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INTERVIEW

Transitions in development – an interview with Chin-Min (Kimmy) Ho

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Kimmy Ho is an Assistant Research Fellow at the Institute of Plant and Microbial Biology, Academia Sinica, Taiwan. Her research focuses on leaf epidermal development. We caught up with Kimmy over Zoom to find out about her research, her transition to becoming a group leader and her approach to mentoring students.

Can you tell me how you first became interested in science?

When I was in junior high, I saw a picture of a tree on Jade Mountain, the highest mountain in Taiwan at 4000 m (13,000 feet). I started to wonder why the tree, a Juniper tree, was growing there alone in a place where the temperature is so low and it is so windy. I was interested in the shape of the tree and why it looks like it does. Our teacher started questioning us about it; he pointed out the shape of the leaves and asked us why we thought they were shaped like a needle. My answer back then was that it would reduce stress from the wind, so it doesn't fall off, and limits water loss through transpiration. That is how I started to get interested in biology, because of that picture and because I wanted to learn more about the shape of the plant.

For your PhD, you moved to the US, what prompted this move and how did you choose your lab?

I really wanted to go to other countries to explore different cultures; that was my dream. When I was looking for schools, I found that a lot of senior students from the National Taiwan University were attending UC Davis. When I looked into the school, I found that it was performing well in plant biology and this was important to me as I graduated from the botany department. I thought it would be a good choice for me and would help me pursue my future career. That was why I decided to apply there and I felt lucky to be selected. I chose the Liu lab because I was really interested in cells and how they – just like a tree – have different shapes. I thought it would be fantastic to be able to see the dynamics of plant cells. I wanted to image cell division events under the microscope. So that's why I joined Bo Liu's lab: to study how the cells decide to divide, how the microtubules reorganise, and how the cell makes a cell plate and then divides. I just like to see something move and something colourful. That's why I like cell biology!

What was your research focus during your postdoc with Dominique Bergmann at Stanford University?

I joined the Bergmann lab because I wanted to understand asymmetric cell division. Previous studies in her lab focused on the stomatal lineage: how a precursor cell becomes a stoma. To form a stoma, the precursor cell undergoes asymmetric cell division: the small cell becomes a stomatal cell, but its sister cell, the big cell, called a stomatal lineage ground cell (SLGC), had never been studied before. The SLGC has the ability, just like a stem cell, to either divide again or differentiate. I think it is very cool and I was most interested in this project asking 'what is the cell identity of the SLGC type?' Now, in this last year, we have finally published the data I obtained during my postdoc (Ho et al., 2021).

What were your most important considerations when you were looking for group leader positions?

I feel the environment is very important; having support from colleagues and from the director. You also need to see whether your research expertise fits the institute and whether they have the equipment needed to perform your research. These were my main criteria in choosing my place for research. During my interview at the Institute of Plant and Microbial Biology, Academia Sinica, I had some time for discussion with my colleagues, and I found

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The Juniper tree drawn by Shao-Li Yang

they were really supportive and interested in my research. They gave me a lot of suggestions and asked me questions; they made me feel as though we had the same interests and curiosity about nature. I felt then that I belonged here. I think the institute is the best place for research in Taiwan. We are equipped with many good instruments and we have specialists operating all the core facilities. So, I feel not only supported by the people but also, hardware-wise, that we are really well supported. I only looked for positions in Taiwan because I knew I wanted to come back here. I also applied to the National Taiwan University, but I prefer doing research to teaching, so I thought the Academic Sinica was the right choice for me.

What have been your most challenging moments in your transition from postdoc to group leader?

I feel that the most difficult thing for me was being focused on many projects at once instead of just my own project as a postdoc. You need to be able to help your teammates to think about their individual projects, so you need to read a lot. I think this is especially true for young group leaders, who may not yet have the profile needed to recruit experienced researchers. One of the challenges is to help new students to learn to think about their project; for example, by asking if the question is reasonable or discussing whether the experimental design is good enough for them to pursue the project. Keeping up the reading for multiple lines of research projects was very challenging for me initially.

What would be your advice to scientists starting their own lab?

I think the most critical thing is human resources – finding all your teammates. I definitely think that this is the most important thing. Of course, I wanted to find very motivated people. So, when I went to seminars, I would always pay attention to the students who asked questions. Then, after the seminar, I approached them to see whether they wanted to join my lab. One of my research assistants joined me after I approached her like this, and she's great. I feel that it is a really efficient way to find students as you can have discussions with them and find out if you have some similar interests. Since we are doing fundamental research, it's very important to have some curiosity in nature and in biology.

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Can you tell us about the research themes of your lab?

