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Welcome to Media Masters, a series of one-to-one interviews with people at the top of the media game. Today I'm joined by Alok Jha, science correspondent at The Economist. Having studied science communication and physics at university, he spent 11 years at the Guardian where he broke dozens of front page stories and presented the award-winning Science Weekly podcast. From there, he spent three years leading ITN's science and environmental coverage. He was also a presenter on Dara O'Briain's Science Club, as well as on BBC Radio 4 and BBC World Service programmes. Alok has written three best-selling books, and since 2017 has been an honorary senior lecturer in the Department of Science, Technology and Public Policy at UCL.

Alok, thank you for joining me.

Pleasure to be here.

Alok, from climate change to the impact of technology in our lives, science is really the heart of public debate these days. It must be an incredible time to be a science journalist.

Yes, it is, because actually for me science journalism is all about accessing really interesting people and information, that's why I did it. I started around 20 years ago, and I wanted to be able to talk to physicists and discuss black holes or I wanted to understand the latest technology and things, and I was one of those kids that took things apart – though I mostly broke things. But, actually, you're right. Now, science and technology really are the engines of everything from economics to understanding climate change to public health. It's all got very serious, and it's not just the fun whizz-bang stuff that we were taught when we were in journalism school.

Did you always want to be a science journalist?

Not particularly. I was always interested in science. At school that's what I was good at; mathematics, physics, chemistry, etc. So, a classic nerd before nerds were in any way cool. Not suggesting that I'm cool now.

You are cool. That's beyond doubt now.

That's your words, not mine! Anyway, I was interested in all those things, and I would even do extra science lessons at lunchtimes because I was just interested in knowing things. And then when I went to university, I did physics because I just wanted to understand some of these great problems of the world. I didn't think about jobs or anything like that.

You were too busy wondering about the fabric of the universe.

Well, weirdly, and this will make all my physics colleagues – who are actually physics professors now – laugh. When I went to university I was convinced that I was going to be the person that unified general relativity and quantum mechanics, because I'd heard that it was a problem.

So you weren't particularly ambitious then?

No, definitely! I was ridiculously, ignorantly naïve, is what I was. But I remember thinking, "Oh, this is a problem in physics, I could probably do that."

There's still time for you.

You've got to have that ambition, right? Otherwise, you're not going to do these big things. Anyway, I realised about a week into my physics degree that I wasn't going to be able to do this massive challenge. However, I was writing a lot for the student newspaper, because I love music. Mainly I really like music and I like writing, so I thought, "I'm going to write music reviews." And I would get free CDs. I don't know if anyone remembers CDs, but I used to get them for free, and go to gigs, and that's what I did. Mainly I did that, rather than actually doing most of my degree, to be honest. And I realised about three years into my degree, "This is a good job. I wonder if this is an actual thing that people do in the real world?" Because, growing up, I didn't know any journalists. I had no contacts in the media. You sort of aspire to the jobs you see around you, don't you? So, my dad's a doctor. All his friends are doctors. If they're not doctors they'd be lawyers, professionals – and that's what my parents wanted me to be. So, that's what I assumed I would do. Already doing a science, that was sort of slightly far apart from what their ambitions for me were, and so I was thinking, "People, are they journalists? Is this a thing?" And then after that, about third year of my college I realised this is what I wanted to do, so just tried to get on to some journalism courses. Back then, it wasn't really the done thing to have done a science degree if you wanted to do journalism.

Did you want to be a kind of, as I said generic journalist, but like a mainstream journalist?

Anything, yes. I just wanted to be a reporter. So, you know, I used to write news stories for my student newspaper, features, all sorts of things, investigate corruption, all of those things you see. And I wanted to do anything. So I tried to get on to a journalism course, and it wasn't really, like I said, you have to be an English graduate or a history graduate or one of those sorts of things. You did a science

degree, why on earth would you want to be a journalist? And also, can you even write? So I had to do science communications instead, which was a halfway house between science and journalism, and much more academic. Then after that, I got a work placement, a couple of work placements, and then it went from there really.

So, at that point had you already formed the opinion that you were going to be a science journalist?

No. Again, I was happy to do whatever journalism came my way.

Work is work.

Yes. And I thought, "I'll get any training I can." The first job I got happened to be in a newsletter, which did politics actually. It was a politics newsletter about science, but it wasn't like I had to explain physics or anything. It was more like science policy, science funding. It just happened to be that I ended up working there for three years, and did a traineeship, essentially. But I had no intention of being a science journalist. That's just the jobs that came my way, and when they did come my way I thought, "Actually, I have a science background, so why hide it? I might as well use it in some way."

What came next?

I was working at Research Fortnight, which is this policy newsletter which I talked about. Which has since, by the way, spawned many significantly successful science journalists, some of whom have been on your podcast, in fact. It's a very small newsletter, read by a few hundred people, but they're very important people.

That's like this podcast. It has are seven listeners.

They're all Presidents of the United States, right?

Well, there's my mum. And my wife's mum.

All the most important people.

But not my wife.

So yes, when I was at Research Fortnight I was writing about higher education policy. Not something I ever expected to write about, but I really got into it. And, I freelanced for the Guardian at the time, just one or two articles whenever they couldn't fill their reams of pages without classified advertising. This was back in 2003 when the Guardian made tons of money in advertising.

Back in the day.

A million pounds a week, or something. Whenever they couldn't fill their pages, they had some space left, and I would write some feature about astronomy funding or

something like that. In the end, what happened was that in 2003 or so, after three or four years of this, I was about to move to Washington to do a job there, doing some research policy funding stuff over there, and around the same time, Alan Rusbridger, the Guardian's editor at the time, wanted to increase their science coverage at the Guardian. And he put out an email to the Guardian internally, saying, "Look, I'm going to set up a science section, if anyone wants to write for it let me know." My contact at the Guardian, who used to commission me, said, "Oh, you might be interested in this." I had no national newspaper experience at all. Again, this another naïve thing I suppose, but you know, you've got to do these things... like trying to unify general relativity and quantum mechanics and not being able to do it, I decided, "I'm going to email the editor of the Guardian and suggest some ideas for stories that he might want." And I did. I just emailed Alan Rusbridger.

Just emailed alan.rusbridger@guardian.co.uk.

Absolutely.

It's amazing how guessable so many important people's emails are.

That's right. I guessed his email address. And I didn't hear anything for ages, and then I heard an email back from someone called Emily Wilson.

Never heard of her!

