**The G Word Transcript**

**Nicola Perrin: Making research relevant to the user**

**Chris:** Hi, I'm Chris Wigley, CEO of Genomics England. I've spent my career at the intersection of technology, ethics and human stories. Now, I lead the amazing team here at Genomics England. We're trying to bring the benefits of genomic medicine to everyone. And that involves accelerating genomic research, and also working with the NHS to bring genomics into the heart of healthcare. Genomics is a word that can trigger really strong responses, hope, fear, anger. And there's a lot of information out there, but it's not all accessible to non-experts, and there are some myths out there. So, we want to talk more about this word, the G Word: genomics. That's what this podcast is about. Welcome to The G Word.

So it's my huge pleasure to welcome to The G Word today, Nicola Perrin MBE, who is a new director on our board of Genomics England, has also recently been appointed to the board of UK Biobank, so is the power woman of large genomic cohorts in the UK, as well as being the CEO of the Association of Medical Research charities (AMRC), an organisation that brings together and supports over 150 health and medical charities to enable and support high quality research. Nicola, welcome to the pod.

**Nicola:** Thank you very much for having me.

**Chris:** So, Nicola, you are now sitting in a very key position in the middle of this rich and complex ecosystem in the UK around life sciences. Tell us how you started on that journey.

**Nicola:** I started off doing a science degree, read biochemistry, but didn't stay in the lab. I thought I would go and see the real world first before going back and then never quite got back. I went to the Science Museum first, which was a brilliant overview that there was some sort of history of science. One of the first things I did as a curator was have to acquire Dolly, the genetically modified sheep. So lots of variety there, and displaying genetically modified tomatoes on the gallery was also interesting. But the main thing was translating science, and the really exciting cutting-edge developments, and trying to make them accessible and understandable to the public. And then I went from there. I love that I did a science news gallery for ages. It was a really exciting way of knowing what was happening in science, which was the thing that I really wanted to do. But there came a point where you couldn't say as much as you wanted to say in a 20-word label. So, I then moved from there to the Nuffield Council on Bioethics. Again, explaining the reports and translating the reports to a wider audience, to policymakers as well as to the public. And a range of really fascinating topics, again, genetically modified crops, patenting of genes, pharmacogenetics, research in low- and middle-income countries, lots of really meaty issues, behavioural genetics, lots of things to get one's teeth into. I then from that, again, I was translating the science and also some of the ethical issues and trying to make them as accessible as possible to people and make sure our recommendations could be understood – and that got me into the world of science policy.

So, I went from there to the Wellcome Trust and was in the policy team there, gradually working my way up, and then led the policy team for 10 years, working on a range of really interesting issues, some about the research environment and the funding and how charities fitted into that landscape. But then also some ethical issues, and particularly more and more focusing on issues around data. So, a lot things around open access, data sharing, and then from that into the use of patient data, and looking at how one could use NHS data for research purposes. And it became really clear, quite quickly, that the problem wasn't whether or not researchers could get access to it. And the problem wasn't so much the technical problems, the problems was the governance and the public conversation and the lack of public confidence in using data. So, I then moved across from the policy team to set up *understanding patient data*, which was a standalone independent initiative within Wellcome that was trying to support better conversations about how patient data could be used; what were the problems? Why is it important to use it, what are the benefits, what are the risks? What are the safeguards that are needed? How can we have better conversations and make sure that data is used responsibly, and to feeding all that into the NHS conversations.

From Wellcome, I did a bit of freelance work working predominantly on data things, but it was during COVID, so it became more and more around data and how to share data effectively for COVID. And then from that, I moved to the Association of Medical Research charities. So, I’d previously been a trustee at MRC, and then became chief executive just about exactly a year ago – and loving it. So that’s the potted history. I think the common theme throughout everything, if one wants to retrofit and make it sound sensible, is that being a bridge and translating either science to the public or to policymakers, but always thinking about the importance of the engagement and trying to get the benefits of science to people and recognising that you can only do that if you have their trust and confidence. And so, you have to take them on the journey with you. You can't just develop some amazing cutting-edge thing and land it on people and expect them to like it. How do you set up the framework so that people are going to want to be part of it and feel that it's relevant for them?

**Chris:** You've touched on a few themes there that I think we could do a whole podcast on each of them. One was communicating science to the public or policymakers, often both groups have a short amount of time in order to absorb a lot of information. And I don't know if there is such a thing as a set of top tips that you've developed through doing that for many years. But if someone is listening to this podcast who is a scientist or who is involved in a kind of complex scientific endeavour in some way, if you're going to give some practical tips to someone trying to explain something complex to a layperson, what would you say?

