

Title	Even when things felt they weren't going well, I would ask, "What can I do now?" This helped me gain a lot of valuable experiences. : associate professor Shu Tanaka
Sub Title	
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Publisher	Faculty of Science and Technology, Keio University
Publication year	2024
Jtitle	New Kyurizukai No.40 (2024. 9) ,p.4- 5
JaLC DOI	
Abstract	
Notes	Quantum annealing from Keio's Faculty of Science and Technology : challenging the frontier of physics and information science Shu Tanaka : associate professor Department of Applied Physics and Physico-Informatics The interview
Genre	Article
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO50001003-00000040-0004

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Even when things felt they weren't going well, I would ask, "What can I do now?" This helped me gain a lot of valuable experiences.

"I went from place to place before I landed my permanent research position," says Associate Professor Tanaka. Yet even throughout that period of uncertainty, he made use of his circumstances, and he has since established his own place in the new research field of quantum annealing. Now that he is the laboratory head, he shows a tougher side, saying, "Life is not so easy." Yet at the same time, he hopes that students with different backgrounds will be able to demonstrate their abilities and play an active role in their respective fields.

I understand that you are an Edokko (someone born and raised in Tokyo), correct?

I was born in Edogawa Ward in Tokyo, and went to the Tokyo Metropolitan Ryogoku High School. It was also where the famous writer Ryunosuke Akutagawa graduated before me. I guess my tendency to not worry about details is what makes me feel I am an Edokko. I went to the Tokyo Institute of Technology (Institute of Science Tokyo from October 2024) for my undergraduate and went on to the University of Tokyo for my graduate studies. Since I did not have a lot of financial leeway, I chose to study at a public educational institution.

When I think about it now, I wonder if everyone was desperately trying to do the same. This is probably a feeling that many people have to some degree when they are young. In the end, I realized that there is no point in rushing things, and that first and foremost, it is important to fulfill your role as a university student, for doing so will be a huge boon for the rest of your life.

What did you study in university and graduate school?

Throughout my schooling I studied physics. When I was in junior high or high school, I became really drawn to physics when I saw pictures and videos of magnets floating over superconductors. I thought, "If I learn physics, I'll be able to study about these kinds of phenomena, too!" It was from that point that I started thinking about a career in physics.

In my fourth year of university in 2002, the first place I officially

began research at was Professor Hidetoshi Nishimori's laboratory at the Tokyo Institute of Technology. In his physics lab at the time, Professor Nishimori was already working on quantum annealing. I was actually not interested in quantum annealing at the time, so I ended up choosing the option to tackle a problem with just pen and paper. It's something that many aspiring physicists dream of doing. Since I was a senior in college, I had only touched upon the relational expressions in physics reading them in existing papers at the time. Still, a very high level of mathematics was required.

Today, when I see students grumbling about physics calculations, I think back to those days and can't help telling them, "It's a good thing they're even solvable. Doing research means you have to take on solving problems that you don't even know if you can solve."

What led you to study quantum annealing, which you discussed in the research introduction section?

It was during my doctoral studies. I was working under Professor Seiji Miyashita at the University of Tokyo, and one day I came across a paper on quantum annealing that I thought was very interesting. When I mentioned this to Professor Miyashita, he encouraged me to give researching it a shot. When you look at the word "physics," you can see that it deals with "the physical." It was therefore a surprise to learn that non-physical things like information can be handled by a physical phenomenon called "quantum annealing."

Did you go on to continue researching about quantum annealing from that point onward?

Actually, no. I was unable to get a permanent position for a long time and went through multiple universities. Because I worked on research topics that I encountered at each of those universities, I did not work exclusively on quantum annealing for many years.

Including the laboratories at the Tokyo Institute of Technology and the University of Tokyo, where I spent my time as a student, the Department of Applied Physics and Physico-Informatics in the Faculty of Science and Technology at Keio University counts as my tenth department. In particular, my post at Kinki University from April 2010 was decided around February 15, about 40 days before I was set to start there. The fact that I had not been able to find a full-time position by that point was breaking my heart as a 29 year old.

