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CELL SCIENTISTS TO WATCH

Cell scientist to watch – Pakorn ‘Tony’ Kanchanawong

Pakorn ‘Tony’ Kanchanawong grew up in Thailand and received his bachelor’s degree in chemistry and biological sciences from Cornell University (USA) in 2001. He then went on to Stanford University for his PhD work on non-classical Stark spectroscopy of photosynthetic reaction centers in the laboratory of Steven Boxer. Subsequently, Tony joined the research group of Clare Waterman at the NIH as a post-doc, where he used super-resolution techniques to study cell adhesion and cell migration. In 2011, Tony started his own research group at the Mechanobiology Institute (MBI), with a joint appointment in the Department of Biomedical Engineering, National University of Singapore. His research interest lies in dissecting the structure–function relationship that underlies protein complexes that are involved in cell migration and adhesion, as well as their capability to transduce forces from the environment into the cell.

Tony Kanchanawong

What inspired you to become a scientist?

The initial spark was astronomy, comets in particular. Halley’s comet happened to come by in 1986 when I was young, and my parents were very supportive and got us a small telescope. I actually didn’t see the comet, but from then on, I was tinkering with telescopes and cameras and computers. Later on, I was quite undecided between doing computer programming or biology, until I realised that I could actually do both. My undergraduate research at Cornell on simulating the molecular dynamics of proteins got me really hooked on research. The training was very interdisciplinary – I double-majored in chemistry and biochemistry, with an interest in programming, mathematics and physics. To me, there are no real boundaries between chemistry, biology, physics and maths.

Research projects in cell biology have certainly become more interdisciplinary. It seems that there are parallels between your career and the way the field has evolved

Yes, I would agree with that. But it was more of a series of unplanned adventures [laughs]! For my PhD, I joined the biophysics programme to work on spectroscopy of photosynthetic proteins with Steven Boxer at Stanford. Stanford has been one of the epicentres of single-molecule fluorescence spectroscopy, so it was a very interesting experience. After that, I looked again for something new and exciting, which led me to work on cell biology and super-resolution microscopy. Today, I’d probably consider myself a full-time cell biologist. I couldn’t have foreseen what I’m doing now, because many of the things that we’re doing were unthinkable – or impossible – 20 years ago.

What questions are your lab trying to answer just now?

We want to understand how molecules self-organise into the dynamic and very sophisticated machineries in the cells. Broadly speaking, it’s a question of how the structure–function relationship operates at the nanoscale. Our current focus is on cell adhesion complexes – focal adhesions and adherens junctions – which are the nexus of many important biological processes. We’ve been looking at the protein Talin in focal adhesions, and we’ve been studying the interaction patterns and conformational changes of vinculin in adherens junctions, using super-resolution microscopy. What we have seen so far, however, has been static snapshots. So, going forward, we want to look at the dynamics of the process: what are the molecular scale motions, and how can we ultimately link this to downstream biological functions. One of our key techniques is super-resolution microscopy. We’ve been involved in super-resolution microscopy since its early days, and although it’s more of a mainstream technique today, there is still a lot of room for improvement. That’s why we’re also quite active in the methodology development side of microscopy, as well as augmenting it with advanced computing approach, for example, integrating the technique with machine learning.

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Specifically, which super-resolution techniques are you working on?

We have been working with photo-activated localization microscopy (PALM) quite a bit. We’ve built our own setup for a specialised technique called interferometric PALM (iPALM),

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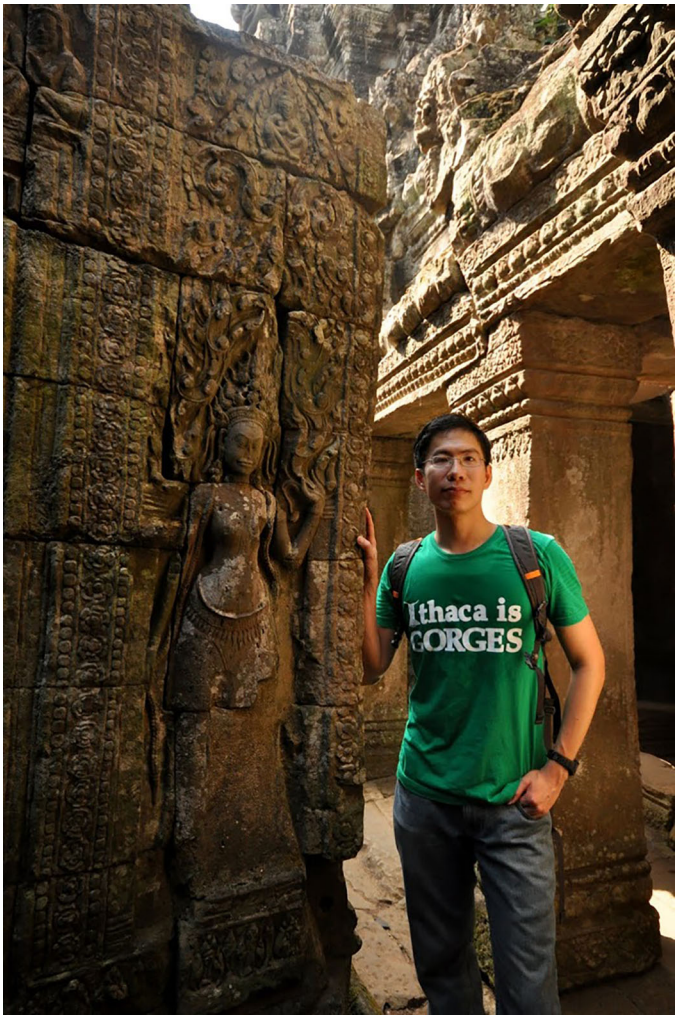

