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INTERVIEW

An interview with Celina Juliano

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Celina Juliano is an Assistant Professor at UC Davis, where she uses *Hydra* as a model system to understand development and regeneration. She is co-founder of the Cnidarian Model Systems Meeting (Cnidofest) biennial conference and the OpenHydra *Hydra* resource platform. This year, she was awarded the Elizabeth D. Hay New Investigator award for outstanding developmental biology research during the early stages of her independent career by the Society for Developmental Biology (SDB). Following the virtual SDB 2020 meeting, we met with Celina over Zoom to hear more about her life and career.

Let's start at the beginning – when did you first become interested in science?

It's kind of cliché, but I was interested in science since I was pretty young. I have a memory of collecting spiders from the garage and bringing them for show and tell when I was in second grade. I even have a scar on my hand from trying to catch lizards with a glass jar and falling down on it. When I was in fifth grade, I wrote a report on the ocean and for the rest of my childhood I wanted to be a marine biologist (in some ways, I feel like succeeded). I was just one of these typical kids who loves animals!

Did you go on to study Marine Biology as an undergraduate?

I majored in Marine Biology at the University of Miami, but after graduation I didn't really know what to do with my degree. I took some time off school and I went to the University of California San Diego (UCSD), where I was a technician in a protein chemistry lab that focused on crystallising proteins. At the University of Miami, I was more ecology focused, so at UCSD I was exposed to a totally different field of science. Working in an academic lab was an eye opener for me because, even though the science wasn't really what I wanted to do, I appreciated learning what it means to be a graduate student or a postdoc. I was never really taught these things as an undergrad and I had to figure it out for myself. I took some time to explore different fields of biology and see what I liked. I took some classes at UCSD: molecular biology, developmental biology. I took a class called marine biochemistry, which was basically faculty from the Scripps Institute of Oceanography talking about their research. There was a lecture from Vic Vacquier on fertilisation using sea urchins and I really loved it. It strongly influenced me to do my graduate work on the development of sea urchins. It's how I ended up going to Brown University for my graduate work, where I worked in the lab of Gary Wessel.

Can you tell us about your PhD research while you were at Brown University?

I set out to study sea urchin fertilisation (that's what Gary was known for), but just when I joined the lab, he had just finished a sabbatical in Eric Davidson's lab at Caltech (California Institute of Technology) and there he had initiated a new project. Instead of studying fertilisation, he was interested in where the germline originates in the early embryo. That's a great developmental biology question, so that was when I started becoming a developmental biologist. I got in on the ground floor of that project. I think that this was fantastic training, as a graduate student, to work on a project from the beginning. It was learning how you start a project from scratch that probably gave me the courage to do that again as a postdoc.

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You went on to do your postdoc at Yale University. Why did you decide to go to Yale and what were you researching at that time?

Before I finished my PhD work, I started thinking about what organism I wanted to use for my post-doctoral research; I was interested in using an organism that was a little bit off beat. I liked working with sea urchins because it is a small community; you weren't going to be trampled by tons of other people doing the exact

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same thing. I was also beginning to appreciate the need for more diverse organisms in biology. I wasn't brave enough to start working on an entirely new organism from scratch, but I wanted an animal that was good for stem cell research and was established, but did not have a lot of people working on it. Rob Steele from UC Irvine – who I still work with and talk to almost every day – came to Brown to give a seminar, the theme of which was basically, '*Hydra*'s amazing, why doesn't everybody work on it?', and I was like, 'you're right!'. I got in touch with him and he was so supportive right away; he sent me animals and taught me how to work with them in the lab, and I started exploring *Hydra* at Brown while I was finishing my PhD.

I became interested in a particular germline-associated pathway, the PIWI pathway, which was just being worked out at the time. It appeared to have a broader stem cell function that I wanted to understand. *Hydra* has this pathway in their stem cells, so I wanted to try to understand what that was all about. My postdoc advisor Haifan Lin, who actually initially discovered PIWI, is at Yale University. He works on *Drosophila* and mouse, but he was open to me coming into his lab with *Hydra* to work on PIWI, as long as I could get funding for it. I wrote and received an NIH F32 before I started at Yale, so I hit the ground running with that money to study *Hydra*.

In 2015, you set up your independent lab at UC Davis. What was that transition like for you?