**Nicola:** I think it's about starting from where people are instead of where you are. So, what would make it relevant to somebody? That kind of ‘why’ question, making it as accessible as possible. And, as you say, using simple words. I think Twitter in a way has made quite a difference because you can say to people, okay, explain your PhD in a tweet, and that really focuses the mind. But it's getting that hook in, to start things off as to why you should be listening. Obviously, metaphors and things help bring things to life. But starting with your audience and what they are interested in and what's relevant to their lives, I think makes so much difference always. And then clear, simple bullet points is my other maxim.

**Chris:** That's definitely a good. One of our other board members and former pod guest, Ewan Birney, is extremely active on Twitter. And he slightly breaks this rule by doing Twitter threads which are about 400 tweets long. So, we can all use tools in different ways. But I'm teasing him, he’s actually a fantastic science communicator. But it's an interesting medium.

**Nicola:** Ewan and I did a degree together.

**Chris:** Ah, right, wow, there you go. And you've now reconvened on the job board, small world. So, one of the things you touched on there, and I don't want to open us up to a broader conversation about the role of charities, and so on. But I can't resist touching on this point that you mentioned around patenting genes, that this was a big debate during the Human Genome Project, and the sort of private sector efforts against the massive multinational human genome projects, public sector efforts. Were genes going to be patented, were they going to be sort of open sourced available to everyone? We've obviously ended up in a world where people didn't materially kind of patent or protect that information, and it has been become available science. What are your thoughts on how that played out, and what we can learn from that for the future as we keep on making all of these new discoveries?

**Nicola:** That is a huge question. And not one I was necessarily expecting today. I think it's been a really good demonstration of the importance of open research and how you need those underpinning basics to be available to everyone to build on. And then the things that you build on top of that basic knowledge, you can then have a commercial business model from that. But you have to have those underlying things open. And I think you see the same thing with weather data, it's really important that that is open to everyone, but then the company that can work out when it's going to be a good day to sell ice cream as a result of the weather data, you can make a business model out of that and sell an App on it, because that's not going to affect somebody else looking at rain patterns and what you need to know about them and then the environmental science issue. So, it's the same kind of principles, that that underlying basic knowledge needs to be openly available to everyone. I think the Human Genome Project was a brilliant example of that.

**Chris:** You mentioned earlier the use of analogies, that's a great – not necessarily an analogy, but an illustration. Speaking of someone who cycles everywhere, and if we were recording the video here, you can see my two bikes in the background of my camera. There's a small App that started up about 10 years ago called *dark sky* that aggregated all of this open source weather information and then did hyperlocal and hyper time specific forecasts. I realise people don't necessarily come here for the weather data chat, but here we are. If you're in Clapham, where I am now, and you're cycling to Farringdon, where our Genomics England offices are, you should leave at 11:20 because there's a window of 45 minutes where it's not going to be raining, which is just super, super useful. Whereas if you don't, then as you say, you know, the underlying data was available to everyone, they were just really clever about how they aggregated it and added value on top of it. But, you know, we can see lots of very clever biotech companies doing stuff with all of that underlying data. Very cool.

So, we talked earlier about this amazing ecosystem that we have in the UK, right? You know, Darwin, Rosalind Franklin, Crick and Watson, Sanger, we have this incredible legacy around scientific research, genomics, in precision medicine. There's obviously the whole NHS ecosystem, which is a complex series of organisations just in itself, all of the universities, the sequencing companies, the lab and tech companies, the biotech and pharma companies, how do medical research charities fit into this ecosystem? And what's the kind of unique role that they play?

**Nicola:** So, it's a brilliant question, and they are a really key player. One of the key things that I've been trying to push in my first year is that they shouldn't be forgotten as a key partner. On the one hand, you can look at it financially – charities fund. Over the last 10 years, they’ve put fifteen billion pounds into the UK research ecosystem, so they're really significant players financially. And a lot of that support goes to career development and fellowships and building capacity and talent, all of which is hugely important. But I think there's something different about that money when it comes from charities that is so important. And that's what makes them really a vital partner. I think there's probably three pieces to that. The first is that charities are very connected to public and patient priorities. And they work so closely with their communities, they are really looking at what would make a difference to people's lives? And what do people need? Where should they be focusing their investment? So that connection to patience and understanding of needs and where you can make a difference, I think charities are the best partners at providing that. And they also have a really good connection with the general public, for want of a better phrase. I mean, you see people running across Tower Bridge during the London Marathon with all the different charity logos on them, it's fantastic, it’s all our member charities, you just see all their logos go across the bridge. But people are choosing where they want to put their donations, and they're choosing medical research. And then they have a connection to medical research, which I think you don't see across other types of research in quite the same way. So that connection to public and patients, I think is really important.