We are researching stomatal development. We know that stomata are very important structures for plants, for respiration and for controlling water loss. In my own lab, I want to extend my background in stomatal development to epidermal development. As well as stomata, the leaf epidermis has many other structures, such as pavement cells, trichomes or even cuticles on the leaf surface. I want to understand how, during the developmental process, each naïve cell decides to become one but not the other. How do they decide to become stomata, pavement cells or trichomes, and how is the cuticle formed? Does cuticle formation involve some crosstalk with stomata or other structures? How are they balanced? Basically, in a process just like any organ or tissue formation, how is the leaf epidermis formed?

What do you think is the most exciting new direction in your field?

Understanding the development of leaf epidermis and how plants adapt to their environment is important, especially with climate change affecting life around the world. In my lab, we consider how we can modulate the development programmes to make the plants grow stronger or fit better into particular conditions. We have some overexpression lines that produce the cuticle at the wrong time and then the stomata are produced in pairs. Usually, a stoma is a single mouth in the epidermis, but if you produce a cuticle early on, then you can start to disrupt patterning. This implies that stomata and cuticles have some crosstalk during development and they need to be balanced. One consequence of stomata forming in pairs rather than as a single stoma could be a reduction in the photosynthetic efficiency because under the stomata is a sub-cavity that contains CO_2 and then the photosynthetic machinery. But in nature, there are examples of clusters of stomata and we have observed this in Begonia. We think that because the stomata can crosstalk with each other, they actually have better water use efficiency. For example, in drought conditions, one stoma could be lacking water and could communicate to its neighbours, very efficiently, to close the stoma mouth. There are also some ideas that clustered stomata might build a shell so that water cannot evaporate at the same rate as compared to a single stoma. So, there are many hypotheses for us to test!

Do you have a particular approach for when you're mentoring students?

With my students, I like to give them free time. I will give them some questions and then wait for one or two days so they have time to think. Then I'll come back to them and we will discuss again; how to design experiments, how to write the introduction, etc. I'll come back to them again later to build upon that discussion, but I really like to give them the time to develop themselves. I also think the environment in the lab is very important and, even though I don't talk to them every day, I feel the other people in the lab will also discuss the projects. So, overall, I usually try to inspire them by asking them a question. Then later, I ask them, 'how do you feel about it?'

Do you think mentorship has been important for your career?

I feel that, in biology, you can learn skills from other people, but the big ideas and developing critical thinking are difficult to teach. You can't give people a set of guidelines, so a lot of that development comes through reading and discussion with others. In my postdoc lab, I feel that we had a good environment for doing our critical thinking together and discussing how to approach a lot of questions. When I was writing my manuscript, I would give it to my mentors to see whether they found it logical, whether it flowed and whether

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they had suggestions for me. I think having an environment where you can discuss science, rather than mentorship, is important.

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Is the funding system similar in the US and Taiwan?

I feel the funding situation is better in Taiwan than in the US. For an application in the US, especially with USDA, I think you need to be working on crops; for NIH funding, you need to be working on disease or human-related research. In Taiwan, I think that fundamental research is well supported. In my research institute, we don't have strict teaching requirements and, as I mentioned, our institute is really well equipped. I feel that the Academic Sinica is a good place to do research, so I would really encourage people who are interested in our research areas to come and see us or apply here.

Did you ever consider an alternative or non-academic career path?

I did my postdoc research in the Bay Area, and, as you know, there are a lot of biotech companies around there. A lot of my colleagues were interested in going to biotech companies and I felt that it was possible for me to do that. If I joined a biotech company, I thought I would have very focused questions and then try my best to solve them. At the time, I felt that it might be a different life than managing people and managing their different projects as an academic, but because I wanted to come back to Taiwan, I chose an academic career. Then, to my surprise, in my position now I feel I have so much freedom and I have my dream. I feel that teamwork is much better here than going to a biotech company. I can build my own team and then try to make my dream possible. I think it was a very good choice for me.

Finally, is there anything that Development readers would be surprised to learn about?

During college, I did field research. I measured the size of Taiwan cypress trees that are 1000 years old. I spent five days in the camp without showering; we were drinking from the river and cooking meals in the wild. I found that really special to me as a city girl, but I don't know whether it would surprise people!

Reference

Ho, C. K., Bringmann, M., Oshima, Y., Mitsuda, N. and Bergmann, D. C. (2021). Transcriptional profiling reveals signatures of latent developmental potential in Arabidopsis stomatal lineage ground cells. *Proc. Natl. Acad. Sci. USA* **118**, e2021682118. doi:10.1073/pnas.2021682118