Who then was... Yes, obviously she's the editor of New Scientist now, but then she was an editor at Guardian. She emailed me and said, "Look. I have this email from Alan saying that you have some ideas. Do you want to come in for a chat?" I thought, "Great, this is fantastic. I'll pitch those things." One thing led to another. She said, "Look. You've got no experience in national newspapers, why don't you just apply for the jobs that are going?" I was like, "I can't, no, no, I can't apply. I've never worked for a newspaper before." She interviewed me. She was really nice. She was just lovely.

I love Emily. She's a very good friend of mine.

I had an interview with her and Tim Radford, who was the science editor at the Guardian at the time, and just got the job, to my shock. I didn't get the job that was advertised. They made a job for me, which was like web reporter, or something. That was when the Guardian website was just starting to take off.

Guardian Unlimited.

That's right. They wanted someone who understood websites, and technically I was under 25 at the time. I was under 30, so I knew what websites were, unlike the rest of my colleagues. So, I got a six-month contract, and it went from there really.

A six-month contract that became 11 years.

Yes, that's right. So after six months, they kept me on, and I became a science correspondent, and I continued to do digital things, and writing and audio and all those things. My intention always was that I wanted to do TV news, actually. When I started, I was like, reporting was important to me but telly news would be great. So one of the work placements I did, after my masters, was with Lawrence McGinty of ITV news, who was a god to me, basically. He was a TV news science legend.

God to us all.

So, I thought one day I'll work my way back into this. And I did actually, in the end.

We've got 11 years at the Guardian to go through, so...

Well, what I was going to say is the reason I bring that up is because I really intended to be a TV or a radio reporter, and ended up at the Guardian doing writing. But then, all of the other stuff came to me, audio, video, as the internet and the web became bigger and bigger at the Guardian, all these other media sort of came to me. I was really happy there for a very long time. I didn't need to go anywhere else, and in fact, it was a really wonderful 11 years. The Guardian itself changed completely in that time. From just a couple editions of newsprint a day, broadsheets, Berliner, lots and lots of different types of people. It was a fantastic time. We moved buildings, from a decaying thing on Farringdon Road to the hip Kings Cross.

I've been there many times. It is pretty hip.

Hip and, you know, looks ridiculously expensive.

It is. It's the building that Auto Trader paid for.

That's right, yes. And so, the Guardian is an amazing institution. It'll always be there, at the core of what I'm doing in terms of like, the reporting. And they were really serious about science. And so, that's the point. There were three of us doing science at the time, and then it just got bigger and bigger. They wanted to do more on climate change. They were interested in technology. Obviously, digital and technology reporting became bigger. So, it was a really interesting and formative time.

I think that's when you first came on my radar because I'm a huge fan of the Science Weekly podcast.

Yes, that's interesting actually. The Science Weekly podcast came out of nowhere for us, because where that came from was, I think it was 2006 or 2007, the first wave of podcasting. And so, this current wave, where everyone's excited about podcasting, it's happened before.

Podcasting is like flared trousers. It's coming back, and in a big way.

So, we didn't know what we were doing really, to be honest.

It's never stopped me!

Neil McIntosh, who was then one of the digital editors. He's now at the BBC as a managing editor of the website. Amazing guy. He was one of the first people at the Guardian with me to be somebody who wrote for the paper and also did digital things. Now everyone does that. But we were pioneers.

Multi-platform journalism, as they call it.

We genuinely were. We genuinely were. It sounds ridiculous now to say it, but me and him, when we worked on Farringdon Road, the first people in the entire Guardian to have access to the website from our computers in Farringdon Road, because the website and the paper were in completely different buildings, they were different companies, basically. But we were the only people bridges, so he had become quite senior at the time, and he wanted to do something in audio. I think I was walking past him in the corridor, and he had a piece of paper saying we're going to launch a podcast. He said, "Did you want to do a science podcast?" I'm like, "All right." I'd never made a radio programme in my life.

Amazing how these things just literally just come out of a corridor meeting.

It really was like that.

I won my biggest client in 10 years because I just happened to be walking past him in a corridor.

Right? And you just end up having an awkward chat, and you think, "Okay, well yes, sure we'll do that." And he said, "Well, what would you put in it?" And I was like, "Right..." So I went back to my colleagues, and I sat on the science desk, and I'm like, "Can we just chat about some science stories?" So, then we just dragged in a bunch of people. In fact, the first episode of Science Weekly, I was presenting but also doing all the desk, the microphones and all that, and the music.

I have someone else do that for me. I have a guy from youth training.

Right, exactly.

The YTS.

That's the sensible way of doing it. That's the sensible way. And I think the Guardian has even adopted actual producers to do that now. But I was doing that. And I dragged in the technology correspondent. I dragged in Charlotte, our arts correspondent at the time, just to see her take on science. We didn't know what we were doing, but we recorded it and it actually took off, like loads. Honestly, I'm not even joking. We had tens of thousands and then hundreds of thousands of downloads.

Incredible.

With just four people literally in a room about stories.

It was, and is, a great podcast.

Well, it got a lot better when actual radio people got involved. And actually genuinely then, I think it became a good programme, because we were doing something that actually hadn't been done when it comes to science reporting before. So, for me and my colleagues, Ian Sample and David Adam, at the time, we spent all our time reporting science stories from all over the world. And we'd talk about them all the time. Those conversations, which we never wrote down anywhere, were often the best parts of the coverage.

Yes, absolutely.

Why is this a good story? Why is that not? Oh my god, not that scientist. Or, how about this? This is really exciting. Or, do you want to go on this trip? And that conversation between people who respected each other and really got on well, and we're still very good friends, was just dynamite. It was actually really lovely, and that's what people wanted to hear. Genuinely, you could say, "I didn't want to report this story, but I had to because the news editor made me, and here's what I think is wrong with it." People like that inside track.

They do. Behind the scenes.

Yes, absolutely. That's basically what it was. And then it got more professional. We had actual trips out with our producers who recorded things properly. It was, I have to say, the most fun I've ever had in journalism was that podcast. And it was a real shame to leave it behind, I have to say.

I can imagine.

But I'm pleased with what they're doing with it now.

Absolutely. I can remember the very first podcast we did. We used to be called Media Focus, many, many years ago. And then before then we were the Media Society podcast for about three or four episodes. For the very first one I got my friend Torin Douglas, who was just leaving as BBC's media editor, and my friend Tim Collins, who is still deputy editor/senior producer on The Jeremy Vine show. And I just kind of got two mates in, but I had literally no plan to do it. We got in, and I remember Torin had brought the newspapers, and he said, "Well, should we go through the newspapers?" And I went, "Yes, all right." I mean, there was no plan. And now, it's totally professional.