The second area is focusing on unmet need and areas where other funders aren't specifically focusing, and that includes rare diseases, which is obviously really relevant to Genomics England. So, I think about 67 of our members fund research into rare conditions of some sort or another – a number of those that focus just on one particular rare condition. And so that ability to target money to areas where others aren't focusing and make a real difference is also really important – so, neglected conditions. Charities were funding mental health research long before anybody else. They've been funding research related to health inequalities for decades. Now, it's a sort of really important topic and everyone recognises how important it is, but charities have been in there funding things to look at different communities and how a condition affects a different community for years. So, a real focus on unmet need and where they can make a difference.

I think the third area is that their funding is designed to really accelerate health impact, to get to benefit as quickly as possible. Charities are often very mission driven. They're investing really strategically. For many of them, particularly if it's a condition involving children, for example, or a life limiting condition, they don't have the luxury of time, they want to get to an answer as quickly as they possibly can. And so, they're targeting their investment in the way that they're going to get that benefit. They will look at where we are now, where we want to get to, and really think, where are the blocks along the way? What are the roadblocks that need investment to address? So they'll fund enabling infrastructure or patient data registries or clinical trial hubs to really sort of attack the barriers and get rid of them as quickly as possible. But they'll also convene partnerships. And they'll bring together industry and government and regulators and patients and sort of look at what you can do if you're working together to achieve things. Or they'll pump prime research, they'll focus on a very early idea that might lead to something but no one's quite sure and it's really high risk, and they'll just put in a very small bit of funding, and then de-risk it, show proof of concept, and then other funders can pile in on the back of it with a really serious investment that you need for large clinical trials. So, a combination of all of that, they're able to get to that health impact much quicker, I think. And so that's one of the reasons why they're very important funders, because they're helping to fund things more cost effectively, because they're getting there as quickly as possible.

**Chris:** It's such a great point. And I think, this may be a bit of a sort of stereotypical image of charities as being a bit sort of sleepy or kind of inefficient, or whatever. I think it's remarkable how that's not just inaccurate, it's like 180 degrees wrong, right?

**Nicola:** Absolutely. So I think one of the things that people have often thought in the past is that charities are kind of do-gooders and nice to have and almost a bit fluffy. And, as you say, it's completely not like that now. Some charities, some of our members are just doing the most innovative things, they're really pushing the boundaries in a way that more traditional funders possibly aren't able to. Really cutting edge innovative approaches to how you do research.

**Chris:** And we were lucky enough to have Julia Vitello, who's the mum of Mila, who was a girl who had a rare condition and who, sadly, despite the story I'm about to tell, eventually died of it. But Julia, her mum, was incredibly proactive in researching the condition, finding a kind of clinical academic who was working in that space, actually developing an N of one drug formula that was then approved by the FDA and sort of safety tested. And then Mila was taking the drug in under a year from starting to work with this clinical academic, Tim Ewan, in Boston. And, you know, any pharma company in the world would kind of give their eye teeth for an 11-month turnaround from concept to actually a medicine being in a patient, it’s absolutely extraordinary. And Julia has now set up a charity called Mila to millions to say, why can we not take this process that worked for Mila and improved her condition, even though she ultimately sadly passed away, and get this into millions of kids. And she's an incredibly effective advocate, but also an incredibly effective kind of operator just in terms of getting things done, lining people up, and so on.

**Nicola:** So, never underestimate the power of mothers on a mission. The number of charities that are created with a few people sitting around a kitchen table. And those mums have such drive. And, as you say, coming up with really innovative treatments and getting there much, much faster.

**Chris:** What do you think the rest of the ecosystem, like academia, biotech, pharma, can kind of learn from that? Is it about that sort of personal passion? Is it about a different operating model? You know, what can we take away from that?