It's one of these things that, until you do it, it's really hard to explain to other people! It's so exciting, but it's also so overwhelming. On my first day, when I got to my office, the colleague with the office next to me introduced himself and he said something like, 'I am so glad that I'm not you right now'. I remember this sense of fear went through me. Now, in retrospect, I can understand why he said that. It's unbelievably overwhelming, in terms of the number of different things that you suddenly have to do that you were not trained for. You're used to largely controlling your own schedule when you work in the lab. But now, every day is an adventure, where my calendar is not controlled by me! You can't focus on things for long periods of time; you're continually being asked to do one task and then quickly transition to another task that is totally different. It's learning to juggle all that – kind of intense! But, just like everything, you get faster and better, and more comfortable with it. Still, for an introvert, it's very exhausting, constantly having to be 'on'.

Do you consider mentorship an important part as your role as a group leader?

I think it's the most important part of my job. It is something that I was looking forward to doing even before I started. I had a very good graduate mentor and I always knew that this was a way that I could contribute something positive to science. Of course, we want to do great science; we want to make big discoveries. But even if I don't make the big great discoveries, if I can make a positive impact through mentoring, then I have done something good in the world.

What was it about UC Davis that appealed to you?

I liked it as soon as I got here, because it's a small close-knit community and the MCB (Molecular and Cell Biology) department is full of supportive people. I am a single mom and I have a son who is 17 now, but he was 12 when we moved here. Being in a place where he can walk across the street and go to school was a huge component for me. When I was trying to start a lab, it just made things easier. My day-to-day life is quiet and simple in Davis, so that allowed me to have more focus on the complicated task of getting a lab going.

My advice is to not take any one person's advice too seriously. Certainly listen to what everybody has to say, but then in the end, listen to your own gut

Do you have any other advice for people that are about to start their own group?

My advice is to not take any one person's advice too seriously. Certainly listen to what everybody has to say, but then in the end, listen to your own gut. Everybody has a completely different path in terms of starting a lab and setting it up in a way that works for them. A lot of people, in a very unscientific but well-meaning way, will insist that whatever works for them is what everybody else should do! Remember that you've got to this position of running a lab because you've been making the good decisions for a while – some luck, of course – but you're also making the good decisions. In the end, you have do what you think is best.

Now that you've established your lab, what are the main themes of your research?

We immediately went off in directions that I didn't expect, which has been maybe the most exciting thing about starting a lab and having fresh ideas from the group. We've really broadened our view of what we can accomplish. *Hydra* is a pretty simple organism, maybe 25-30 cell types (depending on how you want to define cell type), and it's in a continuous state of development; all cell types are continually being made. It seems reasonable to me that, we (as a community) should eventually be able to understand how all those cells are made. What makes *Hydra* particularly unique is that it can regenerate its whole body, even from a small piece of tissue. So, for example, when you cut the thing in half, we want to understand how it 'knows' to rebuild structures in an unexpected place. In particular, we're interested in how the injury response triggers the developmental pathways needed to rebuild structures. Basically, we want to solve all of development and regeneration in *Hydra*!

You've become quite an advocate for *Hydra* as a model species and are co-founder of the Cnidarian Model Systems Meeting (Cnidofest). What's the story behind these meetings?

The Genesis story of Cnidofest is that, initially, we started as 10-15 *Hydra* scientists, gathering at UC Irvine when I was a postdoc (organized by Rob Steele). There is a *Hydra* (plus many other non-bilaterian organisms) meeting that happens in Germany. It's a great meeting, but it happens only every 2 years, and it's in Europe, so sometimes it's difficult for everyone to get over there; it can be very expensive for people to take all of their trainees. At the small gathering in Irvine, we started talking about organising a *Hydra* meeting to take place in the USA during the 'off' years of the meeting in Germany. At first, I was very reluctant to organise this, because I was a brand-new Assistant Professor; everyone tells you don't do stuff like that when you're just starting your lab. In the end, I just decided it was important and jumped into it – it was a really fantastic experience! Initially, we decided to go a little bit broader: not just *Hydra*, but all the hydroids. We got NSF (National Science Foundation) funding to support that meeting. We did the first 'Hydroidfest' in 2016 at Bodega Bay Marine Lab and we had about 55 attendees. Besides Cnidofest, which we did 2 years later, it was really the best meeting that I've ever attended – it was just such great fun! I knew every single person by name and talked to every single

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person. The plan was then to organise another Hydroidfest for 2018, but in 2017, when we went to the meeting in Germany, we were talking to the other Cnidarian scientists and learned that they would love to join us to form a broader Cnidarian meeting. My co-organiser, Christine Schnitzler, is an Assistant Professor at the University of Florida; she works at the Whitney Laboratory for Biological Scientists in St Augustine, so we held Cnidofest 2018 there. We were double the people (120 people), and it was completely amazing again. We were so pleased with ourselves for pulling that off! Our philosophy is to be trainee focused, so we have a lot of trainees giving talks and every poster presenter has a lightning talk. We have NSF funding that we use to pay for student registrations and to make it as student friendly and training focused as possible. Unfortunately, Cnidofest 2020 had to be cancelled, but we will resume in September 2022 with our next instalment taking place on the UC Davis campus (https://www.cnidarianmodelmeeting.org/).