Scripts.

Yes, there's an intro script, and I have a producer that helps with questions, and an audio editor.

The funniest thing for me about that is we did two episodes, clearly didn't know what we were doing, and one of my very good friends from college, who was at that time a very senior radio producer on the BBC. Brilliant in what she does. She emailed me and said, "Hey, I was wondering if I could just come in and watch?" And actually what she was doing was that she felt really bad for me because I was doing such a terrible job of presenting the scripting, and she gave me some advice about how to script a programme and how to structure a conversation. Very useful advice, and very kind. People did sort of like drag me out from my drowning self, basically.

I get listeners that email in all the time. I got a piece of anonymous feedback about two years ago, and it was really useful. It said, "Paul, this is meant really benevolently, I'm a long-time listener, but just shut up. Let the guest speak a bit more, and you speak less. In friendship, X." I've actually tried to abide by that.

I think, and one of my tutors at college told me that, because I was worried that after many, many episodes, I had never had any training in voice or presenting or any of those things, to this day. I said to one of my tutors at college, from college, who is a radio professional, I said, "Gareth, I've never had any training. What should I do? Should I get some training?" And he said to me, "You know, you could, or people want to hear you being natural. Don't get presenting training, don't do any of that stuff. They just want to hear you being natural." He was right. I never did it. I mean, I probably could be much, much better if I had some, but actually it's not that bad in the end.

What I used to love about Science Weekly though was not just the chat, but also the specials that you used to do where you'd say, "Why is 95% of the universe completely unknown to all of the scientists in the world? We're now joined by three of the cleverest people in the world who are going to tell us if they have a clue what's going on." I used to find that fascinating.

Well, I mean these are the questions you just report anyway in science, right? We started by saying that science is important to a lot of decisions one makes now in important circles, whether it's government or business or whatever else. But actually, the thing that gets people into science are questions like that. Why do we have 95% of the universe missing? What does that mean as a question, even? What are stars made of? What does a black hole look like? How many dinosaurs were there? These aren't things that actually you're going to put into your science policy briefs or are going to stop the next recession, but the things you need to know, and the way you need to think to answer those amazing questions that get everyone from five-year-olds to 95-year-olds interested, that way of thinking is, I think, one of the most important things that humans have ever come up with. One of the most creative things that humans have ever come up with. And it has led to quite incredible progress in the world.

We'll carry on going through your career shortly, but let's just take an interesting segue, because a question has popped into my head. Presenter's prerogative. What are the most interesting aspects of science for you? Are there certain fields or certain topics, or what is the bit where you would genuinely read it out of curiosity, even if you were off-duty?

I love astrophysics and cosmology.

So do I.

And black holes, and, I mean, that's kind of where my background is anyway, astrophysics and all of that. Because it's just quite awe-inspiring and huge, and the numbers are massive. You don't know what's out there in the universe, and the stuff we see around us, you know, stars, planets, atoms, all of these things.

Stuff that's made of quarks, and electrons.

Exactly. Yes, you know your stuff. Stuff that's made of quarks and electrons.

Standard model stuff.

Standard model stuff is only five percent of the mass fraction of the universe. The rest of it is either dark matter or dark energy. Now, these things are labels for things we have no idea about.

Yes.

It's not like we know what dark matter is and here's a lump of it, and there's lots of it. No, we literally don't... it's just a label for ignorance, basically. And dark energy is even more mysterious. Like what is this stuff? It makes no sense physically. So, I like the idea that we have all questions to answer about the universe, and people are out there trying to find answers to them. There are lots of ideas of what these things could be, so that's an endless quest that I quite like the idea of. So, I find that quite interesting. I find the other end, quantum mechanics, quite interesting.

Me too. It's my favourite.

It's just so weird.

Well, is it Niels Bohr that said if anyone who claims to understand quantum theory clearly doesn't actually got a grasp of it?

He's one of those early quantum physicists, wasn't he? You can make a joke about it, but yes, you're probably right. It's so strange, and we don't even know if it's actually real or not, but it seems to work. But it's one of the most successful theories that scientists have come up with.

That's what blows my mind. Like wave particle duality.

All of it.

Quantum superpositioning, as well. How can a photon be in two places at once?

Well, good question. This is something that I don't know the answer to.

It's weird, isn't it? I read something in New Scientist a year ago about a respected physicist has postulated that there's just one electron in the whole universe, and it's everywhere. And I was like, "What?!"

If you can get a quantum physicist drunk in a bar one day and ask these sorts of questions, there's some mind boggling things out there about the fact that there could be only one electron, or, if you're a photon, a particle of light, you travel at the speed of light, and Einstein's special relativity tells you that you travel at the speed of light, time basically stops around you. So, do you move? Are you in all parts of the universe at the same time? Do you not move at all as a photon? What does the universe look like from the point of view if you're a photon?

To a photon.

Yes. I mean, and actually...

Well, a photon has no mass, well, it has no rest mass to be technically accurate.

It has no rest mass, correct. But the thing is also, the closer you move to the speed of light, the more the universe contracts around you. It's just like what does that look like? And of course, the thing is we're humans, and we have human sensibilities and senses. We can't anthropomorphize all this around us. It could just be that the universe is too complicated and weird and multidimensional for our particular set of senses to understand.

A cat can't be both dead and alive at the same time.

Well, that's Schrodinger's cat obviously. Yes, I mean, it sounds weird, and you have to assume that for quantum physics to work. What does that mean? Literally, what does it mean? And there are physicists out there who say that quantum mechanics is not real, it's just not real. It's just...

Well, it clearly is.

It's just an illusion that we've made work, but there is something deeper. They might be right, who knows? This was only discovered 100 years ago. Think about what physics was like 200 years ago. It was nothing like it is now. And who's to say that in 100 years it won't be completely different again?

I read a book recently, sort of 13 things in science that don't make sense, and it was talking about things like the pioneer anomaly as well as dark matter and dark energy. It was even talking about homeopathy and all of these kinds of things, and viruses that are bigger than bacteria and are arguably alive, which draws into sharp focus what is life? What is death? And the placebo effect as well, and the nocebo effect. I mean, there's so many tons of things that no one truly knows the answer to.