**Nicola:** I think the most important lesson is the partnership and collaboration. I don't think the lesson is that others should do exactly the same thing. I think it's about working with the people who – that is their expertise and they can bring that to the table, and add it into the other expertise that a pharma company has, or that biotech has. I think you need all those partners together, and you need them to be working together as effectively as possible. And perhaps that's the other lesson about really looking at where those roadblocks are and what you can do to get rid of them.

**Chris:** I think that's a great point, right? Because people who have grown up in a system often just take things for granted. Well, that's the way it is. And I think sometimes you need that kind of grain of sand in the oyster, or the sort of campaigning parents or whoever to say, Well, I know that's how things are, but does that mean they always have to be like that? Is that carved into tablets of stone somewhere? Like, why don't we just change that? Why are they like that? Why does it take 10 years just to develop a drug? And, actually, pushing on those questions is such a powerful way of achieving change, right? Whereas other people just get, I guess, inured to kind of, oh well, these are just the frustrations that are involved in doing this work, but we're used to it and we just kind of get on with it.

**Nicola:** Absolutely. And I think also, the other bit that a charity brings to that kind of conversation is what makes the most difference to patients, or people living with a condition on a day-to-day basis. And so, they just ask questions in a very different way. I think *Versus Arthritis* has a really good example where they were funding a lot of very important basic research, very worthy, looking at biomarkers and immune response. And when they involved people living with musculoskeletal conditions on a day-to-day basis and asked them, what would make most difference to them, the thing that made most differences is tackling pain and that chronic pain that they're living with day in, day out. And so, Versus Arthritis sort of pivoted their funding and focused much more on pain, but also put together a whole consortium of other funders to think about pain as well. And there's now a really big pain development platform addressing that issue that makes the most difference to people on a day-to-day basis.

**Chris:** It's such an important lesson, isn't it? I mean, I came to Genomics England broadly from the sort of tech world where there's this obsession with kind of, you know, engaging with the user. And rightly so, because I think otherwise we see these examples, historically, of technology that's been built by a really smart team who are convinced that a problem is really important, but develop it without engaging users. And then just like the old, who was it, von Clausewitz thing about sort of ‘no plan survives first contact with the enemy’? It's like, no well-meaning tech or science survives first contact with the user, if you haven't actually developed the idea or co-shaped the work with the people who are your supposed beneficiaries of this sort of genius work, right? You very quickly realise, oh, actually, you know, we haven't actually done something as relevant because we just hid ourselves in a cupboard and go with what we thought we should do? And so, in terms of that link between charities and their communities, you talked about Versus Arthritis engaging with people with arthritis and asking them what's most important to them. What is it that charities do to build that sense of community, or are they sort of born with it? And what can other kinds of organisations learn from that?

**Nicola:** That's a really good question. And I think it looks different across different charities. I think a lot of them, as we've talked about, start from the people with the condition or with the lived experience, and so they're inbuilt into it right from the beginning. Others are sort of on a journey to think how to include people and patients more. I think you see that a lot with some of the charities that either fund a number of different disease areas, or that focus more on the basic research. And so, they're looking increasingly at how to involve the patient voice in their research, both in the setting the priorities and then also making funding decisions, or recruiting people to take part in research. And that's another area where charities, because of their links with communities, are really good at identifying opportunities for clinical trials, sharing information across their communities, and then following through as well, and making sure that results of research are communicated to them.

It comes back actually to the discussion we were having at the beginning about the importance of communication and making things relevant. So, charities are able to explain the importance of research and the impact of research in a way that's relevant for their communities. And that encourages more people to see the importance of it, so they then donate more. So, you get this sort of virtuous circle of people donating money, and so then you get some brilliant impacts that then makes people realise just how much you can achieve if you donate to charity. And so, then they give more to it. It's getting that circle. But also being able to demonstrate impact, because you're involving the right people in the trials at the right time. They're helping to co-design the trials so the methodologies are relevant to people, and they're able to take part in trials because you've thought about where the trial is going to be, how many times you have to visit the hospital, what you can do virtually, making it as accessible and inclusive as possible. So, then you get the better results, so then you can talk more about it. So, a whole range of different things across the whole cycle of research from bench to bedside.

