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INTERVIEW

An interview with Emma Rawlins

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Emma Rawlins is a senior Group Leader at the Gurdon Institute, University of Cambridge, where her research focuses on lung development and regeneration. This year, Emma was the recipient of the BSDB Cheryll Tickle Medal, which is awarded to a mid-career female scientist for outstanding achievements in developmental biology. We talked to Emma about her research career, mentorship and how she felt about receiving the Cheryll Tickle Medal.

Congratulations on winning the Cheryll Tickle Medal: what does the award mean to you?

I've been a fan of Cheryll's work for many, many years, starting as an undergraduate. It was one of the first things that got me excited about developmental biology. So, it's a great honour to win something with Cheryll Tickle's name on. It makes me incredibly grateful to all the excellent scientists who have worked in my lab over the last few years. It's also really nice to feel that someone thinks you've done something well, after all the hard work!

When did you first become interested in science, and biology in particular?

My parents were both maths teachers and my dad was always keen on watching the Royal Institution lectures at Christmas. That was a big highlight growing up, watching those lectures. But what really got me interested in science was an almost retired A-level biology teacher, who encouraged us to read widely and lent us books, such as the popular science books about evolution by Stephen Jay Gould and Richard Dawkins. Initially, I wanted to do a chemistry degree and it was only as an undergraduate that I realised that chemistry wasn't for me, and I switched to biology. Then I heard about developmental biology in undergraduate lectures. I remember learning about experiments using beads to manipulate limb development, and John Gurdon talking about oocyte injections!

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Then you became a developmental biologist and have been ever since! Why did you choose Andrew Jarman's lab for your PhD?

I did final year genetics as part of my undergraduate degree, and I loved the logic and the precision of genetics. I knew that the genetic tools in *Drosophila* are very powerful and, being in Cambridge, I was exposed to the amazing fly community there – people such as Alfonso Martinez Arias, Steve Russell, Sarah Bray and Daniel St Johnston. These people were teaching us about amazing fly genetics, so I applied to lots of fly genetics labs! I was extremely fortunate to be able to do a PhD with Andy. It was great. Andy was incredibly supportive as a supervisor, and I learnt so much amazing science.

You had two first-author papers arising from your PhD work, both published in Development. Can you give us some insight into your experience of the publication process back then?

Yes, this is a story that I still tell my students! For the first paper (Rawlins, et al., 2003a), we had some revisions and we had to do some more crosses. I actually went on holiday and left Andy to do them. I was told stories about him standing in the lab consulting my crossing scheme while scratching his head, but they got done! For the second paper (Rawlins, et al., 2003b), all we had to do was move the *y*-axis on the graph and relabel it. That was the only revision we had to make. It was a very different time and that never happens anymore.

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When you finished your PhD, you moved away from *Drosophila* to use the mouse model in Brigid Hogan's lab. What was your research focus during your postdoc?

Actually, the reason I wanted to switch to mouse was for a change more than anything else. I had stayed with Andy for 5 years, and it was time to do something a bit different. I don't think I really appreciated that the model you work on for your postdoc is what you get stuck with! But mouse genetics was really exciting and the next thing for me to move onto. I chose Brigid's lab largely because of her reputation, but also because I really liked her when I met her. I thought she would be someone who I could work with. When I arrived in Brigid's lab, she told me that I could work on anything I liked, as long as it was in the lung. Historically, she had always followed the phenotype; for example, if a mutant had a gonad phenotype, you worked on the gonad and so on. But when I joined her lab, she had just become chair of cell biology at Duke and decided we had to focus; the lab had to be a bit smaller, and everyone would work on lung development. Then it was a case of finding a question I wanted to answer in the lung. To develop my ideas, I talked with Brigid, and I actually wrote a review for Development (Rawlins and Hogan, 2006)! I eventually started working on stem cells. My questions were centred on the identity of stem cells and whether this differed during development versus in the adult, as well as in homeostasis versus injury. We now know these stem cells are all completely different. Although intuitively that may be obvious, at the time we didn't know. We decided to take a lineage-tracing approach, partly because I wanted to make the mouse models and partly because we felt it was the best experimental approach to answer our questions. It felt weird when I was putting together my medal talk because lineage tracing is such a common technique now, but I wanted people to understand that this approach was state-of-the-art at the time and it was exciting!

Aside from moving to another model organism, you made a big move to the USA for your postdoc. Do you think that was essential for your career and how did you find the move?

