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CELL SCIENTISTS TO WATCH

Cell scientist to watch – Julien Berro

Julien Berro completed a master in engineering in applied mathematics and computer sciences at Institut National Polytechnique de Grenoble, France. He then received his PhD in mathematical modelling in biology from Joseph Fourier University, Grenoble, working on modelling of actin cytoskeleton dynamics under the supervision of Jean-Louis Martiel. He continued for a short period in Grenoble, working with Laurent Blanchoin and Rajaa Boujemaa-Paterski, before joining the laboratory of Tom Pollard at Yale University, USA. There, he started to look at actin dynamics in the context of clathrin-mediated endocytosis. In 2013, he became an Assistant Professor in the Department of Molecular Biophysics and Biochemistry at Yale and an Assistant Professor in the Department of Cell Biology in 2017. His laboratory is interested in force generation during endocytosis, and the underlying molecular mechanisms controlling membrane deformation and tension sensing.

Julien Berro

What inspired you to become a scientist?

My mum was a psychiatrist and my dad was a journalist and I didn't grow up with a lot of mathematics, physics or cell biology around me. My grandparents had a butchery in a small town in France. My granddad was from a poor family and left school at 12 to do an apprenticeship, just like his brother who became a baker. The rationale was that they would always have something to eat. However, my grandfather was a very curious person and had he been born in a different time, I think he would have become an engineer. He was always trying to fix things; people would bring him electronics and things that he didn't really know so much about, but his inquisitive mind drove him to try to figure out what was wrong – sometimes he would manage to repair it and sometimes he would irreversibly break it [laughs]. I remember him making a rake to collect shellfish, which was a bit of a contraption, but he liked this kind of thing. Despite no formal training, he had an engineer's and scientist's mind-set and I grew up with this inspiration. So as a child, my dream job was to be a doctor and car mechanic at the same time ('médecin-mécanicien' in French), because I was convinced that it was pretty much the same thing! Funnily enough, I feel like I achieved my dream job – I do biology and look at the mechanics of the cell!

However, your studies and initial training were of a mathematical nature, right?

I got into mathematics in college because the French educational system pushes you mostly towards maths and physics when you're good in science. Afterwards I attended a school of engineering for computer science and applied mathematics. I think it was a good choice and don't regret it, but I always felt there was something missing and I thought I would do a master in something more physics related. In the end, a master degree in mathematical modelling in biology in Grenoble caught my eye and I really liked it; so that's how I switched.

What questions are your lab trying to answer just now?

We'd like to understand how forces are produced in the cell and how forces are sensed. Our favourite case study for these questions is endocytosis, specifically, how cellular mechanics and biochemistry work together to deform the membrane. I started to look at endocytosis because I was interested in the actin cytoskeleton. It's a challenging system, because endocytosis is a very transient process involving proteins and lipids, and the process is diffraction limited. I feel that with our quantitative and modelling background, we can make the biggest impact and have a unique angle to address some of the open questions in the field. Most of the projects we are working on now came from discrepancies between the conceptual models that the field thought about in terms of mechanism and the numbers that we measured or the mathematical models that we made. The quantitative mismatches forced us to revisit the mechanisms and perform new experiments to test them.

What are the techniques you are currently using in the lab?

We use a lot of quantitative microscopy and our workhorse is still the spinning disc confocal microscope. In addition, we've developed single-molecule methods to get a sense of how dynamic the process is and how fast proteins exchange during endocytosis. We also aim to get a sense of nanometer resolution of the protein movements. Several labs are looking at the overall super-resolution organisation of these structures, but we think that by looking at the movement of single molecules, we can learn a lot about how forces are produced. We developed these methods in collaboration with David Baddeley at Yale before he moved to the University of Auckland, New Zealand.

What do you find more fulfilling – imaging a single-molecule assay or to see that the data fit the prediction from the model?

Many people get excited by pretty images, but I prefer to see when an analysis comes together well. It's fun when you make a prediction from modelling and then the data work with the prediction. Actually, I'm also excited when the model doesn't work because it raises more questions about the mechanisms. The postdocs or students in my lab tend to get depressed when the

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“Lily, watch the road!”

hypothesis was wrong, so I try to cheer them up – when things don’t play out perfectly, it’s good because it means we have to be creative to figure out what we and the field missed.

