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FIRST PERSON

First person – Atsushi Taniguchi and Yukinori Nishigami

First Person is a series of interviews with the first authors of a selection of papers published in Biology Open, helping researchers promote themselves alongside their papers. Atsushi Taniguchi and Yukinori Nishigami are co-first authors on 'Light-sheet microscopy reveals dorsoventral asymmetric membrane dynamics of *Amoeba proteus* during pressure-driven locomotion', published in BiO. Atsushi is a postdoc in the lab of Toshiyuki Nakagaki at Research Institute for Electronic Science, Hokkaido University, Kita-Ward Sapporo, Japan, investigating algorithms for collective space exploration and use in ciliates and amoebae. Yukinori is an assistant professor in the lab of Toshiyuki Nakagaki at the Research Institute for Electronic Science, Hokkaido University, Kita-Ward Sapporo, Japan, investigating the behavior of protists.

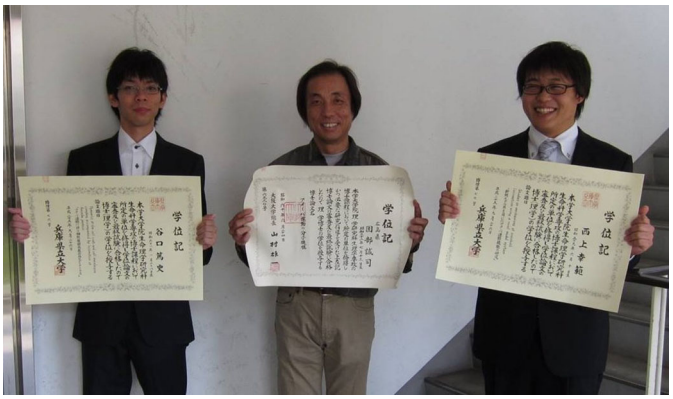

Fig. 1. Atsushi Taniguchi (left) and Yukinori Nishigami (right) sandwich Professor Seiji Sonobe holding their PhD diplomas. All three received their PhDs for their work with the minority organism, *Amoeba proteus*.

Describe your scientific journey and your current research focus

A.T. I have been interested in science since childhood, and I studied biology at university. I joined Professor Teruo Shimmen's laboratory at the University of Hyogo and studied cell membrane dynamics in the giant amoeba. After obtaining a PhD, I joined Professor Shigenori Nonaka's laboratory at the National Institute for Basic Biology as a research fellow. There, I engaged in research on the detection mechanism of nodal flow that determined left–right asymmetry in mouse embryos and acquired knowledge about mammalian embryonic development, microscopy techniques and experimental methods. Currently, I am studying the behavior of various protists, such as amoebae and ciliates, in their microenvironment at Professor Toshiyuki Nakagaki's laboratory at Hokkaido University.

Y.N. When I was a child, my mother taught me about the preciousness of living things, and my father taught me the joy of making things. When I think about it now, those experiences have greatly influenced me. My coauthor, Dr. Taniguchi, and I were classmates at university, and we belonged to the same laboratory and research similar subjects. We even obtained our PhDs at the same time. My degree research was on the creation of artificial amoeba. After obtaining a PhD, I continued this research as a postdoctoral researcher in Dr Masatoshi Ichikawa's laboratory at Kyoto University. In addition, I began research on the behavior of protists. Currently, I am researching the behavior of various types of protists under Prof. Nakagaki, who is famous for his maze-solving slime molds. Every day, I am impressed by how these tiny, invisible creatures work so hard to stay alive.

Who or what inspired you to become a scientist?

A.T. What made me want to become a researcher was observing pond water with a toy microscope as a child and being amazed by the numerous microorganisms moving around in a drop of water. I then joined Professor Shimmen's laboratory at the University of Hyogo, where I could research the protists, as I longed to do. In the laboratory, I researched the cell membrane dynamics of the giant amoeba under Associate Professor Seiji Sonobe, who taught me about amoebae, various protists, and experimental techniques. I also went to many places to collect protists for my fieldwork, observed various protists, and learned how to culture them. The experiences I gained during this period as a student form the foundation of my professional life.

Y.N. I am trying to remember specifically why I wanted to become a scientist. However, since I was a child, I have always thought, "I will be a scientist in the future." I am sure it was because my parents gave me an education, which granted me freedom, so that from the time I was born, every day was research for me. Perhaps I also subconsciously longed to be a researcher because my father was a dam development engineer. Additionally, after joining a research laboratory at the university, I saw my supervisor, Professor Sonobe, enjoying his experiments, and I felt that research is exactly the world I have wanted to be involved in since I was a child, which has also influenced my career.

How would you explain the main finding of your paper?

