# Transcript

Paul

Hello, my name is Paul Klenerman. I'm a professor at Oxford and I'm the host of this podcast on immunology called To Immunity and Beyond. So this is just to say that what we're putting forward with the podcast is a scientific discussion, and it's really just for information. And it isn't in any way medical advice. So if it's medical advice you’re after, please go and talk to your doctor or some other medical professional. Meanwhile, enjoy the podcast.

Welcome to another edition of To Immunity and Beyond, and today I'm going to talk to Zakiya Leeming and Rachel Hindmarsh, who are involved in an interesting public engagement project. So it's a little bit different from a from a normal podcast. We're not talking about a paper. But I thought people would be interested in public engagement, and since there's something coming up that Zakiya and Rachel can talk about, there's a sort of a, a little bit of novelty to that aspect. So perhaps first of all, Zakiya, you'll be just be able to introduce yourself briefly.

Zakiya

Hi I'm Zakiya Leeming. I'm a composer and I have written various pieces of music that have been inspired by the sciences.

Paul

Great. And Rachel?

Rachel

Hi, I'm Rachel Hindmarsh. I am the project facilitator for Thanks for the Memories, which is the project that we've been working on to bring together immunology and music.

Paul

Brilliant. OK, so perhaps Zakiya you could start, and normally what we do is just ask people how they got into the science project they're doing. But in your case, perhaps you could talk about how you developed your career, how you got into this particular public engagement music project?

Zakiya

I think. starting maybe way back, I think I've always been really inspired by the processes of science in particular and in a way that to me has a musical process parallel. So I think naturally as I was finding out about new ideas and processes first of all, starting from astrophysics, which was sort of a bit of a hobby for myself on the side, I would naturally think about ways that these could mirror some kind of formal structure in music or some kind of process in music. So, for example, one of the first pieces was inspired by the moons of Jupiter and how three of them are locked in a Laplace resonance cycle. So periodically they would move across each other's paths and musically this resulted in a set of pieces that referred to each other at particular moments in the pieces. So this came on to me deciding to investigate exactly why that was the case, why I felt inspired, maybe not by poetry or landscape paintings or the works of Shakespeare as many composers are. But why particularly the sciences did that for me. And that's why I did a PhD in music that's informed by science and its knowledge and its processes.

Paul

Great. So you're at the Royal Northern College of Music in a unit called PRISM. Perhaps you could explain a little bit more about what the kind of background to that is and what it does.

Zakiya

So yeah. So PRISM, which is the Centre for Practice and Research in Science and Music, is a centre at the Royal Northern College of Music. That was really being built at the same time as I was doing my PhD by Doctor or now Professor rather Emily Howard. And she's a composer who similarly, who has been inspired by science pretty much her whole compositional life as well. And we really want to find a way to connect with scientists to form a centre that would create the opportunity for lots of different people to come together and to collaborate, really particularly. So the centre has done lots of different projects that have brought together scientists and composers and performers in lots of different ways. And I was part of one of the original collaborative projects where I met a doctor of biochemical engineering, and she was researching how nerves could be reconnected through built scaffolds that could be inserted into the body and really draw the axons in the direction that they wanted them to. And so this inspired my first piece of music that was a collaboration together with the scientist. And from that point on, I really wanted to connect more with actual scientists, not just being sort of led by my own interests as I had been in the past in my own research, but really to be able to ask questions of a living scientist who might be able to tell me whether I was going down the right path in some kind of a metaphorical analogy. Or whether I was sort of trailing off into some kind of just invented pathway that worked for me, but maybe not, you know, so closely mirroring the science. And that's what led me on to creating new projects that were in health data and then finally meeting Paul on a project that was with ISARIC4C. And this was during the pandemic and Paul was a member of this consortium and we put together a piece of music that was really looking at the narrative and the history of each of the people who are involved in the project and their particular history with music. And also how they got to where they did in their careers, why they chose the pathways that they did and from all of that information and their experience during the pandemic, I put together a piece that they then played and Paul was an amazing star on the violin for this piece and it was performed online, during that time that we can think back to where we had those online concerts but yeah, so the piece was called Dawn on the Morning after the Storm.

