

CELL SCIENTISTS TO WATCH

Cell scientist to watch – Pere Roca-Cusachs

Pere Roca-Cusachs received his doctorate in cellular biophysics from the University of Barcelona, Spain, in 2007, having worked with Daniel Navajas on mechanical properties of cells using atomic force microscopy. He then joined the laboratory of Michael Sheetz at Columbia University, USA, to study integrin-mediated mechanotransduction. In 2012, Pere established his own research group with a joint position between the Institute for Bioengineering of Catalonia (IBEC) and the University of Barcelona. His research focuses on the mechanisms cells employ to detect and respond to mechanical signals. Pere is the recipient of an EMBO young investigator award and has received numerous national awards.

What inspired you to become a scientist?

It was only after I started working as a researcher that I became inspired! After my bachelor's degree in physics, I was actually quite disoriented regarding what to do with my life. One day I was passing the university, saw an advertisement for a biophysics student programme and decided to give it a try. I then talked to Daniel Navajas (University of Barcelona) and he proposed that I work on cell mechanics. After a couple of weeks working in the lab, I quickly became hooked on research – I still am today.

Is academic research something that runs in your family?

No. My brothers studied business and law, respectively, and my parents are both lawyers; my grandfather was a lawyer, too.

Your family background might thus rather help you to defend your research proposals in front of grant committees

[laughs] Yes, maybe!

What questions are your lab trying to answer just now?

Our main question is how mechanical transduction works. In other words, how do cells transform mechanical signals into biological responses? We are not only trying to understand what the molecular signals are to do this, but how this is regulated and fine-tuned. How does a cell know whether a specific physical signal has increased or decreased, and how does it decide when to turn a specific switch on or off? How does the physical environment modulate this decision? In order to get answers, we are using a combination of cell biology and physical modelling. We started by looking into this mostly at the level of integrin-based adhesions. Now, we are also interested in what happens at the level of the nucleus and the plasma membrane. I think we are getting to some interesting conclusions on how mechanosensing is regulated in these other nodes, which is less well understood.

Do you feel that your career trajectory has been nicely aligned with the way mechanobiology has evolved in the last decade?

The field has indeed gone from being small and focused on technical issues of how cell mechanics work to a broader interest for



Pere Roca-Cusachs

the biology of it. The number of studies have exploded in the last five to ten years – precisely at the time when I was asking my research questions as a student or post-doc. Therefore, in that regard, I don't know if I was smart or just lucky to be doing what seemed to be interesting to many people at the time. But, in many ways, it was also a natural evolution of the field – when you're able to show that mechanical details really have an impact on the biology of a cell, you attract a wider audience and show the scientific community that this research matters.

What work or publication has influenced you during this evolution of the field?

During my graduate years, more and more people were showing the mechanics of development at conferences, which was very striking and very impressive. It fascinated me at the time and was one of the turning points where I really decided that I wanted to work on mechanobiology. Interestingly, I never ended up working on developmental problems per se, but it always exemplified for me how mechanics can be relevant in a very important biological context.

To look at the mechanics of development requires the integration of several approaches. Do you think this is something the field will further expand on in the future?

This is absolutely where the field is going, and where we will try to go as well. The challenge is that if you want to do precise mechanical measurements, it obviously becomes much more difficult when dealing with a multicellular three-dimensional environment. Then again, we should not stop working at the cellular molecular level. It is the integration of all these scales that will bring answers.

Pere Roca-Cusachs' contact details: Institute for Bioengineering of Catalonia (IBEC), Baldiri Reixac 10-12, 08028 Barcelona, Spain.
E-mail: proca@ibecbarcelona.eu



Pere with his kids Bruna and Mateu, and his wife Isabel at a local restaurant.

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

The obvious difficulty – as everybody finds – is making a niche for yourself; having something that the community will recognise you for that is not what your former mentor did. This is very challenging. Apart from that, one aspect that I was probably not ready for was how important people management is. As a group leader, a huge part of your job becomes managing people in a stressful environment with a lot of pressure and uncertainty. I think learning how to do this properly was something that I was not prepared for, and that I've learned a lot about, but it's still an ongoing process.

“...the main challenge is moving from simple, single-cell systems or single-molecule systems to more complicated three-dimensional multicellular environments...”

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

From a managerial perspective, I had to change the way that I run the lab since we transitioned from a smaller lab to a medium-sized lab of about ten people. I cannot be so much on top of the projects as I used to be, so that involves a transition to allowing more independence and fostering that. Scientifically, I think that the main challenge is moving from simple, single-cell systems or single-molecule systems to more complicated three-dimensional multicellular environments, as I have mentioned.

How do you achieve a work-life balance when you're trying to establish yourself as an independent investigator?

My wife is a high school teacher and our kids go to the school where she works, which means that she has the same schedule and vacations as the kids. This has made daily tasks easier, but it has also sometimes shifted the balance for me to no balance at all – a lot of work and very little family time. I have therefore changed this: I do not have email alerts on my phone, so I am not checking them all the

time at home. I also chose to take on more tasks and responsibility regarding the kids. Otherwise, it will be a scenario that I'm not interested in: get home late to kiss the kids goodnight and that's it. How to do it properly – how to have a great balance – is something that we are trying to solve on a day-to-day basis, and that I do not really have an answer for.

“Do good science, do something different and original and try to make your point...”

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

Dennis Discher (University of Pennsylvania) once told me “focus on science, not the grants”. I think that is good advice. Do good science, do something different and original and try to make your point; the other things should follow from that, not the other way around. Sometimes you also get advice that doesn't really apply to your situation or funding landscape. People have told me that the first four post-docs you hire will decide the direction where your lab goes. I told this a friend of mine who was starting his lab in Barcelona as well, and his answer was “well, by the time that I hire my fourth post-doc, I will nearly be at the end of my career already.” [laughs]

Are Spanish graduate students or post-docs aware of career options outside academia nowadays?

Fortunately, I think that in terms of alternative career options, things have changed for the better in the last few years. When I started my PhD, it was said that the only option if you want to stay in Spain is an academic career. It was probably correct at the time, but now there are more and more alternatives for careers in industry, or at research institutions. I think that is great, and some of my students have gone on to do things that are not the traditional academic career towards tenure.

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

Be open, listen to people, and go with the flow. If you try to over-impress the big names in the field, I feel that this is not really helpful. Show your work, put it out there and defend it vigorously. You may get interesting suggestions from people who you had not previously considered to have expertise in your field. To me, that is the main value of meetings.

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

At one point, I seriously considered a career in stand-up comedy. We had a small theatre group with a few friends here in Barcelona and for a few years, we had gigs in small theatres and we had a small comedy show going. At one point, it even looked like this could actually be going somewhere; it did not, and also my thesis took up more and more of my time – and that was okay. However, sometimes I do look back and think about what would have happened if I had pursued stand-up comedy.

Pere Roca-Cusachs 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.