

CONVERSATION

Early career researchers: an interview with Caroline Williams

Caroline Williams is an Assistant Professor at the University of California, Berkeley, USA, where she studies evolution of metabolic physiology in ectotherms. She grew up in New Zealand, where she received Bachelor's and Master's degrees in Zoology from the University of Otago in Dunedin. After travelling and working in Asia, she moved to Western University, Canada, for her PhD in the laboratory of Brent Sinclair, before joining Dan Hahn at the University of Florida as a postdoctoral research fellow. In 2010 she received the Scholander Award from the American Physiological Society.

Can you tell me a little about your research career to date?

I started out in a Master's programme in New Zealand working on mechanisms of host manipulation by a parasite. The host was an amphipod and the parasite was a mermithid nematode. I studied the physiology behind how the parasite manipulates the host's behaviour and I loved doing that. Then I switched gears during my PhD with Brent Sinclair at Western University, Canada, to study overwintering energetics of Lepidoptera (butterflies and moths), thinking about what happens to them when the winter gets warmer, which increases their energy use. I found that different species were able to compensate for warmer winters in different ways: some of them were vulnerable to the increased energy drain associated with warmer winters, but some of them had these amazing coping mechanisms where they could modify their metabolism. I continue to have an interest in winter temperatures to this day.

During my postdoc with Dan Hahn at the University of Florida, I used *Drosophila melanogaster* to study cold adaptation. Using lines from an artificial selection experiment performed by Ted Morgan, I found that the flies that were more cold-hardy had higher metabolic rates and higher rates of substrate oxidation, causing them to burn through fuel faster. That made me start to think about the energetic costs of stress hardiness. Since I have started my faculty position at the University of California, Berkeley, USA, we have moved into a different system studying montane willow leaf beetles, in collaboration with Elizabeth Dahlhoff and Nathan Rank. We are using them to ask what are the life history trade-offs involved in overwintering? For example, are there certain genotypes that are cold-hardy that do better under very cold conditions, and genotypes that are more energetically thrifty that do better in years that aren't so cold? This is particularly interesting in the context of snow cover, because snow really alters the thermal environment for beetles that spend 8 out of 12 months of their life cycle under the snow. If there is lots of snow it is warm, which will increase their energy use, but if it is dry it is very cold, which will increase their cold stress. We are teasing apart this trade-off.

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What did you do before you came into research?

Between my Master's and my PhD, I took four and a half years off and taught English in Japan for a year. Then I moved to Malaysia and worked on a variety of projects. First I worked on a science literacy magazine, writing stories. We'd write stories about why chilli peppers are hot and why people and animals go a bit crazy during the full moon, that kind of thing, to increase literacy in the general public. I also wrote scripts and edited footage of animals and people from Borneo to make natural history documentaries. I then taught English at an International School there for the last year.

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For me it was essential that I took time out after my Master's, because I wasn't 100% sure that I wanted to do a PhD. I felt like I had been on these railway tracks from primary school to high school to undergraduate to Master's and that I had never taken the time to see what it was like to work a 9–5 job for more than a couple of months at a time. I knew from doing my Master's that it was going to be a really all-encompassing experience to leap into academia, so I wanted to be sure that I had to do it. And I think that was a really good decision. If you are not absolutely positive that you want to do a PhD, then I would suggest taking some time out and figuring out whether you can live without research.

What did you learn from the experience of contributing to natural history documentaries?

I think the most important thing that I learned was how to take a pretty complex story and boil it down to a simple, clear, appealing narrative. That is something that has been really useful in my science, to craft the simple narratives that people can grab onto and connect with. I try to think of things from the listener's point of view and to make them accessible for people outside of my field, because I often try to incorporate things from different disciplines into my own work. A lot of those skills also help me to speak to scientific readers from other fields.

You recently set up your first laboratory; what did you look for in a student or a postdoc when you were recruiting?

The most important thing for me was an individual's personality; I wanted to have a really collaborative group. That was the kind of group that I came out of in Brent Sinclair's lab. We all collaborated on projects and that has been really integral to my success in maintaining a high publication rate. I was also looking for people who were critical thinkers, really good at identifying interesting questions to spend their time on. The particular system that they were working on was less important to me because of the range of different things that we do.

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Looking around your lab, what would you say is the most important tool?

Our Sable Systems respirometry system; we use that all the time for any insect we have around the lab. The respirometer gives us our first pass at obtaining an organismal energy budget. We have two systems, a Licor and an Oxzilla II, and we also have a FOXBOX, which is a field portable system, so we have the capacity for two people to be taking measurements at the same time.

As a single parent family, how do you manage the competing priorities of your home life with running a research lab and teaching?

Something that is really key is being clear about my goals, not only professionally, but personally, and to incorporate those personal goals into my plans each semester. I try to work from home a couple of days a week to preserve my research productivity, because when I'm in the lab my door is open most of the time so that I am available to my lab members and undergraduates that I teach and advise. I preserve two days a week for my research because my appointment is 80% research, so I really need to protect that. I then try to squeeze the service, teaching, and mentoring into the other three days. Every day between 5pm and 8:30pm (when my daughter goes to bed) and at the weekend I am not available, except under very extreme circumstances, as I try to preserve those hours to spend with her. I really prioritise my personal life alongside the research.