Paul

And that I think the key to that piece was the bagpipe solo by Calum Semple, who did a lot during the pandemic, but additionally played the bagpipes. Is that the only bagpipe solo piece you're aware of, or are there other concert pieces for bagpipe?

Zakiya

Oh there are others, there are. There's not that many of them, as I discovered through this process. I was so pleased to be writing for the bagpipes. I'm one of those people that really enjoys the sound of the bagpipe. I know it can be divisive as an instrument, but it was a challenge, as I discovered, because what I hadn't realised is that the bagpipes are not in concert pitch. So this is a limiting factor for getting the bagpipes to be able to play with lots of other different instruments. There are some bagpipes that are in a, that are in the tune to a pitch. That means that you can use them, but they're not as common as what you might think of as the standard bagpipe, which isn't. So that's one of the reasons why you don't get too many pieces that bring them together. There is, of course, also the dynamic difference between one single bagpipe and an entire orchestra. Even so, there are some practical challenges to that. But there are pieces.

Paul

Good. Well, I think we'll leave some links for people attached to the podcast so they can listen to some of the things you've produced. But maybe we’ll just talk to Rachel just for a minute. So Rachel, perhaps just introduce your background and how you got into sort of science, art, the science arts interface.

Rachel

Thanks, Paul. Yeah. So my background is in the history of medicine really. So looking at how medical practices have been understood at various points in history and also how they're then interpreted in literary and artistic works. So that's one part of my background. The other part is that I did some work in schools, engagement and outreach, which is kind of working with primarily secondary school students to raise aspirations around coming to university, but also to see what universities are doing in a bit of a different way. So when I kind of got involved in this project I had these two parts of my background and working with you both has been a really exciting way to bring those parts together, in a really creative way.

Paul

Could you maybe just explain to people about your PhD because most people listening come from a pure science background and so they won't really understand what sort of things you’d be doing.

Rachel

Yeah. So in my PhD, I focused on an area of medicine in 16th century France. So this is a period in which the kind of medical sciences as we know it today are extremely different. There was still an understanding in humoral medicine. Dissections were only just starting to take place. There was still kind of really big divides between surgery and physicians, so that that’s a really interesting kind of context of history. And in my PhD I was looking at how one French writer in particular who's called Francois Rabelais, who's writing in the mid-16th century, how he was incorporating these kind of medical practices and theories into his literary writing. So Rabelais is an interesting figure because he was a physician himself, but he was kind of bringing all of these medical practices that he was doing in his in his medical life, he was bringing them to life in literature, in these really kind of exciting ways. So yeah. So my research is very much at the intersection of medicine and the humanities, and bringing these spheres into dialogue and into conversation, to think about literature and to think about the history of medicine in different ways.

Paul

Great. That's fascinating. I didn't know Rabelais was a physician, but there have been quite a lot of doctors who've sort of done some writing. So perhaps if you just get on to the piece that that you've written and is going to be performed soon, Zakiya, perhaps you could just describe the historical element that attracted you to it or… that you could have picked any of the kind of immunological stories that that have emerged. But you really seized on this one. So what attracted you to the story, or perhaps you could explain what the story is first?

Zakiya

Yeah. So. First, the first thing I like to do when I start a new collaboration with the scientist is to just talk and to hear about what the things are that they've been interested in. What's really sort of captured their imagination and really to just get an understanding of what it is that is changing through their research. So, early on, Paul and I were talking all about his research and we were going into as much of the detail at that time that I could understand, but also more widely what the sort of big picture takeaways were. And a lot of what we talked about came back to the idea of memory and how memory can function in different ways. Obviously in the immune system. But how the idea of memory and its processes in the immune system could be analogous to other types of memory, so this could be our neurological memory or our social memory, our cultural memory, and so this was the link that brought really these sort of three concepts together of personal memory, biological or immunological memory, and also social and cultural memory in the form of history. So we were, I was looking at all the different ways that the science had got to the point where Paul is, you know, carrying out his cutting edge research. And so to find this link to understand how both the sciences have changed over time and also our understanding of our history together has changed over time and that's what drew me to the story of Lady Mary Wortley Montagu. Lady Mary, as I'm sure Rachel can go into more detail about, was a really pioneering medical advocate. In addition to being a writer, I think that's what she would say would be her true calling. But we possibly remember her equally now, as someone who was a medical pioneer, so maybe I can hand over to Rachel to tell you a little bit more about her story.

