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First person – Sonal

First Person is a series of interviews with the first authors of a selection of papers published in Journal of Cell Science, helping early-career researchers promote themselves alongside their papers. Sonal is the first author on 'Myosin-II activity generates a dynamic steady state with continuous actin turnover in a minimal actin cortex', published in Journal of Cell Science. Sonal conducted the research in this article while a PhD student in the lab of Petra Schwille at the Max Planck Institute of Biochemistry, Martinsried, Germany, studying biological pattern formation using a bottom-up reconstitution approach.

How would you explain the main findings of your paper in lay terms?

Animal cells are capable of very fast and fine changes in shape – a feature that is crucial for cellular functions such as cell division. Cell shape depends on the actin cortex, which is a meshwork of actin protein filaments that lines the inner surface of the cell membrane. Myosin-II motor proteins are also important components of this cortex, as they can bind multiple actin filaments and relocate them by pushing and pulling, thereby changing the structure of the mesh. Additionally, it has been proposed that myosin might also influence the dynamics of the cortex by increasing the recycling of actin proteins that form the filaments. However, this role of myosin is difficult to study in a cell, where many other proteins also regulate actin recycling. To overcome this hurdle, we have constructed a simplified artificial cortex, which includes only the minimum biochemical components necessary to study the effect of myosin in isolation. Whereas previous studies could only show that myosin motors fragment actin filaments, we went on to demonstrate that these filament fragments can further break down to actin monomers, which in turn form new actin filaments. Thus, we established that myosin can enhance actin recycling even in the absence of additional factors. By regenerating the components of the actin mesh, in addition to translocating actin filaments, myosin plays a double role that can speed up the restructuring of the cortex, potentially having a broader contribution to the fine-tuning of cell shape.

Were there any specific challenges associated with this project? If so, how did you overcome them?

A common challenge in working with reconstituted systems is to get a mixture of numerous biochemical components to behave reliably in each repetition of the experiment. It took many iterations of sample preparation to identify and control the key factors that introduced variability into the system. Since there were many variables to consider in our experiments, this initial step of protocol standardization took quite a long time and very little of these data finally featured in the manuscript. However, these efforts were extremely rewarding because the experiments proceeded quite smoothly once reproducibility was established, even when additional proteins were introduced into the system.

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Sonal

When doing the research, did you have a particular result or 'eureka' moment that has stuck with you?

A critical aspect of our study was to show the formation of new actin structures during continuous disassembly of those structures by myosin. To this end, we introduced two sets of actin monomers with different fluorescent labels into the reaction mix at different time points. Interestingly, the resulting distribution of the two actin pools revealed much more of the underlying processes than we had originally anticipated, giving rise to this rare and unmatched feeling that this study was now complete. The reviewers, quite understandably, were not equally impressed with that particular result and we conducted some even more satisfying experiments at their behest, thus demonstrating that even the 'eureka' moments in biology are subject to evolution.

Why did you choose Journal of Cell Science for your paper?

Being a synthetic biology lab, our research does not regularly feature in Journal of Cell Science. However, the 'Reconstituting Cell Biology' special issue might as well have been designed specifically for us! We were very keen on having this study published here, considering the broad audience that Journal of Cell Science reaches. This platform is valuable to our work since reconstitution projects often draw inspiration from interactions with cell biologists. Personally, I also greatly appreciate the quality standards that this journal maintains, having read many Journal of Cell Science articles during my previous stint as a cell biologist.

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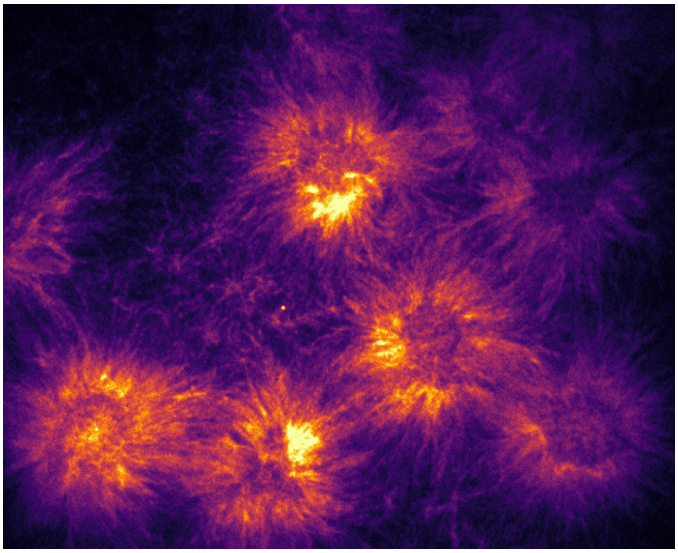

Transient actin structures formed during myosin-II-reorganization of branched actin networks on a lipid membrane.

“Each tiny victory [in science] is so fulfilling that it motivates you to keep striving.”

What motivated you to pursue a career in science, and what have been the most interesting moments on the path that led you to where you are now?

I believe the aspect of science I enjoy the most is the unabashed and continuous learning. Each day in the lab is different from any other – a new problem to solve and a new skill to acquire. A large part of thorough scientific practice is rote repetition and frustrating, failed attempts, but the intellectual stimulation of the remaining minute fraction more than makes up for the rest. Each tiny victory along this path is so fulfilling that it motivates you to keep striving.

Who are your role models in science? Why?

I have a profound admiration for scientists who have a penchant for teaching and infuse their students with the same enthusiasm that drives them. One such person I have had the absolute pleasure of working with is the accomplished evolutionary biologist, Prof. Amitabh Joshi. Research discussions with him were always insightful, but his influence extends far beyond that. Not only can he engage even the most mathematically wary biologist with his statistics lessons, but he also encourages students to cultivate their own philosophy for science. I can only aspire to have such a long-lasting impact on young minds!

What’s next for you?

I am fascinated by mathematical models of biological phenomena and have always hoped to learn how these theoretical paradigms are developed. I am currently looking for postdoctoral positions where I will have the opportunity to extend my skills in this direction.

Tell us something interesting about yourself that wouldn’t be on your CV

My obsession with learning is not limited to my profession. Alongside working on my PhD, I also worked towards learning swimming, diving and dancing tango and swing, besides making reasonable progress with the German language.

Reference

Sonal, Ganzinger, K. A., Vogel, S. K., Muecksch, J., Blumhardt, P. and Schwille, P. (2018). Myosin-II activity generates a dynamic steady state with continuous actin turnover in a minimal actin cortex. *J. Cell Sci.* **132**, jcs219899.