Well, isn't that the good thing about the world? Is that you don't know the answers to everything, and that there is a place for you to go and answer curiosities out there. That's the thing that science allows you to do, which is that you can ask all these questions and then test it, and find out what the truth is. Now, I'm not suggesting that all science is truth, because the point is that scientific ideas are there to be tested and if new evidence comes to light you have to change the scientific ideas. And many scientific ideas have had to be junked because of that.

Well, or improved. You could argue that Einstein's general theory of relativity was an improvement on Newton's original calculations on gravity.

That's correct.

And even then we still don't quite know. We have to have an open mind that dark matter and dark energy don't exist, and we've just simply got gravity wrong.

Well, that could be true. There are theories out there that modify Newton's dynamics to incorporate... they changed them slightly so that you don't need dark energy and dark matter. But, we haven't got evidence that's true either.

I mean, you look at Fritz Zwicky, who says rightly that galaxies should fly apart if we hadn't... but there's obviously something keeping it together. Then you've also got Hubble seeing all of these galaxies expanding further away from us, when they shouldn't be. The whole thing's crazy.

And that's the basis of dark matter. Fritz Zwicky, by the way, he has one of the best insults known to man. I don't know if I can swear on this podcast.

You can.

I will anyway. And this was told to me by Simon Singh, the great science writer.

He's a legend as well.

He's wonderful. He told us that Fritz Zwicky, he's quite a mean person, not a very nice person.

Massive self-publicist as well, actually.

Yes. And so, he came up with the idea that there might be some sort of dark matter, or the galaxies are spinning faster than they should and so on, that led to the ideas of dark matter. He would call people he didn't like "spherical bastards" because you're a bastard in all directions, basically, which I think is a great insult.

I had a client who wrote software for a living, he had quite a few clients and he would call them custards. He said it's a cross between a customer and a bastard. I've always liked that.

Custards, yes. I'm going to use that!

Absolutely. Let's go back to going through your career then. When did you realise it was time to move on from the Guardian? Because after 11 years you could have just become part of the wallpaper.

Yes! That's such a good way of putting it. I never thought I'd leave the Guardian if I'm honest.

So you've literally thought there's no parole, it's life?

This sounds really sort of weird and sad in modern times when you move jobs all the time, and there are so many digital start-ups, and all these exciting things going on. I just wanted to be a classical journalist, really, on newspaper. That was my ambition when I started. I thought one day, I'll work for the Guardian. That's what I thought to myself because I liked the Guardian. Maybe in 10 years. And then I suddenly got this job at the Guardian 10 years a bit too early. And I was like, "Hang on, I've made it now. Now what do I do?" I just thought I'd never leave. "Well this is it, I'm going to retire here." And to be honest, everyone around me thought the same thing pretty much. The Guardian, no one leaves. And then what happened was that after 11 years, I'd been there as a science correspondent, and the job changed so much. It kept being interesting, and there's all these audio and video and...

What an amazing beat to cover.

Yes, really, really interesting. And you can travel the world. People talk about science as being kind of a nerdy thing. Actually, your beat is global, unlike many other people's. So it's in some sense a foreign correspondent job as much as it is a UK home thing. Anyway, after 11 years, I'd just been to Antarctica as part of a piece for the Guardian, which was an epic journey. Pretty much, I would say the pinnacle of what I've done.

I remember you doing that.

And I got stuck there, and there was a whole story.

Because you extensively covered that on the website with photography and video and everything. It was amazing.

Everything.

I followed that with massive interest.

We were one of the first people, actually, in the world to send images and video and tech back, almost live.

I followed that in real-time.

So, we came back from there...

That was awesome, by the way.

It was awesome, scary, brilliant...

Scary good, or scary as in, “I think I actually might die,” type scary?

Do you know what, talking to you now, I realise I’m an incredibly naïve person. I didn’t realise how scary it was. That’s the third example of being incredibly naïve about the world.

Probably good though because you still did it without realising how dangerous it was. I can confirm to our listeners that you’re still alive, and you’re here.

I’m still alive. Well, it was very dangerous.

I wouldn’t do it.

We were stuck in an ice flow, with icebergs all around us. We were rescued by helicopter. I mean, the story has been told, so I’m not going to tell it here again. Looking back on it, and speaking to some of the scientists and others who’d been on that trip with us, they were really worried about what was going to happen. Anyway, we did get rescued, and the weird part that was Anderson Cooper from CNN was absolutely was taken by the story. He interviewed us from the top of our ship three times while we were stuck there, including on New Year’s Eve he interviewed us while he was presenting the New Year’s Eve ball drop thing from Times Square.

In New York.

We were there. Beamed onto that screen whilst we were stuck in Antarctica.

Incredible. My office used to be right next to that.

Oh, so strange.

So, I know it very well.

Anyway I'd done that, and I was going to take six months off to write my book. I took some time off, and I was thinking I was going to take some time off and I'd come back in, thinking what can I do next? And it was then that Lawrence McGinty emailed me. Lawrence McGinty, he was the *legendary* science editor at ITV news, had been there for 20, 30 years. He emailed me and said, "Look, I'm retiring from my job, so I think you should apply." He obviously must have emailed lots of people, not just me, by the way. But I had done a work placement with him 20 years earlier.

You were obviously memorable.

I applied thinking, "Oh well, I'm not going to get this, I've got no TV experience." So I went for an interview with then the new editor of ITV news, Geoff Hill, who I got on with really well.

Geoff's a good guy.

Oh, really nice guy. And Tim Singleton. So, both of them, we had this chat. I was thinking oh it's TV, I've never applied for jobs in TV before...

But you always wanted the TV job, which was the Holy Grail.

I did. And it was. But you know what, I was so happy at the Guardian at the time that I thought I'm not that bothered about getting a job on TV anymore. But also, I'd never really applied for a job anywhere else, so I thought this is a good thing to do. You've got to try elsewhere. I went for the interview, and the thing about TV is that sometimes they don't get back to you for months. And previous times that I've applied for these sort of jobs it took nine months for them to tell me that I didn't have the experience or whatever. I got a phone call four days later from Geoff saying, "Right. We thought you were really nice. Do you want to have a job? Here's the salary, when can you start?" I was like, "What?!" And this is like, I had not even conceived of leaving the Guardian, so I went through a traumatic week of thinking, "Oh what shall I do? Should I leave the Guardian?"

Oh, the agony of choice.

It may sound silly now, doesn't it? It was like...

It's your career. It's a big, big thing.