Rachel

Thanks Zakiya. Yeah. So Lady Mary is absolutely this kind of pioneering and exciting figure that's often overlooked. We tend to think of kind of histories of vaccination as starting with Edward Jenner and his first vaccine that he developed for smallpox in 1796, but actually kind of earlier in the 18th century, Lady Mary was really important to kind of spreading the news about inoculation. OK, so Lady Mary was born in 1689 and in her early 20s, while her brother died of smallpox while she was a kind of popular socialite in the courts of King George 1st and the future George 2nd. She kind of shortly after this eloped to marry Edward Wortley Montagu, who was at that time the ambassador to Turkey. And this is where the kind of inoculation part of her story really starts. She went with Edward to Constantinople, which is what we now call Istanbul. And there she kind of encountered inoculation as a really widespread part of Turkish culture and a way of kind of providing immunity. So she had her children inoculated, and when she came back to England, she kind of started this campaign really to kind of legitimise the inoculation and to spread the word of inoculation among her peers. And she was met with real hostility. And she was kind of dismissed as bringing this knowledge, which was kind of perceived as dangerous, as kind of oriental as irreligious, and she wasn't taken seriously at first. But she's a real kind of story of perseverance. And she worked really hard to get inoculation kind of more widely understood and more widely legitimised.

Paul

Good. OK. So, well, let's take it from there. And so I mean lots of bits to her story. Absolutely fascinating. But how, how, how do we, how do you go about sort of turning that into a piece of music? What's your approach?

Zakiya

Well, the reason why I think she's such a good metaphor for everything that we've been talking about was really specifically on your research, Paul, into unconventional T cells. And the way that I understood how they operated in our immune system, so maybe you could set up a little bit what these unconventional T cells are?

Paul

Well, I guess that's a good point. So that's yeah, so I think what people need to understand is that you need to be, so you as a composer and I guess other people in your position sort of need to understand what we're interested in a way that's sort of, a bit tractable, and so these cells that that I'm working on. So this is not just an advert for my work for sure, but they are a bridge between innate and adaptive immunity. So they're called unconventional because they sit outside the normal paradigm. But I think the bit that is maybe most relevant to this story is that they they're very important in triggering things so they can't necessarily provide defence on their own, but they can help other components of the immune system get triggered off, so they're sort of unconventional in the sense that they sort of, they're very sensitive to the environment they're in and then they transmit that information onto other cells and kick things off. So that's essentially the thesis of the work which we've been trying to explore in the lab. And I guess that's the bit that slightly got sort of synthesized by you in in into the kind of kernel of the piece of work.

Zakiya

Yeah. So that's the reason why we're setting the story of Lady Mary Wortley Montagu as the wider metaphor for how the these unconventional T cells are operating in the system. There's also the idea that the medical establishment back in England when she returns is the conventional system that she is having to operate around and adopt sort of these new and different ways to transmit this information from one source to another, so that that's largely the overall analogy and within that also we explored different parts of the workings of the smallpox virus. So the opera opens with three of the singers being variola. So they emerge through the sounds of just breath and air in order to evoke a sense of the respiratory system and something may be coming in through that and then they are sort of making sounds that imitate the idea of replication and then explosion. So it's sort of looking at the stages of how the virus is maybe sort of propagating itself. And then the early stage of the infection in the body and then we move into Lady Mary herself, actually suffering from the smallpox. And there's sort of a poetic libretto that is talking about all of the different parts of the body as geographical terms such as plateaus and archipelagos that sort of are meant to be the parts of her body as she's being overcome by this horrible virus, and then throughout the opera we also have in addition to the story as that's unfolding, of the dramatic narrative of Lady Mary, you know, encountering a lot of resistance and trying to propagate this story really. She also then has a moment of, once there's a little bit of take up of this idea, then we go from having the singers being these variolas into them, becoming what we call the lymphocytes, and then they are enacting some of the processes of the various cells within the body that are then operating as immune cells. So. That's sort of largely the opera and the various parts of it. I really wanted to get the idea of the metaphors that we are talking about more widely in using the story of Lady Mary Wortley Montagu, as setting her up as really as some kind of unconventional T cell within the system. But also then musically looking at what's happening in a virus and also what's happening in an immune system, you know, when we do have these viruses enter us.