It was around 2014, while I was at Kyoto University, that I began to focus on quantum annealing research, which I had been working on as side work since I received my Ph.D. It was at that





time that a company expressed interest in a paper I had published in 2009 on my research combining machine learning and quantum annealing. This helped get me serious about quantum annealing research.

While it was a rough time back then, it seems you had a really difficult time after graduation.

It was certainly tough, but I also saw friends who were similarly struggling to find jobs during the so-called “Employment Ice Age,” and I think I was able to make the most of the circumstances I was in at the time without being too discouraged. In my post-graduation career, I worked primarily with supercomputers and other computer simulations to gain insight into the properties of novel materials. One day, however, I began to think, “wouldn’t it be a good idea to know about experiments that actually create substances?” And when I was in the Ohkoshi Laboratory at the University of Tokyo’s Department of Chemistry, I underwent training in chemical experiments and learned how measurements and synthesis are actually done.

The active learning from researchers in other fields and, above all, the fact that they were right next to me where I could converse with them on a daily basis, fostered a sense of diversity in me. It was sometimes difficult to dive into a different field of study and conduct research while working through cultural differences, but I believe I developed insight and communication skills from that experience. I feel that this experience served me well in my various roles, such as head of a national project and CTO (Chief Technical Officer) of the venture company Quanmatic.

What kind of place is Keio University compared to all your experiences thus far?

Although each student’s circumstances are different, I believe that Keio University is a very good place to be. The Hiyoshi Campus is home to students from a variety of fields, not just science. Spending a period of time there while still young cultivates a broad perspective. Then as the student progresses

in their schooling and moves on to the science-focused Yagami Campus, they turn to concentrate on their own specialty.

Keio University has faculty members and colleagues all unique in their makeup, and people in the administrative department are very supportive. Even if for some reason you cannot go abroad to study or do something special, Keio students are in a good environment to learn and experience a lot. I hope that all students will absorb as much as they can there and use that experience to take a very active role in the future. And I hope I can help in any small way I can to make that a possibility.

◎ Some words from students . . . ◎

● The professor told me, “Why not come back again? You can visit as many times as you want until you feel this place is for you.” I did so and through the visits I felt that the vibe with the professor and students was good. I thought, “This is the only place for me!” I would like to go to graduate school and develop myself more in this world (4th year undergraduate student).

● I am from the Shu Tanaka Group’s first cohort of students. Although studying is not my forte, Professor Tanaka taught me about the difference between study and research and showed much kindness in guiding me through the process. I thought about joining the workforce after graduation, but I went on to a doctoral program and am doing research day-to-day. (1st year doctoral student).

● I earned my Ph.D in 2023 through the Shu Tanaka Group while simultaneously working in the private sector. This was my first research endeavor in the field of physics, but my professor eliminated all the reasons why I thought it was impossible and set me on a new path. He is a student-oriented person, and no matter how busy he is, he speaks individually with every student in the lab once a week. (project assistant professor).

(Interview and text writer: Akiko Ikeda)

For the full text of this interview . . .

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Having a problem you can solve is something to appreciate when you don’t know how a research topic will turn out

Shu Tanaka

Shu Tanaka specializes in Ising machines, quantum annealing, statistical mechanics, computational physics, and condensed matter theory. He graduated from the Department of Physics, Faculty of Science, University of Tokyo in 2008 and completed his doctoral degree at the Graduate School of Science in 2008. He holds a Ph.D in Science. After working for the Institute for Solid State Physics in the University of Tokyo, Kinki University, the Department of Chemistry in the University of Tokyo’s Faculty of Science, the Yukawa Institute for Theoretical Physics in Kyoto University, the Waseda Institute for Advanced Study, the Green Computing Systems Research Organization in Waseda University, he has been in his current position since 2020. Since 2022, he has served as Core Director of the Human Biology Microbiome Quantum Research Center (Bio2Q) at Keio University and CTO of Quanmatic, a start-up company he founded. He is also serving as Chair of the Center of Innovation for Sustainable Quantum AI as of 2024.