At the time, it was expected. If you were an ambitious young scientist, people thought that you had to go and work in the USA or you would never succeed. Clearly that wasn't true, but this is what senior scientists and funders were telling us. Fortunately, that is no longer the case and I hope nobody feels that pressure anymore. Having said that, the experience was great. My husband and I thought it would be exciting to move to the USA for a few years, but it was difficult at first as he didn't have permission to work. He is a transport planner and transportation planning, as they call it in the USA, has a very different background compared with the UK. This meant his CV looked weird to potential employers. We had a rocky 9 months while he found a job, but he did, and in the end, he wanted to stay and I wanted to come back! The whole experience was an exciting time for us; we were young and we didn't have children. It was a good time to go and live somewhere else and do completely different things. But I'm very glad we went to North Carolina and didn't try and live in New York or San Francisco. We loved North Carolina; there are lots of fabulous things to do and it's a really interesting place with a welcoming community.

Did having Brigid as your mentor influence how you run your lab?

Yes, definitely. However, when Brigid says she became focused, it was a total lie! But that was one of the inspiring things about working with her; she has about 20 ideas a day. You had to say no to most of them and pick and choose the best ones to work on. I have to confess to being a bit guilty of wanting to do too much as well. Everything's exciting, and I'm constantly trying to call myself back to being a bit more focused. I need to make sure that we aren't trying to do too many different things at once, that everyone comes out with a paper and that my students get their PhDs. It's really important to try and find that balance.

In your medal lecture, you mentioned that Brigid told you that it is important to publish everything – does this influence your approach to publication and openness in science?

Yes, Brigid told us that you had to publish even if it was a really minor story. The first bit of research I did with her was like that; we decided to drop the project because it wasn't going anywhere, at least at that point. But nevertheless, we published it in Developmental Dynamics (Rawlins and Hogan, 2005). Then, many years later when I started my lab, someone told me that they had done some work on the basis of that publication and were now in touch with a company and were looking for treatments for specific conditions. So, it was the right thing to do, to publish. Obviously, this won't be the case for all papers, but I think it is also important for students and postdocs to publish. It really irritates me when PIs don't publish minor stories because they are only looking for big papers. It means that work is lost and it's terrible for the person who put all that effort into the project. I think that it is very powerful to share our research, and I also care about people in my lab getting their hard work published. We now preprint all our research, as I think open science is really exciting. We also share our plasmids in Addgene. It's quite exciting to see who has requested them! We have used a lot of plasmids from the collection as well – we have chopped and changed them for our purposes.

How did you find the transition from postdoc to PI?

Scary! But also very exciting. It is a very different position, suddenly being just you, in an empty lab, with funds to hire one other person. It required lots of balancing. I had a 4-month-old baby when I first started, so my memory of what happened is not great as I was so sleep deprived! I started with just one other person and built the lab up over time, giving me chance to acquire the skills I needed to manage my lab. It must be quite difficult if you get a position where you suddenly have six people reporting to you, but I built up gradually.

Do you have any particular approach when hiring people?

It varies from position to position, but I'm always looking for someone who's just interested. I'm looking for someone who is excited about developmental biology. I often have people write to me and say, 'I have a different background, would you still be interested in me?' If they are doing any sort of developmental biology, then yes, I am! It's great when people have their own questions that they would like to address, and we can come together and develop a joint project.

Do you have any advice to young scientists that want to become group leaders? Did you always have a plan for your path in science, or did it evolve over time?

I never had a plan. And I never thought it through beyond the fact that I was enjoying what I was doing, so I thought I'd keep going! I was encouraged by my mentors to apply for the next step in my career and to continue in research. So, I think the best advice is to have supportive mentors! I was lucky enough to have supportive mentors at every stage of my career, including as a young group leader. My advice to young scientists would also be to just do what

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you enjoy. I've always done the experiments that I found exciting, even if it meant that it has taken longer because it involves setting up something new. It's a very stressful job to have anyway, so unless you're passionate about it, why bother?

Did you go and seek mentors during your career, especially as a young group leader?