Cells adhering to a substrate move in a manner known as amoeboid locomotion. Although various studies have been conducted on this mechanism, it needs to be better understood how the plasma membrane, which surrounds the cell and is vital for interacting with the extracellular world, moves during amoeboid movement. The difficulty was tracking the movement of the whole cell membrane. In this paper, we developed a method to stain the cell membrane with polka dots and used this method to visualize the dynamics of the cell membrane during amoeboid locomotion. The results showed that the movement of the cell membrane differs between the dorsal and ventral sides of the cell, which is different from the previously expected motion of the cell membrane.

" … we developed a method to stain the cell membrane with polka dots … "

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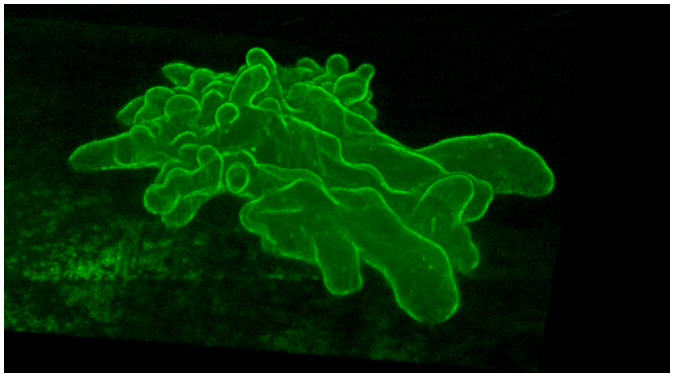

Fig. 2. Three-dimensional image of the cellular membrane of *Amoeba proteus* during amoeboid locomotion.

What are the potential implications of this finding for your field of research?

In this study, we used a kind of protist, *Amoeba proteus*. Amoebae perform a pressure-driven amoeboid movement, which has recently been shown to occur in protists and various other cells, including mammalian cells, in response to the extracellular environment. The polka-dot staining method we developed could be applied to other cells. We hope to use the technique to elucidate the membrane dynamics of cells in various biological phenomena.

"We hope to use the technique to elucidate the membrane dynamics of cells in various biological phenomena."

Which part of this research project was the most rewarding?

We have been working on this research since we were postgraduate students. Therefore, it took approximately ten years for the paper to be published. We had to devise various procedures for each experiment using a minority organism. We especially struggled to find a method to visualize dorsal and ventral membrane dynamics simultaneously. Before developing the current method, we tested various cell membrane markers and cell membrane staining reagents used on numerous cells in previous studies and performed microscopic observations. However, most of them were unsuccessful. We finally arrived at the published method and were very excited when we were able to visualize dorsal and ventral membrane dynamics simultaneously using light sheet microscopy.

What do you enjoy most about being an early-career researcher?

A.T. We can easily obtain advice from different perspectives by casually exchanging information or discussing with researchers in other fields at young researchers' meetings. It is advantageous that it is easy to actively adopt new methods and techniques and try them out with our experimental themes. I also have chances to discuss my research field with the general public through outreach activities. It is rewarding to have so many people interested in my work.

Y.N. It is not only for early-career researchers, but it is an exciting experience to learn about new things. Even if I make no significant research discoveries, I still progress every day, doing new things I could not do before or understanding formulas that were previously difficult to understand. The best part of research is enjoying these small steps one makes yourself.

What piece of advice would you give to the next generation of researchers?

Many experiments are not always carried out as you would like them to be, but it gives you a great sense of achievement when you obtain favorable results. It is essential to deepen your knowledge of your research topic. Nevertheless, it is also a good idea to acquire knowledge and skills in other fields related to experimental methods (For example, if your research is biology, learn about optics, engineering, etc.). This will help you in the future in advancing your research theme.

What's next for you?

Many unicellular organisms have unique cellular structures and organelles and perform unimaginable, strange behaviors (e.g. walking, morphological changes, predation). We want to understand their mechanisms by observing the behavior of these fascinating unicellular organisms.

Do you have any final words to say?

This paper was accepted the day before the final lecture of our PhD supervisor, Professor Sonobe. I am delighted that this paper was accepted before Professor Sonobe retired. He taught us the foundations of research and what researchers are. We hope that we can follow in his footsteps and continue to enjoy our research. In addition, we hope to pass on his philosophy to the next generation

Reference

Taniguchi, A., Nishigami, Y., Kajiura-Kobayashi, H., Takao, D., Tamaoki, D., Nakagaki, T., Nonaka, S. and Sonobe, S. (2023). Light-sheet microscopy reveals dorsoventral asymmetric membrane dynamics of *Amoeba proteus* during pressure-driven locomotion. *Biol Open.* **12**, bio059671. doi:10.1242/bio.059671