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INTERVIEW

Transitions in development – an interview with Aman Husbands

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Aman Husbands is the Mitchell J. Blutt and Margo Krody Blutt Presidential Assistant Professor of Biology at the University of Pennsylvania, USA. He set up his research group in January 2018 at Ohio State University, before moving across to the University of Pennsylvania. His work focuses on CLASS III HOMEODOMAIN LEUCINE ZIPPER (HD-ZIPIII) transcription factors and how they function in different contexts during plant development and evolution. We chatted with Aman to find out more about his career path and the challenges of becoming an independent group leader.

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

I would say, like lots of people, it was probably through watching stuff on TV. I really enjoyed watching marine biology videos and was amazed by how beautiful everything looked. As part of my undergraduate studies at the University of Toronto, I studied chemistry, calculus, physics and biology, and I was bad at everything except biology! There was just something about plants that I intuitively understood as a system. I also had a great teacher – Nancy Dangler – who was a well-known botanist. So that's what got me thinking about plants and plant biology, and that this could be a path forward for me.

Is that what then inspired you to do a PhD?

Both my parents were in academia so the notion of going to grad school was not foreign to me; I knew that it was a viable career path. They're not biologists (they're geographers), but maybe that's what made me love biology even more. Nancy was originally from UC Davis and encouraged me to apply there and to UC Riverside. I got accepted into UC Riverside so that's where I went.

What did you study during your PhD?

I went there initially to do plant anatomy because I'd had a negative experience with molecular biology in Toronto and was kind of turned off by it. But then I had a fantastic experience with Patricia Springer who taught the plant developmental biology and molecular biology classes. She's just an incredible teacher and I really loved her classes and wanted to be in her lab. So, I switched over and, ultimately, that was one of the best decisions I made. There was obviously a very steep learning curve, and I found it a real challenge, but Patty's research was super exciting. She's also a great mentor; she's supportive but gives you the freedom to try things out. For my PhD, I looked at LOB DOMAIN (LBD) proteins, which were presumed to be transcription factors, but this hadn't actually been proven at the time. So, I set out to characterize them and showed that they are indeed transcription factors. I learned how to make and purify recombinant proteins, how to carry out *in vitro* binding studies, and how to do transcriptional activation assays. So, I went from having no molecular biology experience to doing some serious biochemistry and molecular biology! The LBD gene family is also very interesting. These genes encode a large family of transcription factors that bind DNA (via a 6-bp consensus GCGGCG motif; it's funny the things you remember!) and regulate a wide variety of processes during plant development.

You then moved across the country to Cold Spring Harbor Laboratory for your postdoctoral research. What spurred that decision?

I really enjoyed my time at UC Riverside – there's a lot going on there, from molecular biology to ecology to evolution – but it is a plant-focused institution. Cold Spring Harbor Laboratory (CSHL), on the other hand, is very molecular but much broader in terms of model organism types, and they ask questions that are very different from those I'd been exposed to during my PhD. I liked that idea and was keen to move to somewhere that had a solid molecular biology tradition but that was not plant specific. I had also heard great things about Marja Timmermans. I obviously knew about her work and that she was an excellent scientist, but I heard that she's a good mentor as well. I guess all of these things made CSHL seem like a good fit for me.

I ended up being there for quite a while – it was one long postdoc! I know some people say that's a bad thing and that you're better off doing two shorter postdocs, but I think it all adds up to the same

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thing. Ultimately, if you want to stay in academia, the goal is to get you to a point where you can be competitive for group leader/PI positions. Sometimes that happens quickly, sometimes it takes a long time. I also think some of this is out of your control: there's a bit of luck involved. It can be a very long commitment, but I really learned a lot during those postdoc years. By the end of it, I felt comfortable thinking about my science, and I was ready to be more independent. There was obviously a whole bunch of stuff (like hiring and managing people) that I was not trained for, but, overall, I felt ready to run a lab. I guess that was partly because I had an extended period of being quite a senior postdoc, which comes with responsibility. In fact, Marja ended up moving (she got a prestigious Alexander von Humboldt fellowship in Germany) and left CSHL before me. This meant there was a period where it was just me and two other postdocs running, and then packing up, the lab. It also gave me time to figure out what I wanted to do and go on the job market. Luckily, I got to interact with Ullas Pedmale, who was a new Assistant Professor at CSHL and moved into the lab space. He's an awesome guy who helped me think about the process, put my chalk talk together, and figure out what questions I wanted to ask. Having this overlap with a new Assistant Professor was really instructive.

What were you then looking for when you went on the job market?

