

CELL SCIENTISTS TO WATCH

Cell scientist to watch – Alba Diz-Muñoz

Alba Diz-Muñoz studied human biology at the Universitat Pompeu Fabra in Barcelona, Spain and joined the Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany, for her PhD on cell migration in zebrafish embryos, co-supervised by Ewa Paluch and Carl-Philipp Heisenberg. In 2012, Alba moved to California, USA, for her postdoctoral work with Dan Fletcher (UC Berkeley) and Orion Weiner (UCSF) on membrane tension and cellular signalling in neutrophil migration. In 2016, she started her independent research group at the EMBL in Heidelberg, Germany, working on the crosstalk between mechanical properties and cellular signalling for cell and tissue morphogenesis and fate decisions.

What inspired you to become a scientist?

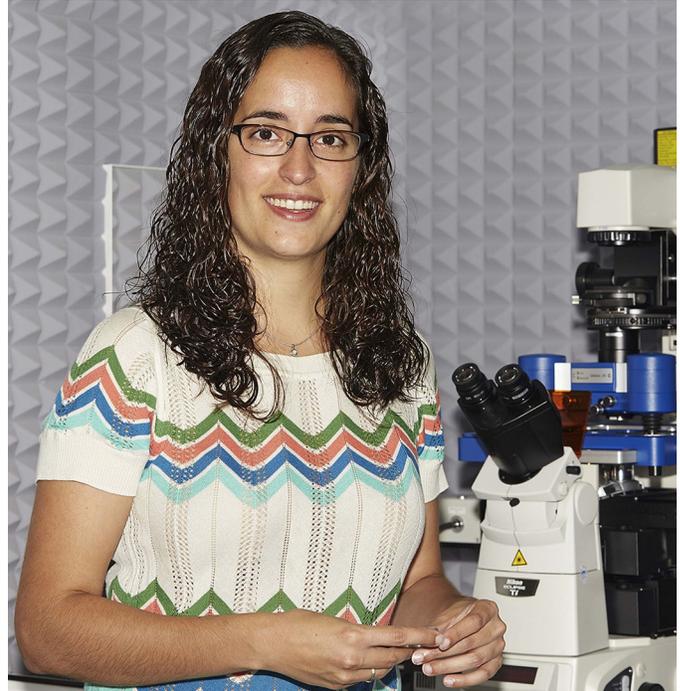
My mum is the reason I went into science; she was a teacher of natural sciences and chemistry. When my sister and I were children, we would run experiments with a basic chemistry kit or collect animals or leaves. Another big influence was my amazing high school biology teacher, Montserrat Omar. She was instrumental in my choice of studying biology.

You had two supervisors for both your PhD and postdoctoral projects – how was that experience for you?

I did my Master's thesis with Carl-Philipp (Heisenberg; now at IST Austria) working with zebrafish and loved it. Ewa (Paluch; now at University of Cambridge, UK) was a new group leader with a lot of energy and I also liked her lab a lot, so when I applied for a PhD position in Dresden, I wished I could work between the two of them. It turned out that they were writing a grant together! It was great because they're friends so the communication between my mentors was very good – they even discussed the project when I was not present. They came from very different perspectives and, as a consequence, the input for experiments was awesome food for thought and it made me think about the questions in a very different light. I decided to take the same co-supervision approach for my postdoc. I first interviewed and decided that I wanted to work with Orion Weiner (UCSF). That summer, I participated in the physiology course at Woods Hole, where I met Dan Fletcher (Berkeley) and his team. There, we worked out a collaborative project between him and Orion. It was an entirely different experience, because this time, all communication went through me. The most draining aspect of this was actually the commute between Berkeley and UCSF, which I had underestimated. There were days where I would spend half a day in one lab and half a day in the other and I hated the commute by the end of it. But it was an awesome experience. You get two very different groups of people to look at your data and to give you feedback and you also get two recommendation letters for your job applications from amazing scientists! [laughs]