**Chris:** If we focus on bench for a second, we have, I think, rightly, pretty much forced all of the researchers who are applying for access to the Genomics England data set to articulate what they're doing in terms of engaging with patients, with research participants, with the wider public as part of their research. For people who are more at the bedside end of things, they're working on a particular condition, maybe a diagnostic or a new therapeutic. That's pretty straightforward. They're always pretty strong on that. But people who are doing much more foundational research, so let's say, we have a research group that's looking at what incremental insights can we get from, on the one hand, looking at clinical data and genomic data linked, you know, genotype and phenotype relationships. On the other hand, turning that into a triangle and saying, right, we're going to have the clinical data, the genomic data and the imaging data from the kind of radiology or pathology images for cancer patients, for example, really fundamental kind of mathematical machine learning type work to look at the relationships between those things. Ultimately, obviously, the whole point of it is to be beneficial for patients. But at this point, it's really kind of, can we get the maths to work kind of thing? Can we get the machine vision algorithms to accurately pick up biomarkers in the image and so on? That's one example. There are tonnes more of people doing fundamental research about, you know, the relationship between RNA and how proteins get formed by ribosomes, and so on. They typically struggle to articulate how they're engaging with patients, research participants, in the public. Any tips for that kind of crowd? How can people doing really fundamental kind of bench research think about this in a more powerful way?

**Nicola:** I think it still goes back to that, why you're doing it? Why is that an interesting question?

**Chris:** Participants have actually said to researchers in the access frequency, it's fine that you want to get another Nature paper, just be upfront, right? If the reason you're doing this is because you're a career scientist and you need another Nature paper to get to the next level of your career, and then therefore you can have more impact, which ultimately is going to help patients, that's fine. Don't pretend you're only doing it for altruistic reasons, right? Let's just have a grown-up conversation. I thought that was one of the best conversations we've ever had in the research community. It was great.

**Nicola:** I think it is true to understanding different people's motivations and what their incentives are. But I think there will still always be a *why* that's an interesting question. And that it's an interesting question, but it's an interesting question because the answer is going to ultimately lead you somewhere. And so, helping to set out what that pathway is, not sort of implying that it's only one quick step, and you answer this interesting theoretical question and you're suddenly going to have a drug in people's hands. But the fact that, if you understand that, then you can look at this, and then you can look at that, and then that will ultimately lead to a treatment. So, it's that thing about there's no such thing as pure research or applied research, all research is waiting to be applied. There is always going to be a connection at some point of how you use that very basic understanding in order ultimately to apply it and have patient benefit. But you just need to help people understand what that pathway looks like.

**Chris:** I mean, it's a bit flippant, but I guess asking the question, *why,* is never a bad question to ask, right? If we go back to this sort of wider debate about how all of these kinds of research are underpinned by researchers having access to data, we've talked a lot on the podcast about these issues around privacy, and so on. I guess similarly to the question about how can early-stage researchers engage better with relevant groups – how can the leaders across the ecosystem, whether that's in medical charities, whether that's in policy development in places like Whitehall, whether that's people like the leadership for Genomics England, UK Biobank other places, and maybe even including politicians here, how can we have a better debate about how data is used? I don't want to kind of slam particular examples, but things like credit data, GDPR have led to, I think, maybe a kind of overly polarised debate between, on the one hand privacy, on the other hand – quote, unquote – research and progress. What do you think we need to do to move that debate forward in a kind of productive way? And what role can charities play in that?

**Nicola:** So that easy part of that question is the second bit as to what role charities can play. And I think they have a really important role as a sort of broker because they absolutely want to see the research benefits of being able to access data for research. And they get really frustrated when their researchers have to go through how many loopholes, but particularly face so many delays and bureaucratic hurdles to get the data. So, on the one hand, they're really pushing for researchers to be able to access data in a responsible way. On the other hand, because of their connection to their patients and communities and families, they understand their concerns, and they realise that you can't just hand out data without thinking about it. So, they are very good at being critical friends to the system and making sure that the governance and processes are right, so that they can talk about it to their patients and say, We think this has been done in the right way, it's been developed in a trustworthy way, we have confidence in it, please do feel that you've got the information that you want and that all the right things have been done so that you can have confidence in it. So, again, explaining the benefits to people because it's not obvious why there are benefits to using data. It's not something people have thought about on a day-to-day basis.

Which comes back to the main video question, how can we have those conversations, and what's the answer?

