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Cell scientists to watch – Jordan Beach and Patrick Oakes

Jordan Beach received his Bachelor's degree from Mount Union University, Alliance, Ohio, before joining the laboratory of Thomas Egelhoff at Case Western Reserve University and Cleveland Clinic Foundation, Cleveland, Ohio for his PhD. He moved to the National Heart Lung and Blood Institute at the National Institutes of Health in Bethesda, Maryland for his postdoctoral training with John Hammer to use high-resolution imaging to explore myosin II assembly dynamics with the aid of a Lenfant Biomedical Research Fellowship and K22 Career Transition Award. In 2017, Jordan became an Assistant Professor at the Department of Cell and Molecular Physiology at Loyola University Chicago, USA.

Patrick Oakes received his Bachelor's degree from Boston College, and his PhD in Physics from Brown University in the laboratory of Jay Tang. He did his postdoctoral work with Margaret Gardel at the Institute for Biophysical Dynamics and the James Franck Institute at the University of Chicago studying how cells sense and generate forces. In 2016 he started his own lab as an Assistant Professor of Physics at the University of Rochester, and in 2019 moved to the Department of Cell and Molecular Physiology at Loyola University Chicago, USA. In 2022 he was promoted to Associate Professor.

Jordan Beach (left) and Patrick Oakes

What inspired you to become a scientist?

J.B.: I can't remember at what point I decided to become a scientist. I was quite naïve and didn't really know what biomedical research was when applying to graduate school. I chose to rotate in labs working on the cytoskeleton and trafficking, so naturally became drawn to those fields. My father is a mason, and I spent a lot of summers working with him. I've often thought that's an underlying reason why I found it so interesting to study how the cytoskeleton provides structure to cells and tissues. When I learned about molecular motors, and how we could manipulate and observe them using imaging techniques, it really blew my mind – and studying motors with microscopy is still where my passion lies.

P.O.: As a kid, I was drawn to maths and science because I really liked asking questions and getting answers. I started pursuing physics and had mentors who told me that biophysics is an exciting, fertile and open area with lots of opportunities to find my own research direction. I took this advice and started looking for biophysics-centred programmes. I was lucky to find good people and exciting problems to tackle, including working with microscopes, and it just snowballed from there.

What are the main scientific questions that have been driving your work?

J.B.: I'm really obsessed (perhaps too much!) with myosin and my driving question for many years has been how myosin builds contractile units in space and time within a cell. Our lab is now starting to branch out and ask how different cell types and different myosins achieve this – I'm really excited about the directions we're going in and what we're learning along the way.

P.O.: I've always been really interested in how cells move, and they can't move without generating forces and having mechanical interactions. I think this is where our research interests nicely interplay, as my primary focus has been studying all the adhesion proteins, crosslinkers and structural elements that myosins are pulling on. When we merge these interests together, we get a lot of overlapping questions that we can tackle from slightly different perspectives.

The mechanobiology field has experienced a huge growth – what do you think has led to this?

P.O.: One of the reasons is the huge advancement in technological capabilities; microscopy methods have expanded in terms of resolution and speed, and with that, the amount of data you can get has massively increased. Adding to this are all the physical engineering approaches that people have brought in from other fields and have applied to biological systems. What's also important is that scientists are now being trained to be fluent in both the languages of biology and physics – for example, physicists and bioengineers are comfortable having molecular biologists next to them at the bench, which allows for real crosstalk.

J.B.: What has also struck me is that people from areas such as cancer and developmental biology have entered this field, realising

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Members of the Beach and Oakes labs celebrating maple syrup and flannel shirts at a lab brunch.

the importance of mechanobiology for studying transcriptional regulation and cellular decision making.

And where do you think the field is heading?

J.B.: There has been beautiful work on different components involved in mechanosensation, including Piezo channels, YAP/TAZ or the LIM domain proteins, which Patrick has worked on a lot, but I think the next big challenge will be understanding how all of these proteins and signals are integrated into a decision-making process.

P.O.: I agree that it's the marrying of different signalling cascades across different scales that will likely be the key – but to be honest, I don't think I can really predict where we'll be in five or ten years. For example, machine learning and deep-learning-based approaches are now starting to be widely applied, so in a couple of years I think we'll all be shocked about the sort of things that will have become very commonplace to do.

