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INTERVIEW

An interview with Jamie Davies

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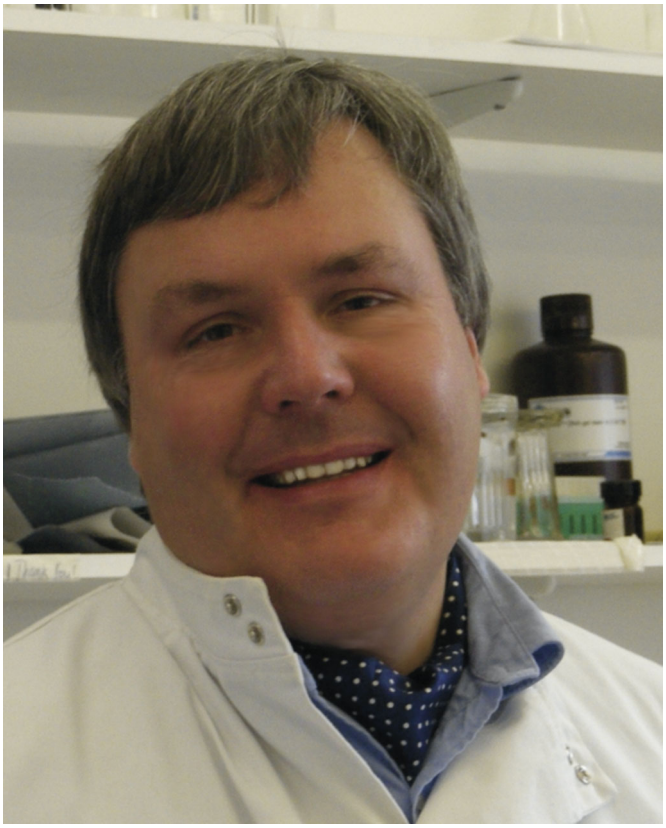
Jamie Davies is Professor of Experimental Anatomy at the University of Edinburgh. Spanning the fields of developmental biology, tissue engineering and synthetic biology, his research aims to understand the mechanisms by which cells organise themselves into tissues, focussing on the kidney. In addition to his research, Jamie is involved in science communication and public engagement, having written several books for specialist and non-specialist readers, and having given numerous public lectures and broadcasts. In April 2021, Jamie was awarded the inaugural Wolpert Medal from the British Society for Developmental Biology (BSDB), which is presented to outstanding developmental biologists who have made a significant contribution to teaching and communicating developmental biology in the UK. We spoke to Jamie to ask him about his cross-disciplinary research interests, his thoughts on public engagement and his advice for young researchers.



Let's start at the beginning – what first got you interested in science?

That's a really good question! I suppose science was something I've been interested in for a very long time. But a scientist is probably about the third thing that I wanted to be when I was a child. If I'm honest, I guess [the television programme] 'The Muppet Labs' and [the book series] 'Professor Branestawm' were probably what started my interest – they just made science seem like so much fun, and I started to realise that playing with the world and understanding it go together. BBC2 also ran wonderful television series with scientists such as Carl Sagan, who just somehow conveyed the joy of discovery. I was also lucky that I grew up in a time with great public libraries full of inspirational books written by people who were really good at writing about their science. I had great teachers at school but science in school was a bit dry – at least it was back then – so the books and the television added excitement. It was a bit like studying music: learning the rudiments of music is dry, and playing scales is boring, but when you turn on the radio and hear a magnificent concert, you understand why you have to start off by playing scales.

How did you then become interested in embryology and developmental biology in particular?

As a child, I actually never thought much about biology. I got really interested in how complicated structures form from simple things but, because of the sorts of things that I was watching and reading, I was only thinking in terms of physics. I thought I was probably heading to be a radio astronomer interested in how galaxies form; I didn't think about embryos at all! But I went to Cambridge to study Natural Sciences and it wasn't divided into biology and physics then – you were simply a 'scientist'. That's when I met people like Michael Bate, who gave brilliant first-year lectures on developmental biology, and I just kind of thought: 'How did I not appreciate that going from a simple egg to a complicated organism is such an amazing process?' I also stumbled on some of Alan Turing's papers – his morphogenesis papers from the 1950s – and I realised that you can bring physics into biology, and that this was exactly what I wanted to do.

Much of your research has focussed on the kidney, aiming to understand how this complex organ forms. Why the fascination with the kidney?