The last 10 years have been incredibly frustrating seeing the same mistakes being repeated over and over again. What's the answer? I don't think there is one single answer. But it comes back to that point about starting where people are recognising that people do have very legitimate concerns and being able to answer them. The first thing is definitely to be able to demonstrate and explain the benefits and why it's important to be able to use data, you have to be able to do that. Otherwise, why would anybody even be having this conversation? So, there's explaining the benefits. I think that has changed over time. And I think COVID did a really valuable job, if there's any silver lining in the cloud. People really saw that there was value to being able to access data and having that real time information to feed decision-making about how to deal with COVID and all the amazing research that was done, RECOVERY trial, vaccine research, everyone got that that was based on data and you had to have access to data. So, I think, the benefits, in a way, the case is more clearly made and communicated now than it has been over the last 10 years. But that doesn't mean that we don't have to keep making sure that the safeguards are right, and that they're explained right, and recognising that none of this is risk free. But what you have to do is have the right safeguards in place that people can have confidence in it. And that includes the technical things, but it's also the review processes, the transparency over how data has been used and who by and who's making decisions as to how data can be accessible. And I think you have to have all of that in place. And you have to be able to be communicating it openly and honestly, right from the beginning, so that some of the myths that are built up, or they're sort of scare stories, where there actually is a justification for an explanation, you have to be on the front foot and explain that that's been thought about and these are the things that have been done to try and prevent that happening.

**Chris:** Yeah, it's such an important point. We did a bunch of research with different community groups in terms of how we best engage with them. And we've found that even just the order in which you talk about things, if we launched into this with, Hi, we’re Genomics England and we're doing these amazing things for the benefit of humanity and you know, the benefits of genomic medicine for everyone, and so on. A lot of communities will be like well, okay, yeah, fine, you know, I've totally switched off at this point, because you're just kind of chatting these highfalutin kind of words. Whereas if you started with, Hi we’re Genomics England and we really want to understand what life is like for you, what's important to you, what the sort of legitimate suspicions you have about medical research, given historical lack of inclusion are, and we want to hear from you. And, by the way, the reason we want to hear from you is that we're trying to bring the benefits of these scientific advances to all different communities. People responded in a completely different way. And we can only learn that by actually taking the time to sit down with people who are kind enough to take the time to actually explain, you know, their views to us. And that's the only way that we can kind of earn that trust rather than, I guess, assuming the trust.

**Nicola:** That's exactly right. And there's two other bits. I think that starting where people are in having an engagement has to be the right way of doing it. And then also recognising that some people are never going to feel comfortable with this. And so, there has to be some element of an option for people to opt out if they really, really, for whatever reason, don't want their data to be used. For you with Genomics England, it's an opt in consent model, but with other NHS data, it will often be an opt out, but there has to be that option. Obviously, one hopes that as few people as possible will opt out so that you have the best possible dataset with as few devices as possible. And I think that's the other area where it's really important to engage with different communities to really understand the difference in their concerns and what would and wouldn't make it acceptable for them. Because, often, it's the populations that feel least engaged, that are most likely to opt out, that are the ones that would actually be the greatest benefit if they were part of the data set. And so, that has to be about taking the conversation to them and using trusted intermediaries and partners to have those conversations in a way that helps people feel comfortable, which again, I think we learned a lot with the COVID vaccine rollout.

**Chris:** Well, that hopefully gives us a useful roadmap of how to be better at these things in future. Nicola, I could dive into these topics for another two hours, but I should probably let you crack on with your day. Final question, you know, the purpose of this podcast is to bring different voices into the conversation around genomics and its implications in society, are there either types of people or specific people that you would love to hear more from on these topics, who should we invite on?

**Nicola:** I think you have to start with the people who will be most affected by the work that you're doing, and who stand to benefit the most. And in everything that I've done, and particularly the data things, it's the stories from the patients and the participants in your case that are the most powerful and the most inspiring, and help you remember why you're doing it. Hearing from them and giving them as much voice and platform as possible, I think is the best way forward to help people understand why this really matters and why it's too important to get wrong.

**Chris:** For sure. Thank you so much for your time, thanks for even more for volunteering to join our board and give us more of your time. Really appreciate it. And thanks for everything that you're doing for the whole community.

**Nicola:** Thank you for this conversation this morning. And for all the amazing things Genomics England are doing. It's fascinating finding out more about.

**Chris:** Thanks so much for tuning into this episode. If you've enjoyed listening, please do give us a five-star review. This really helps others to find out about the podcast and if you have any suggestions of topics or guests, do get in touch with us at podcast@genomicsengland.co.uk. That's podcast@genomicsengland.co.uk. Join in the national conversation on genomics. And we'll see you on the next episode of The G Word.