Paul

That's really good. I mean, I think it's hard to describe a piece of music in just in words, but I that's I guess what I think people might want to understand is how you take an idea and then you construct a kind of kind of piece around it. So yeah, I think and one other thing that I think has emerged about Lady Mary is that she's largely been largely ignored. I mean the story is well known, but it's sort of buried under a lot of other things. And why do you think that is, Rachel? Is it just because she was a woman outside the establishment or I mean, she wrote incredibly well, what's your, what's your view? Of her writing.

Rachel

Yeah, her writing. So exciting, she gives such an interesting window into, yeah, her experiences. And I think it's really fascinating for us to have such an interesting lens on her kind of visit to Turkey especially. Through the lens of her as a woman, as kind of interacting with women in this kind of status of the harem that we find in the letters. So her letters kind of are giving us this really different perspective on history. Yeah. I think really her story, it's just kind of being put into the shadows with the kind of focus on Edward Jenner and his kind of landmark discovery of this first vaccine. But I think certainly for me in this project that's been really exciting to, to understand the kind of prehistory to that moment to her story is kind of pivotal to the, to the development and the kind of broader understanding of immunity and viruses in this period.

Paul

Do you think her work contributed to his development of the vaccine, and how were they connected?

Rachel

So I think what was really important about her work is that it was, it was kind of bringing these ideas about immunity to a more kind of mainstream audience in England. So we kind of talked about her kind of laying the groundwork and I think that's really important, is that she encountered this resistance from the Royal Society, but she was really persistent and she kind of had various allies, including Charles Maitland, who was a surgeon, and she had her children inoculated. That she also kind of encouraged her peers in aristocratic circles to have them inoculated. She kind of launched various experiments that were done on kind of other people. So I think, yeah, I think what she was important about is kind of bringing the practice of inoculation to a much more kind of mainstream audience. And for it to become kind of slowly accepted as a way of kind of dealing with smallpox and dealing with disease.

Paul

And I hadn't really been aware how long the practice had been going on. It's very ancient and very widespread. I mean outside Europe.

Rachel

Absolutely. And I think that's what she was so surprised at when she arrived in Turkey, was that actually it was this completely widespread practice there. She talks in one of her letters about smallpox parties that would happen when they would be kind of gatherings of families and people who are intentionally being infected in order to gain immunity. So I think she saw that there was this completely widespread and kind of effective and successful practice that was happening and that was accepted. And she just kind of couldn't quite believe that in England, there was such resistance went to her. It seemed like such a such an interesting idea.

Paul

Good. Maybe Zakiya we could just change tack a little bit and talk about your work with the schools and the kids because you've used that to kind of inform your thinking a little bit as well as the outreach element of it, perhaps explain what you intended to do and what you've got from it.