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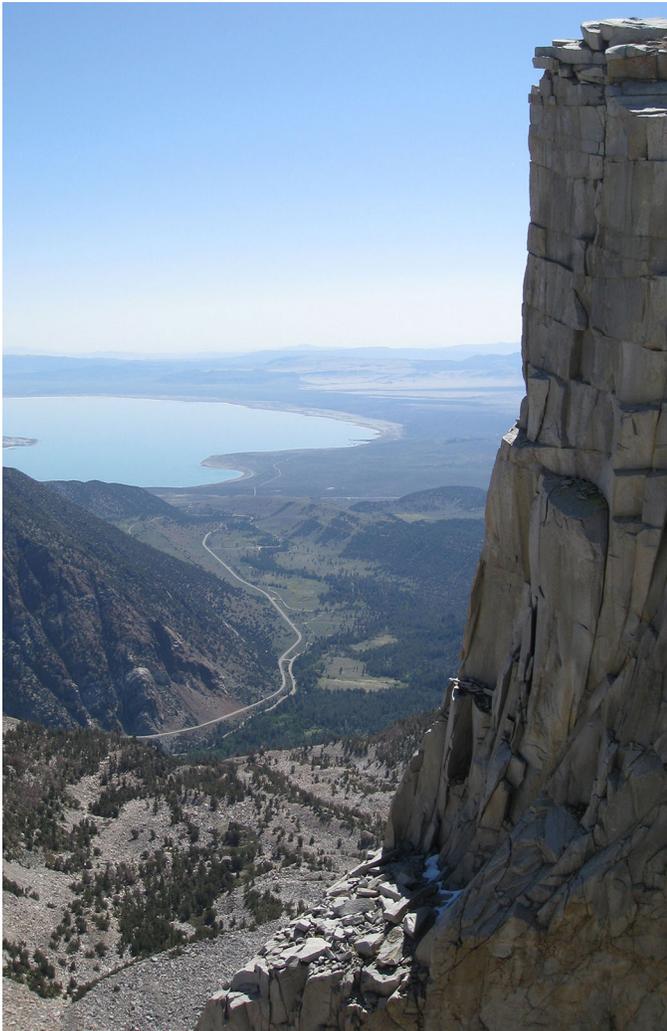
Alba Diz-Muñoz in front of one of the Atomic Force Microscopes in the laboratory.

Commuting woes aside, you felt that the different perspectives of your mentors let you think outside the box?

Absolutely. It allows you to think bigger and dare to dream of doing experiments that are maybe considered impossible in your model system. And different research groups challenge your work differently when you seek feedback from them.

What questions are your lab trying to answer just now?

The overarching goal of my lab is to understand how cell membrane mechanics impact cell signalling and behaviour. We are interested in cell membrane-to-cortex attachment and our recent data suggest that this attachment is a gate for a cell identity switch occurring between the naïve and primed pluripotent states in mouse embryonic cells. We are also trying to develop better models to understand the measurements that we do using an atomic force spectrometer. The lab is also interested in how membrane curvature topology and composition affect cell behaviour. Moreover, we study tissue morphogenesis using zebrafish embryos and try to assess how mechanical properties affect cell shape and fate. For that, we are working with the lab of Robert Prevedel (EMBL) to implement and further develop Brillouin microscopy for life science. Finally, a part of the lab is working on more applied research – taking me back to my old medical school days in Barcelona – where we're looking at how the mechanical properties of human tissues affect the progression of processes like metastasis or the migration of immune cells.



Third pillar of Dana in the Yosemite National Park with Mono Lake in the background, California, USA.

Are you aiming to look at membrane curvature both on a nanoscale and mesoscale?

Yes. People haven't really looked at membrane curvature in a global but high-resolution manner. One can use light microscopy, but then the nanoscale is lost; electron microscopy studies have been done, but then you lose the vision of the whole cell. I believe quantifying what the curvature landscape of a cell is in different scenarios – migrating, non-migrating, dividing, non-dividing – can tell us a lot about which kind of proteins might be generating or reading out those curvatures. Doing this, we are also learning how curvature affects cellular signalling cascades and cell behaviour in general.

Does this involve looking at transcriptional programs, such as the Hippo pathway and its effectors YAP/TAZ?

When we started I thought 'we don't understand enough to go to the transcriptional level, we first need to characterise what is happening on the cell surface'. Now, I would agree that we are going to have to tackle this. Membrane tension has been shown to affect processes such as phagocytosis, endocytosis and exocytosis, and these processes have been related to cell identity, fate and transcription.

What challenges did you face when starting your own lab that you didn't expect?