I knew I wanted to be in a research institute; I enjoy teaching, but doing research is the thing that motivates me. I ended up interviewing at three places – Penn State University, Ohio State University and UC Berkeley – and got offers from UC Berkeley and Ohio State. At that point, I really had to think about both my personal and professional priorities, and Ohio State seemed to be the best place for me and indeed turned out to be a fantastic place. The Molecular Genetics department there reminded me of CSHL in the sense that there were people working on a broad array of model organisms and doing good science. It was also a very supportive environment – one that protects you from teaching when you're starting out and gives you time to get on your feet. It's a huge institution though. It's possible to make good connections but it's a bit tricky to find people – you really have to actively seek them out! But, overall, I had a great time there.

You recently moved your lab from Ohio State University to The University of Pennsylvania – can you tell us more about this transition?

I started at Ohio State in January 2018, but at the very end of 2020 I was in touch with Penn and the idea of a move was discussed briefly. Then, in April 2021, I got an email from my colleague, Doris Wagner, who said the position had been given the green light. Personally, I was excited to move to back to the East Coast, as I have family here, and I was also looking forward to being in a bigger and more diverse city. Professionally, the move was a no brainer. The resources and people at Penn are just amazing. The department is really strong in general and there's also a tight core group of plant people who are well respected. In fact, there are people who I've known and respected since my PhD days who are now my colleagues – how awesome is that? I'm also part of the Epigenetics Institute, which is easily one of the best in the world with some incredible people and resources. Penn is just such a stimulating place.

Of course, a move like this comes with lots of challenges. I think some of them are self-imposed though. For example, I still experience imposter syndrome and wonder, 'What am *I* doing here?' I also feel the pressure to perform and achieve is higher, but again I think that's pressure that I'm putting on myself; I wouldn't say anybody here is putting it on me. But it's these sorts of challenges and pressure that, personally, keep me motivated.

How did you find the transition from being a postdoc to running your own lab?

It was definitely tough, as we're rarely trained on how to run and lead a lab. I quickly realized that leadership is incredibly difficult but really important. You basically control the vision, goals and timeline of the lab – you need to keep an eye on all of these things. But you also need individualized mentoring and communication styles for each of your lab members, which is challenging. There's no substitute – you just have to make time for this – and you can find yourself getting a bit stretched.

I think hiring is a perfect example of something that you have to do but aren't trained for. How do you bring in somebody that will make a positive contribution to the lab and not disrupt the lab ecosystem? I think it starts by having a clear definition of what your lab's guiding ethos is. Then you can bring in people who, you hope, can ask interesting questions scientifically, but also have the attitude and behaviour that fits your lab. I would say that, for the most part, I have been lucky – the people in my group are amazing.

One piece of advice that I would give to people is to recognize that conflict is a bit inevitable and that you – as the group leader – may need to set rules and limits and have tough conversations if they're not being respected. You don't have to be mean; you just need a clear idea about what's important for you and the lab environment, and then be able to communicate this to your team. Clarity and fairness are super important.

And what's been the best moment?

I guess one of the best moments was when I got my first grant – I just couldn't believe it. Getting our first paper out (during a pandemic!) was also really cool. But I would say that the very best moments are when you walk in the lab and can sense that there's a real community there – a community that I helped create and that would not have happened if I had not followed this path. That's wild, right?

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Let's talk about the science: what's your lab working on at the moment and what's the long-term aim?

Well, clearly plant development has always been my love. I can break the lab down into two topics: complexity and robustness. So, how do you build complex shapes? And why doesn't that go wrong all the time? For the complexity side, we focus on CLASS III HOMEODOMAIN LEUCINE ZIPPER (HD-ZIPIII) proteins. These are transcription factors that are deeply conserved and have been redeployed to regulate many crucial developmental processes, like stem cell maintenance, vasculature formation, flat leaf production and floral development. They're clearly very important and operate in a number of different contexts. So, how does that happen? How does the same transcription factor behave differently in different cell types, and how did that change across evolutionary time? One unique feature about these HD-ZIPIII proteins is that they contain a StAR-related transfer (START) domain, which is a lipid-binding domain that has been studied in a number of other organisms. During my postdoc, I looked at how the START domain

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affects the activity of HD-ZIPIII proteins and I started to realize that this domain is very interesting. It can affect dimerization, binding partner interactions, cellular localization and structural stabilization. It can also be found in a number of different types of proteins, such as kinases and transcription factors. It also seems that its effects can vary – they can be binary, like an off/on switch, or they can be tunable. In other words, we have this cool little flexible regulatory module integrated into a deeply conserved and super important family of transcription factors. So, we're looking more at how it functions and how it could have contributed to the continual redeployment of HD-ZIPIII proteins throughout development.