My PhD was actually on developmental neurobiology and I was very lucky because, as an undergraduate, I had a hunch that repulsion must be important in guiding where things go in an embryo and I managed to find the wonderful supervision partnership of Geoff Cook and Roger Keynes, who were willing to let me do a PhD on exactly that topic. I did this at just the right time, as it turned out that several different groups around the world were also thinking about this, and we co-discovered repulsion [and the concept of growth cone inhibition], and all published in the same issue of the same journal. But I got scared by the complexity of the

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brain. I also had a strong aversion to working *in vivo* – maybe it's just squeamishness – and realised that if I wanted to carry on in neuroscience I would be forced to do experiments that I really didn't have the stomach for. So I started to read around and came across a book in the anatomy library in Cambridge called 'Organogenesis of the kidney' by Lauri Saxén. I picked it up thinking 'what on earth could be interesting about kidneys?', but what was clear on just opening the book was that kidneys can grow in culture. So here was a developing organ that is actually surprisingly complicated: it's a plumber's nightmare, but it does all of the kinds of things that classical developmental biologists think about: induction, differentiation, spatial organization, building gradients and setting segment boundaries. I realised that this was a brilliant 'playground' that could be used to study mammalian development in miniature, without actually doing things with living animals.

Your current research spans a number of disciplines, from embryology and tissue engineering, through to synthetic biology and computational modelling? Did this just happen by chance, or were you always interested in all of these approaches?

I think I've always been interested in all of these approaches and, to me, the boundaries between them quite feel artificial. It all feels like the same kind of activity – it's just like picking up a different tool that's lying around, the same way you might pick up a Gilson in the lab to do one thing and look down a microscope to do another. I suppose the synthetic biology side of things came about because I've always been interested in engineering; I've always liked building and fiddling with machines. Perhaps if you've got that sort of mind it's just natural to turn to those sorts of tools, the tools that allow you to start to build a model system. Maybe it's also because I started off by studying natural sciences, focussing on physics. I've always been feeling like an amateur, always having to catch up on biology! But I think that isn't necessarily a bad thing. In a funny way, I think one of the worst things to be is one of those people who is regarded as an 'expert' in something, because that's an awful lot to live up to – it's much more fun to be a bit of a blundering amateur, and have a license not to know what you're talking about, but to surround yourself with people who do.

Has it been difficult recruiting the right people in these various disciplines and bringing them together?

I suppose when I was first starting out, as is the case for a lot of very new PIs, finding good people is difficult because you're actually a big risk to them. But there comes a time when you become more established and people start to find you. When I'm recruiting, I want somebody who seems intelligent and who knows things that I don't, because there's no point in getting another person who just knows what I know. Right now, there are biologists, biochemists and medics in my group but there's also a mathematician, as well as a mechanical engineer and an electrical engineer. Not long ago, I also had a philosopher in the group, which was interesting because she really understood logic, and a lot of biologists don't.

In addition to your research, you've been involved in public engagement and science communication. Indeed, this year you were awarded the inaugural BSDB Wolpert Medal, which is presented to an individual who has made extraordinary contributions to the teaching and communication of developmental biology. What does this award mean to you?

I suppose there were lots of reasons for getting involved in science communication. Of course, some of it just happens naturally because if you're excited about something you just want to tell people more about it! And some of it happened because I was also so grateful for the people who did it for me when I was growing up. But I don't just do science communication for children; actually, most of what I do is targeted towards adults because so many of my colleagues deal with children (plus, I don't really feel I have any particular expertise of dealing with children, so I leave it to the people who do).

As for the Wolpert Medal, I have to admit that I was really surprised by it. Lewis did a vast amount for the field, which is obviously why he is so well known by so many people, so it was actually very daunting to receive an award like that. But I just had to tell myself: 'Look, the award isn't for being like Lewis – it's just for doing something in the spirit of Lewis.' But I think it's really nice that the BSDB have created the Medal. Lewis was a very significant figure for a lot of us, whether we knew him personally or whether we learned about him in an abstract way, for example by hearing about his ideas, reading his books or watching him give online lectures. He is an important figure in developmental biology. In addition to his science, Lewis is well known because he suffered from serious clinical depression at one stage in his life and he wrote a book about this (called *Malignant Sadness*). I think the message that someone can be a great scientist and still have other issues going on with their health is a really important message to convey. There have been physically disabled people, like the immunologist Peter Medawar, who won a Nobel Prize, and of course Stephen Hawking, but we hear less about mental problems and illnesses. So I think that Lewis' book sends out a really positive message – that we are an open community, and that we don't need everybody to be the same. The culture around this is changing a little bit, but it needs to change more. And I think that Lewis was brave to be so open about it at that time.