"What's also important is that scientists are now being trained to be fluent in both the languages of biology and physics… which allows for real crosstalk"

You are now running a joint group. I'd be interested to hear about how you merged the labs, and if this was planned in any way

J.B.: I don't know whether Patrick and I ever had a conversation where we decided that we would run the lab together, it really just evolved over time. It started a few years ago with having joint lab meetings when both of us had very small groups, and we started co-mentoring students over the years, which kind of pulled us together. It's really been a constant merging over the years – from combining Slack workspaces to more recently joining lab spaces and streamlining purchasing. We don't currently have a joint grant but when that happens, it will pull us even closer. What has also helped is that because our interests and approaches are different, there is very little opportunity for any competition between us.

What are the advantages of running a joint lab?

P.O.: I think we have a really special group and it's been great to watch people in the lab develop and build close bonds and natural friendships. Having more people as a joint lab allows us to take on bigger projects, and it's very helpful for making important decisions, such as who to recruit, as hiring is one of the most difficult things a young PI has to do. With running the labs together, we've also more quickly built an environment where people ask each other for help and therefore don't require our input on certain things anymore; it's also much easier to keep the ball rolling when one of us is away. For the students and postdocs, it's great to have two PIs they interact with very closely, and it will also be handy when they'll need multiple reference letters for their next jobs.

J.B.: More people, more fun, better science. I think that's what it really comes down to.

And are there any downsides?

J.B.: The one that I can think of is time – we often spend 10–12 h weekly in meetings together, from group meetings and journal clubs to one-on-one meetings and career development sessions. Of course, since we have different backgrounds, there's a benefit to both of us attending the same meeting, and although it can sometimes be tricky to find the time in our schedule, it's definitely worth it.

More generally, what challenges did you face when starting your own labs and how are those challenges now different?

J.B.: I think the surprising thing for me was that the challenges don't end – it's a bit like climbing over sand dunes where there is always a next challenge that you didn't anticipate. The challenges you face on day one, such as getting reagents and people in the door, will be different a couple months later when you are training people or need to secure long-term funding. My current challenge is writing manuscripts with people who have never written papers before, and I'm trying to figure out where to push and pull so that I provide them with mentoring and also get papers out of the door.

P.O.: I would second that, and it's easy to get overwhelmed if you don't focus on the little things right in front of you, so it's important to take it one step at a time.

Is there any other advice you would give to people who want to start a research group?

P.O.: I'd say it's important to realise that you are not alone and find your support network and peers who can help you through the difficulties of establishing your lab. It can feel isolating, but there are tons of people going through the same process at your institution, department or at other universities. It's also important to remember that science is not a direct competition, so I'd tell people to celebrate everyone's success like it's their own.

J.B.: I think trusting yourself is really important – trusting the decisions you've made along the way in your scientific career and taking that trust forward as you come upon new decisions to make. And to trust yourself, it's important that you don't discount how much you've contributed to your own success, even if you were lucky to have good mentors and collaborators.

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How do you balance being a scientist and parent?

P.O.: It can be hard, especially when science feels overwhelming, but my kids are great at re-centering me. I love observing and participating in their unbiased perspective of the world. Sometimes, I forget how slowly science moves, but children grow up really quickly, so it's important to be able to let go of the work that's in your head and just focus on being present. Having this kind of approach has been really helpful to deal with the disruptions in the last years, for example when day-care was closed due to COVID-19.

J.B.: I don't think I view it as a balance, as this suggests that doing science and being a parent are in some way even, but they're not. I think you have to decide whether or not you want to be a good parent, and if the answer is 'Yes', then that comes first before anything else.

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

J.B.: I don't know how to answer this question, and I don't know how academic parents can have time for hobbies. I bought myself a stained-glass beginner's kit last year for Christmas, but I haven't touched it since, so maybe for this year's Christmas I'll open it.

P.O.: Baking bread is one of my favourite things to do. My grandfather used to bake bread and I distinctly remember that smell in his kitchen. During high school, I worked in a bakery and learned how to bake from people who do it for a living, so it's an inspired passion. At the moment, I also don't have time for this hobby, but I'd like to get back to it.

J.B.: I'd like you to get back to it too, Patrick, the whole lab would appreciate it!

Jordan and Patrick share lab space and microscopes, co-mentor students, and run joint lab meetings, journal clubs, career development sessions, etc.

Their research groups are interested in how all cells build, sense and interpret mechanical forces. Jordan's lab is funded by grants from National Institute of General Medical Sciences (NIGMS) and National Science Foundation (NSF). Patrick's lab is funded by grants from the National Institute of Allergy and Infectious Diseases (NIAID) and the National Science Foundation (NSF).

Jordan Beach and Patrick Oakes were interviewed by Máté Pálfy, Features & Reviews Editor at Journal of Cell Science. This piece has been edited and condensed with approval from the interviewees.