Being organised also reduces the stress for me. I feel really stressed when I feel that I am not on track with my plans. One of my main stress-reduction activities is to go for a hike twice a week: I make that an absolute priority. Often my mind is churning furiously on the way up, but when I get to the top and look out I feel peace come over me and then on the way down my mind is a little bit quieter. As long as I keep up with that, take care of myself and get a good night's sleep, then usually I don't feel chronically stressed,

although there are periods where I have deadlines that can still be stressful. I try to treat it as a marathon, not a sprint.

How important is a support infrastructure for you?

It is absolutely key to all aspects of my success. My social network helps me to deal with stress and it gives me people to talk to. The professional networks have been absolutely critical in all of my career transitions. I got my postdoc with Dan Hahn through meeting him at a conference. When I applied for the job, Dan already knew me and my research; that gave me a huge advantage. I am sure that I got my job in Berkeley because I went to SICB when I was about to go for my interview and I talked to two faculty members in the department. They gave me the inside scoop on the department, which was absolutely critical; knowing what they needed and knowing how to present myself as the person who could fill that gap was key to my success in that interview.

What do you think was essential for your successful application?

There was definitely a large element of luck in getting my CV to the shortlist of really highly qualified and mostly more senior applicants (I had only been a postdoc for one year by the time of my interview). Having been on job search committees, I now see how much luck there is – just five people read your application.

One of the major contributors to getting my CV to the top of the pile was a strong publication record, which came from lots of collaborations. I had a strong record of first author papers, but then I also had lots of middle author papers, some awards and honours, and a well-balanced service and teaching portfolio. I would say that once you get the interview, the job is yours to lose. When they contacted me to schedule the interview I replied straight away that I wanted the last interview slot.

Then I spent months studying the department; I treated the preparation as a part-time job. I read papers by all of the faculty and made a list of questions to ask them. I also practiced the job talk on anybody that would listen. In addition, I leveraged my professional network to get more information about what the department might want. When the interview came around, I went in with a list of talking points that I wanted to say to everyone I met, which described specifically why this was my top choice department in the world, why I was the perfect solution to the problem that they had and I detailed specifically how I would build bridges within the department and beyond.

If you can't articulate why you want to go to that department and you don't know who your colleagues would be, that does not reflect well.

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Did anyone give you any advice that helped you to design this strategy?

I have been extremely fortunate to be given really top-quality mentoring through my whole career. My PhD advisor, Brent Sinclair, is a fantastic mentor. He is unfailingly supportive and encouraging, and gave us lots of advice and ran career development workshops in lab meetings. My postdoc mentor, Dan Hahn, is also extremely supportive and encouraging of work-life balance. From both of them, I learnt a lot about not only designing experiments and testing hypotheses, but also the social and political aspects of science. In general, I am a person who will talk to, and take advice

from, everyone. I ask everyone that I meet for advice and incorporate little bits from everyone into my strategy.

How important do you think awards are for scientists at an early stage in their career?

I won the 2010 Scholander award from the American Physiological Society, which is given to an outstanding young investigator in the area of Comparative Physiology at the intersociety meeting. That was a huge thrill and absolutely unexpected. That probably helped to establish my trajectory for the UC Berkeley search committee and it was a hugely valuable nod of support from the community.

What advice would you give to someone who is starting out on their PhD or their faculty position search?

Making a plan every semester worked for me; sit down at the beginning of each semester to map out your goals. I would suggest that early career scientists should think about their personal goals as well as their professional research-related goals, and then just revisit that plan each week to see where you are. Maybe have a weekly session, where you map things onto your calendar. Schedule time for writing; try to write every day, even if it is only 30 minutes. Writing is such a key to success and it is a really hard skill to develop. Even if you aren't working on a manuscript or a thesis chapter, you can incorporate writing into most activities; if you are analysing some data you can annotate your code so that the information is there when you come to write your results section; or you could keep an annotated bibliography if you are reading the literature; or you could make a file with ideas for future research. I have also read books that have helped me to improve my writing skills. One that I recommend to all of my students is Joseph Williams' book, 'Style: lessons in clarity and grace'. It is wonderful and I think that writing and planning are really key to doing successful science.

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What roles do you think publishers and publishing play in science?

We just received sponsorship from The Company of Biologists for a symposium that we put on at SICB this year (2017) to bring together people who were studying the evolutionary impact of seasonality. For American researchers, funds from charities such as The Company of Biologists are often the only way we can fund international airfares, because the NSF won't permit international airfares to go on the budget. That funding makes a big contribution to breaking down the boundaries in research dissemination by bringing people from different research communities together.

I suppose the positive side of the publishing hierarchy is that it encourages people to elevate their studies, to put in more experiments or more sophisticated analyses, to elevate their research to the next journal tier. But the negative side is that it really puts a lot of pressure on researchers to score one of these big-name journal hits, which can be extremely difficult depending on the field. Getting a paper in Nature or Science can be one of the benchmarks for tenure at an institution and you can spend a lot of time chasing that big fish, but maybe it's not going to pay off. And all of those studies could have been published as five different studies in journals that give a bit more space, which might have been better for the trainees that are involved. So I think there are positives and negatives to the emphasis on journal impact.

Caroline Williams was interviewed by Kathryn Knight, News & Views Editor. The interview has been edited and condensed with the interviewee's approval.