© 2023. Published by The Company of Biologists Ltd | Journal of Cell Science (2023) 136, jcs261459. doi:10.1242/jcs.261459

FIRST PERSON

First person – Katherine Paine

First Person is a series of interviews with the first authors of a selection of papers published in Journal of Cell Science, helping researchers promote themselves alongside their papers. Katherine Paine is first author on 'The phosphatase Glc7 controls the eisosomal response to starvation via post-translational modification of Pil1', published in JCS. Katherine conducted the research described in this article while a PhD student in Chris MacDonald's lab at University of York, York, UK. She is now a Postdoc in the lab of Simon Wilkinson at Institute of Genetics and Cancer, University of Edinburgh, UK. During her PhD, she was interested in the regulation of cell surface membrane proteins but has now moved into the field of autophagy, where she is working to understand factors involved in regulating this process.

Katherine Paine

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

Cells need to be able to respond to their external conditions, like fluctuating nutrient levels and physiological stresses. We previously used yeast as a model system to understand how cells respond to starvation of glucose, an important sugar used to generate cellular energy. Although most molecules on the cell surface are degraded in response to starvation, a small reserve pool of important nutrient transporters is retained in storage compartments called 'eisosomes'. The main findings of this paper show that eisosome storage compartments are modulated very rapidly through a process called dephosphorylation, which we speculate changes the environment to better harbour nutrient transporters. Yeast is a great genetic system, which I used to systematically test all the possible enzyme factors that were responsible for dephosphorylation. The paper concludes with a more-extensive characterisation of one factor called Glc7. Curiously, although Glc7 is known to be involved in glucose responses, this new role appears to be independent from its better known function. Understanding how model systems like yeast respond to stress can help inform us about how pathogenic fungi might also react. Furthermore, understanding how molecules are organised in certain regions of the cell surface is useful to learn how similar coordination is achieved in other organisms, like humans.

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

We began this work when lab access and movement across the department was still restricted due to the COVID-19 pandemic, which was definitely a big challenge and required a lot of organisation to overcome. Even simple things like performing an immunoblot were difficult, as I would run the gels in one contained area but need to move to another area to image the blot – while ensuring social distancing was maintained. Similarly, a lot of microscopy was required for this paper, which meant I had to culture cells in the lab but then organise access to the York Bioscience Technology Facility to perform the imaging experiments.

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

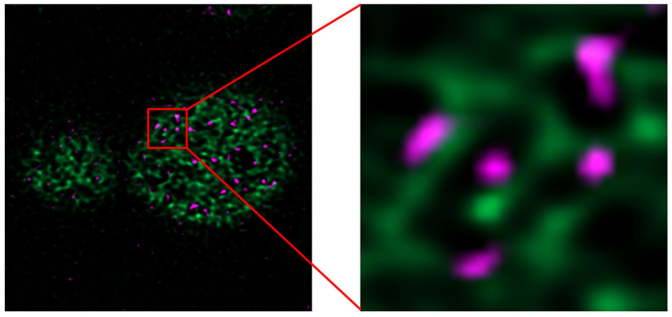
Our preliminary work had used a GFP-tagged version of the phosphorylated substrate that we were characterising and we were keen to study the native protein. This became possible because we were kindly sent a supply of antibody from Tobi Walther (Harvard, USA) as a gift. To test the antibody, I took some yeast strains out of the freezer: some wild-type yeast cells but also mutants of the essential yeast phosphatases. The antibody worked beautifully, but what was really exciting was that I observed an altered phosphorylation phenotype in one of these initial mutants. It was very encouraging going into the systematic screen knowing that our experimental strategy would be able to identify mutants that regulate the substrate. I remember exposing this first immunoblot and being very encouraged and eager to start the screen. I have now done enough immunoblots to know that this phenotype is not common, so it was a very lucky test in the early stages of the project!

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

The original paper from our lab that documented eisosome regulation in response to glucose starvation was published at the Journal of Cell Science. The process was very smooth and it resulted in a lot of interest in our work. The Journal has also published many other wonderful studies relating to eisosomes in yeast, so this follow-up piece seemed like a natural home for our paper. The University of York also has a Read & Publish agreement with The Company of Biologists, so this allowed for a simple way to publish in a great journal and ensure the work was freely accessible.

Katherine Paine's contact details: Institute of Genetics and Cancer, University of Edinburgh, Western General Hospital, Crewe Road South, Edinburgh EH4 2XU, UK.
E-mail: kpaine@ed.ac.uk

Journal of Cell Science (2023) 136, jcs261459. doi:10.1242/jcs.261459



Eisosomes (magenta) of yeast cells are distinct from other regions of the plasma membrane (green). In response to starvation, the core eisosome factor Pil1 is modified to better sequester nutrient transporters at the surface.

Have you had any significant mentors who have helped you beyond supervision in the lab? How was their guidance special?

Aside from my PhD supervisor Chris MacDonald, who has been a great mentor above and beyond lab supervision, I would say mainly my colleagues and friends in the biology department at York. Our chats in the lab about project ideas and troubleshooting helped me tackle experimental challenges, and socialising outside of the lab helped me 'switch off' from work. Having this support network was very special to me and something I think is important to have when conducting research.

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 have been interested in science since I was in school, but during my undergraduate degree in the Biology Department at the University of York I managed to get diverse training in different scientific techniques, working with plant, fly and yeast systems. There were more questions that I wanted to explore which led me to undertake a PhD. There were various 'interesting moments' during this journey, but I really enjoyed working on several side projects that followed unexpected discoveries along the way.

What's next for you?

I have finished up my PhD and started a postdoc at the University of Edinburgh exploring autophagy in mammalian cells with Simon Wilkinson. I am enjoying getting to grips with a new system and new techniques, although I will always appreciate the power of the yeast model!

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

I have a natural talent for finding the snacks and freebies at conferences. I am not sure this is CV-worthy but it is definitely useful!

Reference

Paine, K. M., Laidlaw, K. M. E., Evans, G. J. O. and MacDonald, C. (2023). The phosphatase Glc7 controls the eisosomal response to starvation via post-translational modification of Pil1. *J. Cell Sci.* **136**, jcs260505. doi:10.1242/jcs.260505