The other big question we're looking at relates to the robustness or reproducibility of development, using flat leaf production as our model to study it. Many leaves come off the meristem as little round bumps, and then grow primarily in two dimensions to become long and flat. Developmentally, this is quite a difficult process. If it goes wrong, you can get leaf curling or blade reduction, which can have major effects on photosynthesis and therefore fitness. So, it's really important for plants to get this process of flat leaf production right. And if you look in nature, you can see that they've basically figured it out. For example, trees have thousands of thin flat leaves that all look pretty much the same, despite this being a difficult structure to create. Work from Kathy Barton's lab showed that HD-ZIPIII proteins are also involved in polarity – they can help to drive the polarized growth of organs – so we're also looking at these proteins from this perspective of flat leaf production. Finally, we're using natural variation and mathematical modelling approaches to examine robustness, and differences in robustness, in the many *Arabidopsis* accessions.

What are your views on mentorship; did having a mentor help you during the transition to being a group leader, and what is your approach to mentoring?

I think good mentorship is hugely important; both Patty and Marja were great mentors to me. But a good mentor doesn't have to be someone in your field. While I was in Ohio, I joined a grant writing group in the Cancer Center. It was made up of colleagues who worked on cancer plus me – a plant biologist. But, through this group, I learned how to write a grant that cancer people could understand and see value in. One person who was particularly helpful was a guy called Richard Fishel. He had been awarded multiple grants and really knew how to write a good grant proposal. The fact that he was willing to put the time in to read my grants and really critique them was amazing, and I'm sure that I got that grant thanks to his help.

I also think a lot of mentorship comes through your day-to-day activities and commitments. You never know who's watching so it's important to be a good role model. It could be as simple as taking care of your own mental health, working hard and being a kind person – maybe people can then see themselves in you. In other words, being a good mentor can come just from setting a good example.

More formal mentorship is also helpful. For example, here at Penn and also at Ohio State, you get paired up with senior PIs who you can go to for advice. Based on their experiences, they can then advise you on, for example, which academic committees you should be part of, or whether being a guest editor on a journal is a good idea.

Being a good mentor can come just from setting a good example

What advice would you give to people who are applying for independent positions or starting up their own lab?

The first piece of advice I would give is to ask yourself the question, 'Do I really want to be a PI?' If the answer is 'no' then that's absolutely fine – there are so many others thing you can do and, in fact, academia is becoming the 'alternative' career. But I think you need to ask yourself that question very early on. I waited until I was midway through my postdoc and, luckily for me, the answer was yes, but what if it wasn't...?

The second thing is to think about your 'big question'. I found this incredibly difficult and had to think about it for about a year, driving back and forth from Brooklyn to CSHL. What am I really interested in, what do I really want to know, and how am I going to study this? It's a very hard question, especially if you're used to being at the bench. You need to take ten steps back to make sure you've taken a broad enough look, and then you have to think of some way of framing it. It almost needs to be something so big that three different groups could write three grants on three different aspects of it. It also has to incorporate what you've done before – like an umbrella that captures what you've already done and what you have documented experience in, but also one that encompasses a whole lot more. It's hard.

I see you're on Twitter. What are your thoughts on social media for scientists?

I am on Twitter but I'm using it far less these days. I think, like all social media platforms, it's inherently addictive so you have to be careful with how you use it, as you can easily fall down a rabbit hole and get sucked in! Professionally, I love Twitter for finding out about papers, especially work that's on bioRxiv. I think it can also help you to connect with people and feel part of a community.

On the topic of bioRxiv, what are your thoughts on preprints – do you post your work as preprints and/or read preprints yourself?

I've posted a couple of preprints and I do like the idea of preprinting. I think it's a great way to democratize research, to get your name out there, and to help with job applications. But what I really like about preprinting is that it gives you a chance to actually evaluate the data for yourself. I always see people who say, 'But, it hasn't been peer reviewed', and I just think 'Well, then judge it for yourself!' I totally understand that this isn't always possible, for example if you're outside the field or not fully qualified to review it. But I do think it's better than just listing 'submitted' or 'under review' on a CV.

Did you ever consider a non-academic career path?

Not really. There were obviously times during my postdoc when I thought, 'Wow, this really doesn't seem to be working out', but then the data finally started to come. There were also lots of times when I questioned myself: do you really want this? But the answer was always 'yes'. I just could not think of anything else – any other job – that would have made me feel as happy or that would have been as rewarding (even in the face of all the setbacks we tolerate).

Finally, is there anything our readers would be surprised to learn about you?

Well, some people may not be surprised, but I was a DJ for a long time. I stopped when I became an Assistant Professor because, as it turns out, it's very hard to be an Assistant Professor and a DJ! It was my creative side. I can't sing or dance … but I can definitely mix!