The Guardian for me was who I was, and it's just such an important thing in the world. And part of me thought, "Great." And, "Should I leave?" Should I leave, should I leave? And I did. I don't regret the decision at all. Yes, then I went on to ITV, and TV news. The *madness* of TV news.

What was that like then?

The change was crazy. At the Guardian you would write maybe one or two stories a day, sometimes you'd write features or do audio or video or whatever. But there was

a certain pace to it, which I'd been used to. But TV news, you're waking up at 7am and not going home until 11pm, running around the country with camera crews, most of it is logistics, isn't it? It's all about the picture, it's all about the picture...

It's all logistics in TV.

"Can you write 100 words for this entire story?" which I would have written 3,000 words for before. I was like, "I can't do this." So much to learn. Such absolute, absolute amazing professionals do that job. I have so much respect for TV news crews. You've got Hilary Bell, lots of people I know, but the things that they have to do, and the time and the stress and all of those things, it was a real eye-opener.

You have to kind of relearn the job in a sense.

Completely.

Like you said, you couldn't write 2,000 words. You have to do 100 words to camera, and show rather than tell.

Show rather than tell, think about pictures all the time. Is this a story? For me a story is if something interesting has happened in my field, whereas in TV news, it's like, "Have you got the pictures?" Or, "Can you get the pictures in time?" Or, "Can we get a camera to that place?" All these other factors that I hadn't thought about. And my colleague, Tom Clarke, who was in Channel 4 at the time who I've known for a long, long time. I phoned him up actually, before I took the ITV job. I said, "Should I do this?" He said to me, "You should, but know this: if you're a science journalist or a journalist of any sort in a newspaper or whatever, you can do stories as you wish; in TV 95% of it is logistics, and whether you've got pictures and things." And I was like, "What does that mean?" What he meant by that was, quite often, there's lots and lots of great stories you want to do, to inform your audience and so on, or just because you're interested, you can't do them because there's no pictures. Or what do you put on screen while you're talking about synthetic biology? Who knows? So, that was incredibly frustrating at first. I'd pitch all sorts of things, and they'd be like, "But what can we show on screen? We can't put this on News at Ten. It's going to be just you talking to someone in the room. You can't do that." The thing with ITN, which I suppose I hadn't realised, but became true once you watch actually, is that I'd worked for BBC doing TV as well, but the thing with ITN is they're so, so good in limited resources.

Necessity is the mother of invention.

They don't have the resources of the BBC, but they're almost as good, in almost every single way. And often, in terms of pictures, they're far better. In terms of packages, they're much better. In terms of editing, they're much better. You really realise that when you sort of on the inside of it. They just haven't got the capacity to do all these amazing, glorious things that the BBC does, but I mean, they compete. They're good competition for them. So yes, I had to relearn the entire job from scratch, and met some wonderful people, but fundamentally, I'm a writer underneath, and that was... it was difficult, actually. It was really difficult.

Was it three years you did at ITV News, ITN?

That's right.

What made you decide to move on? Had you had enough?

After three years, well, it's a hard job. It's a really hard job to do. For me, the chaos of it is something I never really enjoyed. Some people thrive on it, and thrive on not knowing what they're going to do that day, and not knowing where they're going to be for a week. When it's fun, and there's lots of adrenaline, it can be really good. Like for example, in the first year I was there, I went to Darmstadt to cover the European Space Agency's mission to land on a comet, and this was covered all over the world. Landing on Comet 67P, the Rosetta Mission. They landed on this thing, and I went to cover it. I persuaded ITV News at the time that we should do this, and, "No I'm not sure, space, whatever. Why do you have to go there?" When we got there, it turned into a three-day story. Because they landed, but they didn't quite land in the right way.

I remember it well.

Twitter went crazy with it. And I was doing... I think it led News at Ten for three days. They loved it. But what was difficult for me was that I got there, I thought was going to be a one-day story. Then I was going to go on to Geneva to film something at the Large Hadron Collider. Because I always try and go to the Large Hadron Collider if I can.

Yes, I always do. I've never been there, but I'm constantly trying to go.

I'm sure they'd let you around. It's wonderful.

Well, I'm trying to get in with Brian Cox, as you know.

He can show you around. That's fine. He's got a pass. I was going to go there. But then, after the first day of the Rosetta landing, my news desk rang me up at midnight, and I'd been up for 22 hours at this point. It was crazy doing all the bulletins, and really, really exciting. I thought, "Right, I'm going to go after the next story." The news desk said to me, "Oh, you have to stay there for tomorrow, because there's going to be more stuff." I'm like, "I don't want to stay here. It's done now." I had a massive argument on the phone with them. Then I realised this was what happens in TV, you go somewhere, then you don't come back for a week.

Yes, you have to stick with it.

You have to stay with it. And of course they were right. They were completely right. But I, in my newspaper way, didn't think about things like that.

So you'd only taken one set of underpants.

I honestly didn't really have many changes of clothes. I'm not even joking! And also, at the time, I had randomly just gone away from friends and family for three days, and I was like, "Hang on, none of them were expecting this either." But the point with TV news is that it's very chaotic, and last minute. Like I said some people thrive on that. And I just didn't thrive in the chaos. I like to think. I like to consider things a bit.

Did you like doing it down the line? So, Tom Bradby is in the studio saying, "We're now joined by the ITV News science correspondent."

All of it was fun, because the people who I worked with were really nice, and having sort of distil your message into 100 words and all that. I covered climate conferences, the Paris Climate Conference, I was there for three or four days. And that felt momentous in a way. And when you've got TV, and you're telling people about things, and there's pictures of people banging gavels and saying, "We're going to save the world." It's all great. So much more theatrical than writing things down in the Guardian or whatever, and I loved all of that. But it was a lot of work to get those two minutes of telly out. And it just felt exhausting sometimes. I think I was at an inflection point of three years. I was thinking, "Actually, it's really hard to do this." And so, I just think I prefer a slightly different type of journalism. So, I started looking around.

What came next?

So, then I spent a year as a fellow...

At the Wellcome Trust, yes.

Yes. They have these public engagement fellowships where you can think and try out experiments and things for a while.

Is that quasi-academic?

Yes. It can be if you want it to be. Not everyone does who it is an academic. Some people are scientists who want to do more public engagement and things.

I suppose it's like anything, it's what you make of it.