Zakiya

Yeah. So before we moved into the phase of the opera, we were going into schools here in Manchester and also in Oxford and bringing the same project essentially to secondary school students. So the opportunity to write a piece of music that was inspired by the same topic. So first of all, we had some sessions on how to compose, how to compose based on an idea that's an extra musical idea. And then also some sessions that looked at the science itself and the history and they were able to choose what really you know what, what really sparked their interest in each of these topics and so we had a real range of pieces that were inspired by various parts of the story. Various parts of the immune system or the idea of suffering and dying from a terrible disease. It was really widespread and it was really interesting to see how the students also then responded to those ideas quickly, so the scores were text and graphics scores, because the idea was that it would be accessible to anyone, including people who didn't have a background in music or previously had the ability to write or read notated music. And in addition to that, anybody who did have those skills was also able to write a score with that notation style as well. The pieces were performed by the musicians from the Royal Northern College of Music here in Manchester and by the students from the Department of Music in Oxford at Oxford University for the Oxford school. So I was really interested to see what it was that they found really, sort of what was really interesting to them. What made them think really differently about how either the immune system worked or how they approached science differently as a result of having a project like this. And that was really what I took with me to the opera, was finding what it is that was shared. There were quite a few pieces and quite a few students who really, who were really taken in by the story of Lady Mary and particularly I think how it was really focused around her efforts as a woman. And with her daughter in order to protect her daughter and how that had been largely forgotten. By, by us, by history, and this is really coming back to the idea of memory. And you know, I think it's a question around what do we remember and how do we remember these things. So yeah, it was a really wide-ranging project with so many different wonderful pieces that came out of it. And really just inspired to see how the students were really taken in by the science in a way that, I think when you translate it to music, I think because it is in the domain of art, they take ownership of it. It becomes sort of something that they are really quite passionate about. So that was really nice to see, particularly for the students, I think who said that they wouldn't normally have understood it, I think, in the level that they did or have that kind of sense of real passion around it. So yeah, that was I think something that I was quite informed by in, in the next phase of the project.

Paul

Great. And Rachel and any reflections on working with schools through this, or through your other work, how do how can we do it better because I mean all scientists are encouraged to do outreach projects, but it's not always obvious what exactly that means.

Rachel

Yeah. So I think so here, it really hit the nail on the head though. I think by introducing this kind of creative and artistic element, I think for the students in our project that was a way of them really kind of digging into the science and understanding it actually in a kind of more engaged way by the fact that they kind of… we had science workshops with the students. And we worked with some fantastic graduate and postgraduate scientists at the University of Manchester and the University of Oxford who did these kind of really engaging workshops with them, which often had a kind of creative elements of them. So we had some scientists from Oxford who created kind of 3D models of different viruses as a way of students kind of getting past the textbook and seeing the science they were learning in a really different way. And then I think what really drew me to working with this project is that it had this real kind of creative element to it. And I think that really pushes students to think outside of the box, kind of think beyond the disciplinary separations that they have in their school lessons and to kind of approach a topic in a really different way, and as Zakiya said to kind of take a bit of ownership of it. I think we were all really impressed with the students that they really kind of ran with this idea and produced their own piece of work about it, which was then performed. So I think that's a really great way of getting students really engaged and really feeling, feeling part of something.

Paul

Great. And that's really I think hopefully given a good airing to these ideas. And I think we all learned in the pandemic as scientists that you can't do… the sort of the science can take you to a certain point but it's all these cultural elements and it's to do with people's beliefs and things that really make the difference to the kind of overall impact. So we're not completely, we're not really working in isolation and that for subjects like this, that's super important. I was just going to ask it here. So there was a final question really. About the, you know you've got, you've done a lot and you've got quite a lot on. I mean this project was one of several that you had sort of in in the mix. So where you planning to take all of this or can you can you have a longer term vision or even a shorter term one about what the next projects would be in not necessarily on immunology? But just in terms of science and music and the integration.

Zakiya

Yeah. I really enjoy the collaborative aspect of this project and some of the other ones that I've done and I really think that that's where I where I see myself continuing on for some time. I really want to be able to just share. I love that, you know, the connection that you have with someone who is operating in a different discipline really makes you think creatively in different ways. And there's no, there's, there's really no replacement for that because there's nothing else that can quite provoke a really different musical thought than maybe I would have done on my own than to have something that's completely outside of my domain or completely outside of things that I've normally been thinking about and also being able to not just sort of learn about it, but then being able to ask questions to delve more deeply, to make connections. Within things in that discipline, but also more widely and across disciplines as Rachel says. So that's what I love doing and hope to continue to do.

Paul

Great. Well, maybe somebody listening to the podcast will get in in contact. Well, I think we'll stop at that point. I just thank you very much both of you for coming on the podcast and hopefully people will be able to listen to some of the works of the previous ones and maybe this upcoming one which is going to be performed in Manchester on the 24th of June and thank you very much, Zakiya and Rachel.

Zakiya

Thank you.

Rachel

Thank you.