On a personal side, when I left Dresden after my PhD, I told myself never to live in Germany again because of the bad weather, but in California I always felt Europe was home. When I got the job at EMBL I was so excited to return! With regards to the lab – it was a bigger challenge than I envisioned it to be. It is a multifaceted enterprise and you have to do many things for which you have zero training. I benefitted massively from being at EMBL because we have a very big collegial attitude – hiring PhD students is undertaken as a team and you also get a lot of feedback on postdoc candidates. Having people around you that have made this journey before and are actually willing to take the time to help you is priceless.

How are the challenges that you're facing now different?

Trainees and colleagues from the first phase of the lab are leaving soon, which is sad. We have grown in size and the challenge now is knowledge transfer. I therefore want people to overlap for a while. In the beginning, when you're a small new lab you think you have so much work but actually you don't when compared to what you have at a later stage; however, you manage the workload better because you've been at it for a while.

“Remember to celebrate your victories, even if they're small.”

Are you still doing experiments yourself?

I had a pet project learning electron microscopy. I had some cool results but I realised I couldn't carry on doing it because of my other commitments, so we managed to get an amazing postdoc on board to continue and she has done in a few months what would have taken me three years to do. [laughs] I still go to the microscopes to support the lab with quality control on atomic force and total internal reflection fluorescence microscopy.

What is the best science-related advice you ever received?

One great thing about having four previous advisors is you see four different ways to do things. I like to think that I learned things from each of them. A common point is that as a mentor you also have to believe in the projects and be excited about the science as hard times will come and your people might need some motivation. I nevertheless give people quite a bit of freedom because I think they should figure out where they want to take things. Here, I should also acknowledge that the lab has an incredibly talented staff scientist (Martin Bergert), who enjoys troubleshooting protocols with the PhD students and postdocs so often I don't even get to know when there are issues until they are resolved.

What is the most important advice you would give to someone about to start their own lab?

Remember to celebrate your victories, even if they're small. It's easy to get depressed about all the things that don't work or how difficult your start into independence is, so celebrate the first time you submit a paper, accepted or not, or celebrate when the first PhD students decide to join your lab. In the end, you should enjoy these first years of independence.

What is your advice on establishing good collaborations?

Pick somebody you can communicate with, which is not always trivial. I have a beautiful collaboration with Robert Prevedel at EMBL, and I think it works well for us because there is never

second guessing or doubts. The other thing that I have learned about collaborations is that sometimes it's easier to just go and meet in person, rather than over the phone or by email. It is more efficient to just travel for a day and brainstorm together; things move much faster.

“We are losing a lot of scientists who are not coming to meetings at critical times in their careers because they don't have childcare support.”

How do you get the most out of the meetings you attend, particularly in the early stages of your career?

I was never particularly shy and I had really good mentors who actually cared about me showing my work to whoever relevant was around at a meeting. They were such good advocates that you get to know people fairly well by the end of conferences, and that's what I offer to do with my people now.

You received support from EMBL for childcare at a previous conference. Is there enough support for scientists with young children who would like to attend conferences?

I am a big proponent of these initiatives. We are losing a lot of scientists who are not coming to meetings at critical times in their

careers because they don't have childcare support. I think this is something that we need to tackle at the organisational level and I will try to do whatever I can to help. I am very privileged that my parents are happy to join me wherever I go around the world to look after their grandchild, and my daughter loves them for that. That is a privilege that not everybody has. Moreover it costs money, and I'm very fortunate to be at EMBL where some of it is paid for by the organisation because they want me to be able to go to those meetings. Support is improving, but we are still losing people as changes are slow. I envision that initiatives at flagship institutions like EMBL and the Wellcome Trust will trickle down, so I believe change is coming.

Could you tell us an interesting fact about yourself that people wouldn't know by looking at your CV?

I really enjoy climbing and diving and our holidays are heavily influenced by that. In fact, I used to be a decent climber. During my years in California, I spent lots of weekends in Yosemite and Lake Tahoe. I still dream about those trips. Last year I gave birth to my daughter, so my climbing shape at the moment has room for improvement, but I am working on it.

Alba Diz-Muñoz was interviewed by Manuel Breuer, Features & Reviews Editor at Journal of Cell Science. This piece has been edited and condensed with approval from the interviewee.