill, and share their information, and want to work together, and oftentimes leave having made a new friend or a new collaborator. I feel it's more natural, in many ways, to do it. I think it's the perverse incentives that we've set up in many of our systems that are what discourage collaboration. The rewarding of faux individual contributions. The tenure committee saying you don't have enough single-authored publications, and a person responding that they work as part of a group. I can't just tell my collaborators to forget it because I need a single-authored publication. I think most people want to work together. The reward systems in science have selected, to some extent, sociopaths who don't want to work together. But I think that most people want to share. I think most people want to learn from one another. I'm more hopeful, actually, that creating a shared vision is really what is important. Our newest collaborative is on collective memory, cultural collective memory. We're trying to understand exactly how it is that we as individuals share cultural knowledge.

How do we build collective memories? How do we act on them? Some of the resistance that we're seeing right now, particularly in the U.S., where our populations have become quite polarized, is that we no longer have a shared vision. Your vision is taking away my vision. We have to get back to how we are all contributing to a shared vision. If we could do that, I think you would see at least a diminution of some of this polarization. I think what many people are afraid of is that they don't see themselves in the future, and I think that's something that we can do. So, maybe if I could fix anything with CRISPR, it would be the scarcity mindset gene, that somehow you getting something means I have to get less. We need to fix a zero-sum gene. If we could identify that and CRISPR it, maybe we could solve a lot of problems.

P. Verschure Susan Fitzpatrick, thank you very much for this conversation.

S. Fitzpatrick Thank you, it's been my pleasure.