What work has inspired or influenced you recently?

I like to go to a lot of seminars and talks. Here at Yale, there are so many great opportunities – pretty much every day, there is a talk by a world-famous scientist. Even if they are a little bit removed from what I do, I really enjoy going because I often get inspired. We just got a grant to develop force sensor tools and the idea came from listening to a student’s talk from Yongli Zhang’s (Yale) lab on protein unfolding using optical tweezers. I also got inspired by talking to David Baddeley and Joerg Bewersdorf (Yale) and finding out how we could adapt their methods to our questions.

“It’s fun when you make a prediction from modelling and then the data work with the prediction.”

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

It was a smooth transition because I didn’t have to move very far. However, a challenge was that I was not completely finished with my postdoc at my official start into independence, and I had to deal with this as well. I feel I had a fairly slow beginning because it took me time to gain momentum, recruit people and get the new projects started; in addition, there were delays in the delivery of our workhorse microscope. This actually pushed us to be creative, collaborative and to take risks to start new projects. I don’t regret it now, but at the time it was a bit stressful. Your department and your colleagues start worrying about you when you’re not prolific right away, and they don’t necessarily have all the details at hand as to why this situation may occur.

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

It’s a different time now. I just got my first promotion and we submitted and published a lot of projects in the past few months. I guess the initial worries of my colleagues, as mentioned above, are gone, which is nice! In the lab, we have reached a steady state now: my first student graduated last spring, another one will graduate soon, and my first postdoc is probably going to get a job this year. I am looking to recruit new people and get all projects to cruise speed with the grants available.

“…the best advice I got came from female group leaders because they had to overcome more hurdles than men to get where they are.”

How do you go about recruiting group members?

I think the thing I didn’t appreciate so much in the beginning is the breadth of different styles and skills, and how different people are in their interests. It’s really challenging to make sure the people work well as a group and are on the same wavelength with your goals. If it doesn’t work out, both sides have to let go and that’s ok. This is advice I regularly hear from some of my senior colleagues. It is therefore important to have good mechanisms in place to keep track of how things are going for both sides. You have to be ready to part ways if it is not working and that’s fine.

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

Seek advice from a diverse range of people. It is likely you will get very different answers to your questions, but probably with very valid arguments. Then, it is important to analyse why it worked for them and why it would or wouldn’t work for you. Also, be careful when getting advice from people who have been flawlessly successful, because they don’t always realise at what point they got lucky or how much working on a hot topic can help a lot. It is important to ask people who have struggled a little bit before they got everything running in their independence. Usually, the best advice I got came from female group leaders because they had to overcome more hurdles than men to get where they are. I’ve got a lot of really great advice from the women at Yale and all different places. Actually, one of my favourite resources when I started was a series of articles that were written by the Women in Cell Biology (WICB) Committee of the ASCB. They have really amazing booklets about lab management!

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

The smaller community meetings are important because that’s where you meet the people that will be your colleagues and reviewers for manuscripts and grants throughout your career. It’s important for people to know you early on. I also like the bigger meetings because I go to talks or see topics that are a bit out of my focus. Of course, there’s always a risk when you present data at early stages of your career, but I remember Tom Pollard commenting on the chance of being scooped by saying “don’t worry, you’re going to do it better!”. I find this a fun way to think about competition. More seriously, his point is that it is unlikely two groups will do an experiment in the same way, so two approaches can reveal different aspects of a process. At the end of the day, this is good for science.

Do you feel pre-prints and social media like Twitter have helped the dissemination of data?

I really like BioRxiv. I now post all the papers of my lab there and also use it to see what’s going on in the field. Things move much faster now and it gives you a lot of ideas to check pre-prints and follow people on Twitter. I started using Twitter a year and a half ago and I love the combination of both; you see papers that are

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maybe one or two arm's length from your core area, but are very important and you would not have seen otherwise.

Could you tell us an interesting fact about yourself that people wouldn't know by looking at your CV?
I'm a new dad and I really love it! Our baby is my 'hobby' now and I really enjoy caring for her, being cheesy and singing songs to her.

Unfortunately, the interview is not in audio format, or I would have invited you to sing now!
I only sing to my daughter! [laughs]

Julien Berro 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.