When you speak about growing a community, is that one of the aims of OpenHydra? What is the story behind that initiative?

Together with Jacob Robinson (Rice University), we were awarded an EDGE (Enabling Discovery through Genomic Tools) grant, which funds the creation of new genetic tools for non-model organisms. It's hard to create new tools, because your trainees need to make discoveries to push their science forward, so having money specifically to support that is a great thing. This grant tasks us with expanding the community and making the new resources widely available. So one of the things we did is start OpenHydra (http://openhydra.org/). It's still a work in progress, but it's meant to be a resource hub, like FlyBase or WormBase. Our hope is to have everything in one place, so that if you decided to start working on *Hydra*, you could go there and find everything you need to do it. We also have started a workshop at MBL (Marine Biological Laboratory, Woods Hole) to teach people the fundamentals of working with *Hydra*. That's also funded by the EDGE grant, but our hope is to keep it going long after the EDGE funding expires.

You mentioned earlier that the smaller communities appeal to you. Is that still the case?

It's interesting because you have to balance wanting to make it a bigger field, with keeping the intimacy of the community, which I think is particularly good for our trainees because they get to talk to the most prominent researchers. As an example, Charlie David did some of the early fundamental work understanding the lineages in *Hydra*, and I got to meet him very early on when I started working in *Hydra*. He was immediately an advocate for me and personally taught me things. Right before our HydroidFest, he came and hung out in our lab for a few days and he personally taught one of my graduate students how to do grafting – it just made me so happy! On the other hand, we need to bring in new people so the community can grow and thrive. It's a balance between wanting not to get too large, but also wanting to have a thriving community; they can sometimes feel at odds with each other. There's no way to solve that, except at some point you maybe have to break into smaller groups in order to get it more intimate again.

What are you excited about when you think about the future of the field?

In terms of our organism, I think we can do so much because the technology just keeps getting more and more impressive generally. When I started my lab, single-cell sequencing was just coming online and it really opened my eyes to the possibilities. When we started doing our first single-cell runs in *Hydra* and we were capturing all of this differentiation and transition states in our single-cell data, it blew my mind. It was a rare moment of clarity where you're certain what you should be doing. I think *Hydra* are really amenable to all of these new sequencing technologies, so we will keep adopting them as they are developed.

Thinking more broadly about developmental biology, the SDB meeting this year was so exciting to me, because there were so many different organisms being talked about. I think that's made possible by all of the new technology – we don't have to be stuck with just a few animals. Nature has provided so many interesting ways to solve problems and now we are in a position to start exploring this.

On the subject of the SDB, this year the society awarded you the Elizabeth D. Hay New Investigator Award. What does this award represent to you?

I'm still overwhelmed by that. I think it represents years of people: great mentors and great colleagues, and friends in science that have been supporting me. Of course, it also represents my own hard work, but there's so much other stuff and so many other people that go into that. Most importantly, the people in my lab – they're just amazing. None of our success would have happened without the students and other members of my lab who were are so passionate about science and so much fun to work with.

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How has the COVID-19 pandemic affected your group and your research?

First of all, compared to a lot of people, I'm in an incredibly lucky position, so I feel bad complaining. I have a job and I can do it from home; we're safe here, I've had lots of extra time with my son. But, it's difficult because – for my students to succeed – they have to be in the lab working and I'm afraid of it stalling their careers. We are working at 20% lab capacity right now. With careful planning, we are still able to get stuff done. Luckily, we do have things we can do from home; we have computational work, and people are taking the time to learn new computational techniques, analyse pre-existing data, and write fellowships and papers. But it hurts morale and it's difficult that all our meetings have to be on Zoom – it's very soul sucking. I'm proud of my group finding ways they can get things done and support each other during this time.

Finally, what would Development readers be surprised to find out about you?

I think a good thing to highlight is the fact that I'm a single mom, because I feel it's fairly unique among scientists, or at least it's not talked about much. It has some challenges, and I have only a small number of friends in science who went through divorce and are dealing with that kind of thing. I also had my son before I went to graduate school, so I've had an alternative path, family wise, but I've still been able to succeed.