That's right. It was completely for... the idea of it, and this isn't how they sell it, but which is like, you can apply for these fellowships. There's only like two year. You get a certain amount of money to then just do whatever you want. The question they ask you is, if all your obstacles were removed from you, like all the career things you want to do, all the ambitions you have, if all the obstacles are removed, what would you do with your life? Here you go. Here's some money, all your obstacles are removed, no responsibilities, nothing, in a year just tell us what you've done, and that's it.

Where do I sign?

The deadline for this year has passed, but they're still running. They're amazing. And all sorts of people did them. Artists, neuroscientists. I was the first journalist. So, I've always had this uneasy relationship between journalism and public engagement. There's a big science communication world out there, that does science communication, doesn't like museums, or PR, or writing about science from a science perspective. And I think this is important. We need more of that. But journalism for me has always been very separate and different from that, because it's about being on the outside. It's about criticising and being critical of...

Holding them to account.

Holding people to account. Being on the side of the audience, not being on the side of the scientists.

Actually making scientists raise their game.

Right, you'd hope so, you'd hope so.

Sunlight is the best disinfectant and all that.

By the way, that doesn't mean somehow shaming scientists or destroying them or something.

I agree.

It's simply...

Critical friend.

A critical friend. Exactly. I've always been seeing myself in all those things. And so, applying for a funding fellowship from a science organisation like the Wellcome Trust, which is one of the most prestigious, biggest science organisations out there was a little bit odd for me, but I thought, you know what, I'm probably about halfway through my career, I probably need a bit of time to think. It was nice to be able to do that, try out some experiments. And yes, we did some experiments. It was really fun.

And then you moved to The Economist after that, how did that happen?

They just advertised for some science correspondents, and I just applied. The Economist is, I would say with the Guardian, the only other place that I ever wanted to work. I genuinely mean that.

I love The Economist.

I've not been just... because they gave me a job. I've wanted to work for The Economist for about 15 years.

I hear they call themselves a newspaper, but it's a fantastic magazine in my view.

Yes. Newspaper, magazine, whatever you want to call it.

No bylines though.

No bylines.

How do I know you've even written anything though? You could still be at the Wellcome Trust, sat with your feet up. This could all be a fraud.

Do you know what, though? I actually wrote *all* of the last issue. So, just assume it was me. All the things you liked, that was me.

What about the things I didn't, was that someone else?

That wasn't me.

That was Zanny, was it?

That was someone else.

That's what I thought.

Yes, that's right.

How does the job differ from the Guardian, then?

In some ways it doesn't, because it's writing, and you get to write long pieces and so on. And there's audio and video, and all those other things. The byline, to me, doesn't make that much difference any more. Because I've had plenty of bylines. On Twitter and things, you can have your own profile, and I think a lot of Economist writers do now, so that's fine. You're not anonymous. How does it differ, though? The one thing... I've only been there for seven or eight months. So, ask me again in a couple of years. But the big thing I've noticed that's different is that you can just write whatever you like. You're more able to be free to explore ideas, because you have a bit more time. Partly because it's a weekly publication, so there's not this daily pressure to get stuff out there. They're not so bothered about covering the news. They want you to analyse the news, and think about things a bit more. If you want to spend a couple of weeks investigating nuclear fusion, which is what I did a few weeks ago, yes, off you go, go and do it. As long as you produce something interesting at the end of it. They're not worried about necessarily everything being completely brand new. But if you can bring a new take onto it, or an interesting interview onto it, that's fine. Because what is this newspaper/magazine for? It's about explaining the world to people who make decisions. That's the way I see it.

I get the sense that even though I'm not important, I get the sense that a lot of Economist readers are, and you're actually feeding into the mind of people that really do make actual decisions.

Right. So, I think that... I would put myself in the same bucket of people who are not important, but I've read The Economist anyway most of my adult career life. But yes, I would say that probably. I've got no evidence to support this. And this is terrible for science journalist, but all the people in the world who make important decisions probably read The Economist, and that is probably not an exaggeration, prime ministers, presidents, business leaders, they read it. And for them, knowing about science, which is what I cover, is important, and they're not going to necessarily read New Scientist, for example, although they probably should.

New Scientist is awesome. Emily is doing a great job. She's sat in that very chair.

Really, really, really good thing. I'm glad they don't read it, because it allows me to rewrite New Scientist stories for them.

Exactly. That's the secret, is it?

No, I don't do that, by the way, editors at The Economist! But the idea being that those people want to know about the latest ideas in the world, whether it's biology or physics or whatever else, because actually – and this might sound utilitarian, but it's true – where do new businesses come from? Where do new ideas come from? Where does progress come from? It comes from these people in labs all over the world thinking up new ideas, investigating the world. In some ways, science is a real... well, this is not even *some* ways, it *is* a driver of growth in economics. And so, it's a respected thing for those people. And so, for them, writing about nuclear fusion or astrophysics and stuff, they want to know these things. Also, I'm fairly convinced that all those people probably want to sound intelligent to their friends and colleagues.

I certainly do.

So, reading about these things, concepts from quantum physics and general activity in accessible language is pretty useful for their dinner party conversation as well. So, it's a good thing.

I flew back from LA last weekend, and I spent two hours watching YouTube videos on the weak nuclear force, because I couldn't of all the four forces...

Goodness me.

Someone asked me, "What does the weak force do?" and I genuinely couldn't even cope with one follow-up question. I could probably blag the other three.

I think you could do quite well. Even the fact you know what the weak force is, is quite impressive.

But now I'm probably at least one or two levels of follow-up questions deep, and I could probably blag it. Still don't quite know what the hell it is.

I'm impressed.

But if I'm honest...

It's not the strong force. That's what it is.

I'll tell you what's interesting about the weak force is it's the opposite of absolutely everything. It changes particles to the opposite of what they are.

How do you mean?

You see, that's what I'm saying!

The interesting thing with the strong force, which is the other thing that probably no one else has heard of, of the fundamental forces...

The gluons.

The gluons, they act in a completely opposite way to the other forces, because as things get further apart, the strong force gets stronger. As you push them together, it gets weaker.

It's incredible.

Which is what keeps nuclei together, basically,

It's incredible. It's all witchcraft, in my view. Actually, you were talking about the great and the good reading The Economist, but it actually made me think of a question about how politicians seem to be fuelling a populist mood these days against experts and against scientists. How damaging is that?

