© 2024. Published by The Company of Biologists Ltd | Journal of Cell Science (2024) 137, jcs262293. doi:10.1242/jcs.262293

First person – Kinga Rutowicz

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. Kinga Rutowicz is first author on 'Multiscale chromatin dynamics and high entropy in plant iPSC ancestors', published in JCS. Kinga is a Research Assistant in the lab of Célia Baroux at Department of Plant and Microbial Biology, University of Zurich, Switzerland. Her research focuses on better understanding the multifaceted role of chromatin in cellular reprogramming during both development and response to environmental stimuli.

Kinga Rutowicz

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

When plant cells are deprived of their cell walls and are separated from each other, they lose part of their cellular identity. When stimulated in culture with nutrients and plant hormones, some of these isolated cells regain remarkable activity: the competence to proliferate, form cell masses and tissues and to eventually regenerate an entire plant. How these plant cells that initially belonged to root or shoot tissues can reprogramme themselves and restore a complete organism remains an enigma.

Our work shows that the first phase of cell culture has a drastic impact on the packaging and organisation of DNA of isolated plant cells, and that both nutrients and hormones influence this process. We also observed that the culturing process rapidly and significantly reduces heterogeneity among the cells, a phenomenon also found in animal cells that are induced for reprogramming *in vitro*.

This work was enabled thanks to a powerful technique that combines semi-automated, high-throughput microscopy imaging and machine-learning based image analysis. Using this approach, we were able to follow hundreds of cells over time in various conditions. We closely observed how the chromatin (DNA with proteins attached to it) changes over time in these cells.

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

Our collaborators had a robust workflow for semi-automated and high-throughput imaging of animal cells in culture and for image analysis, but plant cells present unique challenges for microscopy as a result of their lack of adhesion on coverslips and background fluorescence, which is in part caused by chlorophyll. Thus, the main challenge was to adapt both the imaging conditions, in order to capture high-quality images of plant cells in culture, and the machine learning algorithms, by training them thoroughly, to perform satisfactory analysis on a large number of plant cell images. This involved numerous trial-and-error cycles.

Another challenge was the unexpectedly high variability of the measurements we obtained from image analysis. My supervisor and I questioned the pertinence of simply comparing mean values, because this failed to address the variability of the data, which we thought could be biologically relevant. The solution came from reading publications about variability in biological systems and methods to quantify it. Thanks to a new collaboration, we employed entropy analysis to our data, similar to what has been done previously to measure the intrinsic variability of gene expression programmes in cultured animal cells. This proved to be a very fruitful approach as it uncovered a new, unanticipated aspect underlying plant cell reprogramming.

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

Beyond the high satisfaction we got each time we solved a methodological problem during imaging or analysis, the real 'eureka' moment arose when finally the thousands of data points and hundreds of variables could be plotted as graphs, which revealed an unanticipated biological behaviour of our cell cultures that could not be seen by eye alone.

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

We selected the Journal of Cell Science because it is dedicated to findings describing the behaviour and dynamics of cellular systems and because it values quantitative microscopy imaging approaches, which are two fundamental aspects of our work. Additionally, we aimed to expose our findings not only to the plant science community

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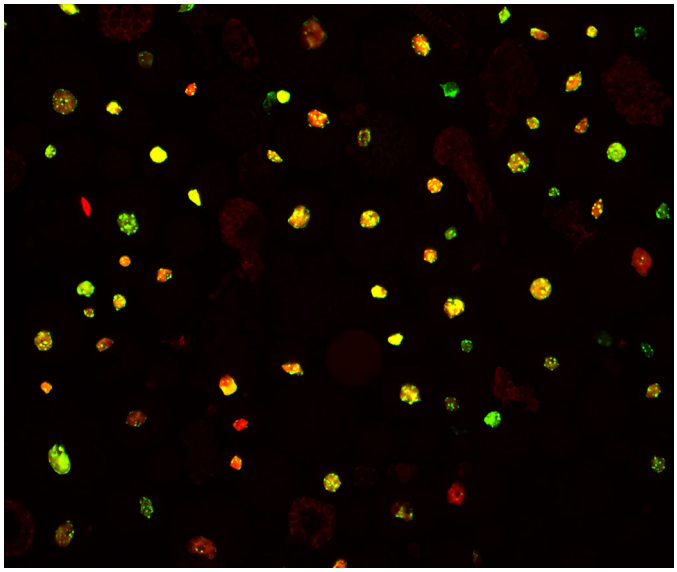

Protoplast nuclei with core histone H2B–RFP (red) and linker histone H1–GFP (green).

but also to a broader community of cell biologists. We believe this is important for fostering productive comparisons between model systems that could potentially reveal universal versus unique cellular strategies.

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

Dr Célia Baroux, the corresponding author of this paper, was not only the leader of the project who designed the project and initiated all the collaborations necessary for its realisation, but also a mentor for my scientific growth. Regular meetings with her enabled me to troubleshoot efficiently and to provide original ideas on how to proceed with experiments and data analysis. She also always encouraged me to keep a good work–life balance and leave enough space for private life. Moreover, she is a role model and extremely inspiring in how she faces and overcomes challenges.

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?

My interest in science stems from a curiosity about how nature works and a desire to contribute to our collective knowledge. I thrive on problem solving and applying advanced methods to challenging questions about fundamental biological processes. The scientific world has also allowed me to be placed in an intellectually vivid environment. Moving abroad for a postdoc project was a particularly exciting and interesting moment in my career and resulted in this publication, among others, as well as some other unexpected discoveries.

Who are your role models in science? Why?

My role models in science are the scientists whom I was lucky enough to work with: Andrzej Jerzmanowski and Célia Baroux. I admire their total and infectious passion for their scientific topics. They are constantly eager to openly share their results, expertise and materials with the scientific community and their research has always been thorough and evidence-based.

What's next for you?

I will soon start a new position as a senior research assistant in another lab group to explore further questions in plant epigenetics relative to genome reorganisation.

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

I used to dance the tango, and I now have two amazing kids who keep me on my toes with their endless energy and creativity.

Reference

Rutowicz, K., Lüthi, J., de Groot, R., Holtackers, R., Yakimovich, Y., Pazmiño, D. M., Gandrillon, O., Pelkmans, L. and Baroux, C. (2024). Multiscale chromatin dynamics and high entropy in plant iPSC ancestors. *J. Cell Sci.* **137**, jcs261703. doi:10.1242/jcs.261703