Travelling around Southeast Asia. Tony at Angkor Thom temple in Siem Reap, Cambodia.

which is a 3D-version of PALM. We're also using another specialised structured illumination technique. Going forward, we aim to make it easier to do live imaging and to integrate the workflow, from acquiring data to actually get some meaningful biological information, in a more streamlined way.

You've mentioned you have been involved since the early days. How must one imagine the work-flow of a project that develops a new technique?

My post-doc mentor Clare Waterman (NIH) is very receptive to new technologies, and she saw the potential for super-resolution microscopy early on. Such a project is actually a very collaborative process, because before everything is commercialized, you really need to work with a team of dedicated physicists or engineers. We got in touch with Eric Betzig and Harald Hess (Janelia) to explore how we could combine these super-resolution PALM techniques with cell migration research. Fortunately, NIH is only a 45-minute drive from Janelia Farm, so the collaboration and logistics of it was quite easy – we worked on the cell biology and would bring the samples to Janelia. Harald Hess and Gleb Shtengel, who worked on the iPALM setup, were very generous in sharing all aspects of how the system works. When I set up my own lab, they were very supportive in helping us to build these capabilities. To me, that's the synthesis of everything that I like about science.

What challenges did you face when starting your own lab that you didn't expect?

It's a very interesting process – it's a once-in-a-lifetime thing, especially in the first month, when there's just you and your computer and nothing else [laughs]. You suddenly become your own boss and the challenge is that everyone will be new to the lab and, also, how to get things going. What I did was I wore two hats – one being a group leader, and the other being my own post-doc. I think that helped ease the transition.

"Don't take any received wisdom for granted, because humans can deceive themselves very easily…"

How are the challenges that you're facing now different?

There's a lot of responsibility that I need to take care of in my office nowadays – it's quite different from the early days. Being at the bench, rather than working on a manuscript or presentation, makes you think differently about a project and that's one thing that I miss. I still do programming, data analysis, and developing software for my students and post-docs to use; aligning optics is also something that I still do, as well as fixing the microscope.

What is the best science-related advice you ever received?

To paraphrase my undergraduate advisor at Cornell, Gerald Feigenson: early on in a project or experiment, test out the assumptions rigorously. Don't take any received wisdom for granted, because humans can deceive themselves very easily, and it's best to be very sure that you're on solid ground before you go on.

What is the most important advice you would give to someone about to start their own lab?

A big difference between being independent and being a trainee is that, as the former, you mostly depend on your team, instead of doing things with your own hands. So it's very important to be judicious in choosing students and post-docs, especially in the early days. The early members of the lab set the tone, the theme and the culture of the lab. Spend a lot of time with your trainees, get to know each of them as a person and take it from there.

How do you achieve a work–life balance when you're trying to establish yourself as an independent investigator?

In a way, establishing a lab is similar to long-distance running, which is something I also do. Thinking of it in this way helps to put things in context. I also did a lot of hiking back then, so organisation, planning and logistics are important lessons that I draw on. I applied this to work as well, and I think it helps, at least for me. Concerning the day-to-day balance, I just unplug after a certain time. One good thing about Singapore is that you can swim in the morning every day of the year, so that's a big plus. I think your health is the most important thing, because if I'm healthy, I can do anything. There's a finite amount of time per day and I have finite amount of mental energy and focus, so I try to prioritise, and above all to maintain good health.

How do you get the most out of the meetings you attend, particularly in the early stages of your career?

Being in Singapore, it takes some pre-planning; we have to choose our meetings. I studied the programme and abstracts of conferences and decided which meetings I really wanted to go to, because of the

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distance and time that it takes to travel. Compared to the US or Europe, there aren't as many local or regional meetings. I think we invest more per meeting, so you try to learn a lot more.

Could you tell us an interesting fact about yourself that people wouldn't know by looking at your CV?

I enjoy cooking! Cooking is chemistry, and I approach this from the thought of combining – it's almost a synthesis of cultures – chemistry and biology. I've also been trying to invent some new dishes in my spare time, especially by mixing the cuisines of different cultures. I come from Thailand, so I like Thai and Asian food, but I spent 15 years in the States, and I actually like a lot of American dishes. In Asian cuisine, we don't use a lot of dairy products, such as cheese, but actually that's one of the things I like about Western cuisine. So what I'm trying to do is to pick all the good elements that I like and make something new, such as combining dairy products with Asian ingredients and see what combination works. Back in college, we did a lot of cooking and sharing with housemates, and I came up with one special fried chicken recipe that my housemates actually named after me [laughs].

Tony Kanchanawong was interviewed by Manuel Breuer, Features & Reviews Editor at Journal of Cell Science. This piece has been edited and condensed with approval from the interviewee.