There is a frustration, I think, probably with people who want to tell you what to think about more than how to think about it. If you've spent your entire career thinking about one very specific thing, whether it's gluons or the economy, and no one else believes what you're saying, and you get upset and angry in the way you communicate that to somebody, and they're going to think you're talking down to them, that relationship is not going to work, is it? Because people don't want to be talked down to. They want to be respected even if they don't know anything. And I think that, in that sense, no one wants to be talked down to or be condescended to or anything. And so, experts are very good at condescending to people because that's just kind of, they want people to get up to speed quickly. In a sense, it speaks to a truth. Yes, people might be fed up with people condescending to them. In things like the Brexit debate, when they're told, oh, well, if you vote for Brexit, you're going to have this much money out of your bank account, and these different things are

going to happen with jobs, and everything. It's like, "Blimey, just treat me with a bit of respect. What does this mean?" I think all sorts of nonsense was peddled there. I don't think people have actually had enough of experts, though. Most people still want doctors to treat them in hospital.

I actually want my local homeopath to be available.

The expert homeopath, right?

Exactly.

I just want to make a joke about expertise in homeopathy being... never mind. Anyway, never mind, you want your doctor to treat you. You probably want, if you're talking to a financial advisor, who's an expert, you probably want advice from them.

And if you get in a plane, you want the pilot to know what he's doing.

You want the pilot to know what he's doing. I really want that. That's a specifically important thing. I think that actually even if you *think* to yourself in a fit of frustration that you don't want to be condescended to, and have experts talking down to you and stuff, you still actually would probably want that sort of stuff. I think politicians fuelling that is just, it feels to me like it's not true that people have had enough of experts, but it just makes a nice line to then allow you to sort of make an argument. I think that nowadays, it's easier and easier for experts to get their information out there. Whether it's through the media, or blogging or Twitter or whatever else. And actually, there's so much information out there. I had a really good point to make, but I've completely forgotten it!

It was an interesting point. Actually when we were talking about flying, and the plane, the pilot having expertise that reminded me of just how I started on my own journey of exploration in science, which is someone once asked me how a plane flies. And I think I'm reasonably clever and sharp, and I just assumed I knew. I couldn't say in any way how a plane could actually get off the ground. Now I can, but that was the thing that actually...

What's your explanation of plane getting off the ground, then?

I'll tell you in a second. That was the one that actually truly taught me that I didn't know, and that I ought to know. I just felt a deep sense of frustration and almost shame that something as obvious as how does a plane fly, that I didn't know.

See, that question is actually quite complicated.

It is because there's 75 different ways of answering it.

That's right.

Air has mass. That's the reason why planes fly.

This blew my mind actually because I've got a physics degree, and I thought I knew how planes fly. I thought this is an obvious question that people ask you. Turns out it's not obvious at all.

There's which level of truth you want to get into.

Exactly. And actually people don't *really* know.

And that's where it gets really zen.

Even aeronautical engineers don't actually know how planes fly. They've got really good ideas...

Yes. A wing generates lift because the air is traveling slowly under the wing. Is that right? And it creates a vortex.

Right. The one I learned was about Bernoulli principle basically, where the wing shape is such that it travels faster over than under.

Yes. And the pressure drops underneath the wing, which pulls the wing up. Is that right?

Well, actually air moving fast has low pressure...

Correct.

... and air moving slowly has high pressure. So, the pressure differential between the top and the bottom pushes...

Generates lift.

Yes. Turns out that might not be true.

Yes. I know.

Turns out, it could be just that the wing shape is such that it pushes enough air downwards that then, because one of Newton's laws, air being pushed down, then pushes the plane up at the same time. I was like, "Are you sure?" Turns out that no one knows what the actual answer is. But it works. Whatever happens, planes work, don't worry about it.

I like the fact that just because we were trying to work out how steam engines work, we come up with the laws of thermodynamics. And it turns out that the second law of thermodynamics is actually responsible for the arrow of time.

Yes, that's right. Yes.

I mean, what the hell?

This is interesting.

Time can only move one way because of the second law of thermodynamics.

Because of the steam engine.

Yes.

That's right.

Absolutely amazing.

This is interesting. This is a properly nerdy conversation at this point. But I wrote a series of articles for the observer, actually, when I was back at the Guardian a long time ago about equations. Because I have a real fascination with equations. And people get scared of equations because they're meaningless jumbles of letters and symbols and things, but my thought was that if you looked at an equation, and you explained to people what each term meant; that you can explain big concepts to people. So, thermodynamics is one of them, and the second law of thermodynamics, as you rightly pointed out, is that the entropy of the universe is always increasing, and that comes from steam engines. That gives you your arrow of time. But that's the beauty of an equation, which is that it comes from something physical in the world. But then the brilliant part of it is it only predicts something epic, and all good equations do that.

Look at $E = mc^2$. In effect, it shows that mass and energy are two flip sides of the same coin, but if you look at the c squared, speed of light squared, just shows you just how much energy there is in mass. An insane amount. You could power the earth for decades on one sugar cube, if you could actually unlock all of the energy in it...

If you could, yes.

That's absolute insanity.

That's proper science fiction stuff. But also, nuclear energy comes from the $E = mc^2$, you're turning very, very small amounts of the nuclear matter inside Uranium into energy, which is plenty to sort of keep your cities and whatever going. Of course, the sun is all nuclear. It's a big nuclear reactor, in its own way. And it's going to continue burning for billions of years because there's so much energy...

It's 99% of the entire mass of the entire solar system is the sun.

It's enormous.

Which is utterly....

We're just bits of dust floating around next to it. That's right.

We're literally stardust, aren't we? We were made in supernovae and stars. Again, there's just so... this could be a five-hour podcast where we just go on about how amazing science is.

This is my favourite topic in the world, because it's just so brilliant.

What's the heaviest elements that we can make in the sun before you have to get them? Is it carbon?

Iron.

And then anything heavier than that? Anything with a greater atomic weight has to be made in a supernova?

So yes, so atoms fuse at the centre of stars, and bigger and bigger, bigger things. So they start off as hydrogen, become helium, and all the way up to eventually iron. Different life cycles of different stars.

And that's where gravity and pressure overwhelms the strong force to create nuclear fusion.

That's right, so you're having nuclear fusion. When atoms fuse, they release a bit of energy. And so, that's how they stick together. And so, you can get to iron inside a normal star, and then you're right, the supernova happens, which is that the whole thing collapses and explodes. These are sometimes the most bright objects in the galaxy, very briefly. In those enormous explosions, you get more heavy elements, essentially. What we've discovered just recently, I mean, we're talking last few years, is that you can get to a sort of very, very heavy elements in supernovae, but really not all of them. You can get gold and you can get uranium and these things from those places, but not in the masses, not in abundance, as you see in the universe. So, where do they come from? Where does all the gold and platinum, and all these other things come from? Turns out they come from the collisions of these weird things called neutron stars.

