© 2021. Published by The Company of Biologists Ltd | Journal of Cell Science (2021) 134, jcs258329. doi:10.1242/jcs.258329

FIRST PERSON

First person – Koichiro Maki

First Person is a series of interviews with the first authors of a selection of papers published in the Journal of Cell Science, helping early-career researchers promote themselves alongside their papers. Koichiro Maki is first author on 'Hydrostatic pressure prevents chondrocyte differentiation through heterochromatin remodeling', published in JCS. Koichiro conducted the research described in this article while a Post-doctoral fellow in Prof Sara A. Wickström's lab at the University of Helsinki, Finland. He is now an Assistant Professor in the lab of Prof Taiji Adachi at the Institute for Frontier Life and Medical Sciences, Kyoto University, Japan, investigating single-molecular biophysics and cellular biomechanics.

Koichiro Maki

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

As we humans do in our daily lives, our cells can also feel stress. One source of stress are mechanical forces that act on tissues and cells due to, for example, body movement. In this study, we focused on joint surface tissue, the cartilage, and their cells, the chondrocytes, which are exposed to high mechanical pressure due to the high water content of the cartilage, and body movement, such as walking (this pressure can be up to 300 times higher than atmospheric pressure!). We found that chondrocytes exposed to pressure become quiescent, i.e. they slow down both transcription and replication, as well as stay as immature chondrocytes instead of differentiating towards bone. This mechanoresponse is initiated by an architectural change in chromatin, which is how DNA is packaged into the nucleus by proteins, thus instructing which parts of the genome are active and transcribed, and which are silenced. Thus, pressure controls the behaviour of chondrocytes, telling them not to differentiate when pressure is high. This might be a mechanism by which cartilage is maintained.

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

The most challenging step was the revisions that occurred during the worst times of the COVID-19 pandemic. I was stuck in Japan, our lab was closed, and I also could not travel to Helsinki to carry out the additional experiments required. Luckily my co-authors stepped in and substantially helped with experiments, and we communicated by Zoom almost daily. It was stressful but in the end was a great collaboration between Japan and Finland.

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

We observed a number of responses to pressure (decrease in nuclear volume, changes in chromatin architecture, reduced transcription and replication, attenuated DNA damage and prevented differentiation), and it was difficult to identify the primary target of pressure among these changes. It was extremely exciting and satisfying to get the first results of the SUV39h1 knockdown, which not only phenocopied the effect of pressure on the histone marks, as expected, but also triggered changes in nuclear volume, transcription and replication. This was not what we had necessarily expected but it did allow us to conclude that the reduction in H3K9me3 was a very upstream early event in the cells response to hydrostatic pressure.

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

The research articles published in Journal of Cell Science are of high quality and very visible to the cell biology community, so we hope to reach a broad readership by publishing here. We also appreciate that JCS is a community journal and does a lot to support the scientists in this field.

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

My PhD supervisor Prof Taiji Adachi (Kyoto University) has helped me to become an independent scientist, and he is almost like a parent to me in terms of career. Prof Takashi Ushida (University of Tokyo) taught me an infinite gentleness and broadmindedness like a blue ocean. Prof Sara A. Wickström (University of Helsinki) taught me how to become a passionate critically thinking scientist, and how to enjoy science to the fullest.

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 was motivated to pursue a scientific career when I was participating in Japanese archery at junior level and junior high school. I found it fascinating to be able to predict and demonstrate how an arrow's speed, direction and axial rotation are determined by specific body movements and environments (wind, moisture, etc.), and thought that science (a repetition of prediction and demonstration) might offer similar experiences that I would enjoy.

Who are your role models in science? Why?

I would like to mention my great grandfather, who enjoyed the dawn of synthetic biochemistry in pharmaceutical science. He visited many countries (such as Germany) by boat, and had lots of global interdisciplinary collaborations. I would like to be a scientist with a wide view of the world and science.

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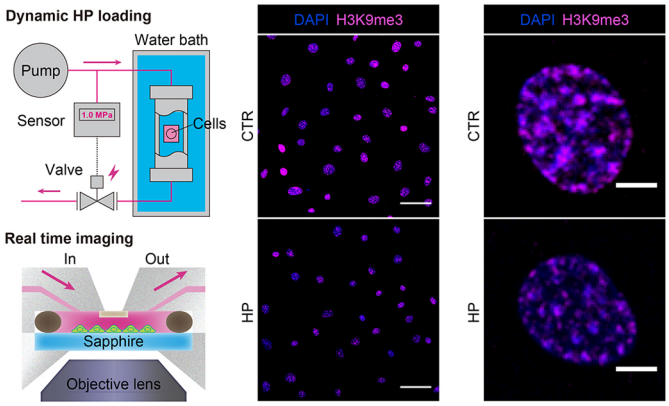
Journal of Cell Science (2021) 134, jcs258329. doi:10.1242/jcs.258329



Custom-made experimental setups for loading hydrostatic pressure and HP-induced reduction in heterochromatin hallmark H3K9me3 in chondrocytes.

What's next for you?

I am currently an Assistant Professor at Kyoto University (Institute for Frontier Life and Medical Sciences). My current/future aim is to understand biological phenomena by developing multiscale mechanical modeling and experiments. In the future, I would like to see myself as an independent scientist in the field of biomechanics and mechanobiology.

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

My hobby is group singing with friends in small quiet karaoke bars.

Reference

Maki, K., Nava, M. M., Villeneuve, C., Chang, M., Furukawa, K. S., Ushida, T. and Wickström, S. A. (2021). Hydrostatic pressure prevents chondrocyte differentiation through heterochromatin remodeling. *J. Cell Sci.* **134**, jcs247643. doi:10.1242/jcs.247643