As a PhD student, I was incredibly lucky to end up in Andy Jarman's lab. He was incredibly supportive. Then, when I was looking for a postdoc position, I made a big effort to look for somebody who I thought would be supportive, and a good mentor. It's always hard to choose, but I was lucky again. Both my PhD and postdoc mentors were critical friends; they were willing to say things like, 'you need to improve this Emma' and 'you're not going to get anywhere unless you do this better.' This advice was obviously great! Then as a young group leader, I buried my head in the sand for a year or two; I had small children and no time for anything! I was pushed by somebody to go and look for help when I was struggling, and as soon as I asked for help, of course, it came. Good mentors are supportive and care, but also continue to promote you. Not in the sense of helping you rise through the ranks, but suggesting, 'have you thought about applying for this' or 'why don't you go and do that?' I think it's really important for young people, and women especially, who might not feel comfortable with self-promotion, to have mentors and supporters that approach them saying, 'I want to nominate you for this award, can you give me a CV?' Finding those people is invaluable.

Back to your science, what are the main questions that your lab is trying to address?

I want to understand how you build a lung, and whether we can use this knowledge to regenerate a lung or to understand what goes wrong in lung disease. We are particularly interested in cell fate choice, and we are now beginning to connect this with morphogenesis. We are interested in how the cells are coordinating their movements, as well as the concept that developmental biology is naturally self-limiting. If we could restart a naturally self-limiting process, this, of course, would be a positive thing for lung regeneration! We are also interested in answering some detailed mechanistic questions. We now have the tools we need for labelling cells, and we have a lot of ideas of how to use them to address our questions.

You're involved in both the Human Cell Atlas project and the Human Developmental Biology Initiative – could you tell us a bit about these projects and how you're involved?

My role in the Human Cell Atlas project is very minor; it's a massive project. I have an MRC human lung cell atlas grant with Kerstin Meyer, who is part of Sarah Teichmann's lab. We are just wrapping up that work at the moment and we are hoping to publish it soon. It's already on bioRxiv (He et al., 2022 preprint). We have profiled human fetal development of the lung, combining single-cell RNA sequencing and ATAC sequencing with spatial analysis. It's pretty cool – we found some new cell types, and we have some interesting potential developmental trajectories and precursors that we didn't know about. There is an awful lot of functional work to do on the basis of this research. But I think my involvement in the Human Cell Atlas project is probably at an end, as I'm not really an RNA-seq person; my interests lie more in answering functional questions.

The Human Developmental Biology Initiative is very different; it's a much smaller Wellcome Trust-funded consortium. It includes ten different institutions across the UK and in Paris. The aim of the project is to ask functional questions about human developmental biology, and to develop new tools for lineage tracing human development in a more meaningful way than putting cells in a dish and seeing what they do. It is a challenge, but a fun challenge!

Although I love working on human developmental biology, I'm still passionate about mouse development and work in other model organisms such as *Drosophila* and *Caenorhabditis elegans*. Ideally, I would have grants to work on all these models, but I don't think anyone would give them to me, and they would tell me to be more focused! At the moment, funders want more human work, and of course we need the human mechanism if we want to tackle human disease, but comparative work is also very informative. Addressing how we can continue using a broad range of model organisms for our research will be one of the big challenges for developmental biology. Choosing the right model is important. We need to ask how we can best model human disease in a mouse, and we must consider whether we need to use different species to answer our questions. I really hope that we continue to see fundamental work done in model organisms. It would be sad if we lost that diversity.

Addressing how we can continue using a broad range of model organisms for our research will be one of the big challenges for developmental biology

As the sixth winner of the Cheryll Tickle Medal, what do you think about the position of women in developmental biology, both today and in the future?

I've got big hopes for the future. Developmental biology has always had a lot of women involved, including in senior positions. It's exciting to look around and see women my age taking on leadership roles. I think that developmental biology has always been one of the least sexist fields in science and we will continue to forge ahead and lead the way.

What will be the big challenges for developmental biologists over the next decade?

I think it's going to be persuading people to fund our functional biology rather than just more and more description. We need to work out how to make sense of all this description, with efficient functional experiments, using the whole plethora of tools that are available to us. For example, if we find a new cell type in humans, why not study it in *Xenopus*, or anywhere else it is relevant. We have to consider the many options we have available to us, especially with the advent of CRISPR technologies, to make the most efficient choice to do the functional experiments.

Is there anything Development readers would be surprised to find out about you?

I once told Brigid Hogan to shut up during a public seminar! It was the talk of the department for months afterwards and was really embarrassing. I was answering a question and there was some confusion over what the person was trying to ask. Brigid was jumping in trying to answer, I was also trying to answer and eventually I just said, 'Shut up Brigid!' She thought it was funny; I went on a communication course! The course was great and I was happy to be able to use that embarrassing moment as a training opportunity!

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