They're amazing.

Neutron stars are crazy objects, which are like... the classic example is like, you can have one which is, it's a collapsed core of a star. It's completely dead. And what it is, it's just neutrons, which are the neutral bits of the nucleus of an atom, and they're so dense that a neutron star the size of London, a teaspoon of that is heavier than... I don't know. I'm going to get this wrong, but something like the sun or something crazy like that.

Yes, it's insane.

It's incredibly heavy. And when those things collide – and by the way, we don't really understand how these things work properly, another mystery out there – when these things collide, they release shit loads of gravitational waves.

That's a scientific term, for our listeners...

Yes, and that's how we know we detected them. That's how we've detected them, only in the last few years. But in those collisions, the energies are so huge that you create entire solar systems worth of gold, just like gets thrown out, or platinum, whatever. It's true to say that basically, almost all the gold on earth comes from these enormous collisions somewhere else. So, they can't be created in stars. They have to be created in these black hole collisions... Sorry, these neutron star collisions. Then there are other types of collisions as well with objects we probably haven't imagined, which create even heavier elements and so on.

We've got some elements that are so heavy, that we're creating them in labs for a fraction of a second. Do you think there is this so called island of stability coming?

I think that. That's a really good question that I was not expecting to be asked here.

Because it's quasi-philosophical at this point.

Theoretically, yes. Well, I mean, the brilliant thing about chemistry and physics and all these other things is that you've got equations and understandings of the universe structures, and so on, which allow you to make predictions. So, lots of theoretical physicists and biologists and chemists and whatever make predictions about the future.

Well, the periodic table made predictions, didn't it? Actually, there was gaps in it that were pointed out.

That's right.

Sorry, in fact, it revealed that there were gaps. It wasn't the periodic table that was wrong, it was the state of science at that moment was wrong.

Yes. We hadn't found a certain number of elements and so on. and people did find them and fill in all these gaps. But the island of stability you're talking about is an interesting theoretical concept that at some point... so, as you get heavier and heavier on the periodic table, the atoms become, they become unstable.

So unstable that they just decay immediately. Like within split seconds.

Even quicker than that, and sometimes they will occur in nature, because they're just so unstable. But the theory is that at some point when you got hundreds and hundreds and hundreds of nucleons, maybe even more, that they'll just exist, and some sort of massive atom exists out there. And we don't know what's in space. We

have no idea. What if there is some enormous atom the size of a planet, with billions of neutrons and other things inside it? With electrons flying around outside. I sound like a crazy person now, but these things might exist. Who knows? We just don't... space is enormous. Who knows what's out there?

What made you choose water as the topic for your fascinating book?

The idea for that book came from quite an idle thought I had actually, in thinking about ideas for stories and whatever, and whatnot. I was thinking about, water is pH seven. It's not acid, it's not alkali, it's completely neutral. And there's nothing else that's pH seven. So, why is that? It's because if you want to measure something that's an acid, what you do is you measure the concentration of H⁺ ions in the solution. If you want to measure something that's an alkali, you measure the concentration of OH⁻ ions. That's just how it's defined. And so, what has an exact number of each.

Dihydrogen monoxide.

H₂O, yes, exactly, H₂O. So, what you realise is, of course, the acid-alkali scale is built around water. Then you realise that the temperature scale, water freezes at zero, boils at 100. That's quite a convenient set of numbers for the world. It's because you're measuring the boiling point and freezing point of water, and that's how you measure temperature. Then you realise that, of course, water is, because it's such a common thing...

It's why our eyes see the spectrum that we can see, the electromagnetic spectrum is because we evolved from fish in water.

Right. And the thing is, water is such an important thing that we don't take notice of because we're kind of... it's like fish who don't know that they're in water. It's just your environment. Once you start unpicking these little things, it turns out the water, which is the bland, boring thing everywhere around you, actually pervades all aspects of everything around you, and I just started investigating. And it led me to write the book, because there's such a scientific story to tell there about what it actually is, and making people aware of it, and how it generates weather and all these other things. But also culturally, you can tell some really amazing stories about water. Because if you think about human evolution. If you went back 200,000 years and met humans, they will be physically pretty much the same as we are now. You won't be able to talk to them, of course, because we don't share a language.

Sounds good to me. I don't like people anyway.

We don't share a language. We would probably eat the same food, but you drink the same water, and it probably is the same water you're drinking now. So your connection to the first humans is water. If there are aliens in the universe, it's very, very likely that they will use water as the thing that carries around all their chemicals in their body and stuff. Does the same things that water does in our bodies.

LUCA was created in water.

I think that this is the thing. Water is the thing that connects everything. But is also invisible. So, I wanted to make it visible. That was the purpose of that book. And it was fascinating to me for that reason, and I hope for whoever else reads it.

Last question, then because to be honest, I've hijacked this podcast by asking you lots of interesting science stuff, and it's been an absolute delight. But what advice would you give to someone who's starting out in their career that wants to be a science journalist? What should they do and what shouldn't they do?

If you want to be a science journalist, first of all, it sounds obvious, but be interested in science. You don't need to have a science degree to be interested in science. Many of the best Fleet Street colleagues I had when I was working in newspapers didn't have science degrees. They were just interested in the world around them. I think that's a general journalistic thing, actually, to be curious, to be respectful of other knowledge and wanting to learn more. I think that nowadays, having a science background or having a different background of some sort is useful in journalism, because it gives you a different perspective on the world. As well as giving you a USP, which you can then set into things, into newspapers and so on. Nowadays, the good thing about science is that it can lead you into careers in climate journalism, which is getting ever more important. And to tech journalism, which is getting *incredibly* important. If you want to understand the tech world, having a technical background and stuff is useful, or understanding or wanting to know these things. What I say to people in those worlds is that I don't know that the specialism of science journalists really exists any more. It's more like journalists who... almost all journalists have to be interested in some part of the science world or have the tools of a journalist in science, whether it's statistics or programming or data visualisations, or any of those things. I just think being interested in the world. Be interested in whatever's new, question everything, think scientifically in some ways, and it leads to some very interesting places.

Alok, this has been an absolutely fascinating podcast in its own right. Thank you ever so much for your time. I really appreciate it.

You're very welcome. It was a pleasure.