You mentioned in your acceptance talk at the BSDB Annual Meeting that sharing science should be a 'cultural mission' for scientists. How should scientists go about achieving this mission?

I think that, as a community of scientists, it is important for us to share our knowledge and our excitement. We have a duty – for example, to the many people that fund us – to tell people about what we are doing. But that doesn't mean that every person has to do it; we all have different skills and different things that we are good at. I also think that communicating our science is important culturally. Culture shouldn't just be about the arts, and I think it's important that we as scientists keep mainstream culture broad, and inclusive of science.

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Also, entirely selfishly, I think that talking to people who are not scientists sometimes uncovers questions that we've forgotten to ask. There are often interesting problems that we can solve, and interesting questions that we can answer quite easily. But there are also interesting problems that we can't solve and we often push those ones aside. Eventually, we end up focussing so much on the questions we can solve that we forget about the really interesting ones that we couldn't. But when you reach out to the public, you're reminded of those really key questions, because those are the first ones that come to their minds. I think that's really helpful. Also, if it's been a hard day

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in the lab, or a hard day getting grants rejected or papers bounced back by Development reviewers, then having an evening where you're talking about science and seeing the fascination in people's eyes can be a great antidote to Reviewer Number Three! It really helps you to put things into context.

Talking to people who are not scientists sometimes uncovers questions that we've forgotten to ask

You have also written a number of books, including popular science books for non-specialist readers. How did you become interested in writing these types of books?

I suppose part of it came from my experience of teaching. I just felt there was a story to tell that wasn't being told. There have been some very good books about genetics, and how this intersects with development, but everything was very gene-centric. I just thought there was another story, and another way of looking at things, and I wanted to give it a try. I suppose the public communication level is actually the way that I think about science – by using analogies, straightforward words and simple drawings. That's actually about the level that my brain has always worked. So I thought I would just give it a go and see what happened. Fortunately, there was a publisher who was interested and so it went on from there. It's more difficult to write that type of book, versus a specialist book or book chapter, but it's more satisfying.

Of all of these activities – research, book writing, teaching – which do you personally find the most enjoyable?

I actually find that really difficult to answer because if I isolate any of them, I lose something; there's a strange loop and interaction between them such that each one helps the others. It's a bit like what I said about the lab and having all of these different people milling around – yes, it can sometimes get crazy and unmanageable (although I've never felt like a manager anyway – I just provide the cupcakes and tea!), but it creates a sense of fun and that makes everything much more interesting.

What would be your advice to young researchers starting out in developmental biology today?

My first piece of advice is don't accept too much advice from ageing scientists who may have known how to win battles of the past, but may not know how you can win yours. But my second bit of advice doesn't relate to developmental biology in particular, it relates to pretty much anything: try to do what you want to do without worrying about what you think other people's expectations are. I think a lot of people, when they're given an opportunity such as their first studentship or fellowship, or their first lectureship or PI position, feel weighed down by what's expected of them. The physicist Richard Feynman wrote about this feeling in his memoirs. But then somebody told him: look, if you're not right for the position, then it's the fault of the people who appointed you – it's their bad judgment, and it's their fault, not yours – so you should have fun in that position and they can take all the stick! I was lucky that I read that book when I was an undergraduate and I thought: 'Okay, I'm going to try to remember that: if somebody appoints me to a job and makes a judgment that I'm the right person, then it's their fault if it doesn't work out. I'm still me.' I guess this is sort of linked to 'imposter syndrome', which is something that is talked about a lot more now. The way that's normally dealt with is that people sit that person down and say: 'You're not an imposter. It's fine. You're great!' But I think more people should just look around and realise that nobody has the faintest idea what they're doing anyway. How could anyone be an imposter when no one else knows what's going on either? We're all just blundering around in the foggy darkness at the front of knowledge. That's what we do – we're professional blunderers in the dark – that's what research is.

Finally, is there anything that Development readers would be surprised to find out about you?

Few science colleagues know this, but I have been teaching, choreographing and performing 1920s-1950s swing dance for the last 30 years or so. I used to teach and perform across the UK and Europe but now tend to teach only in Scotland. Every so often, a medical student will turn up to one of the classes and will ask me if I have a twin who works for the university.