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Finding the fun in the trials and tribulations of research

Professor Kawakami has conducted research in a variety of specialties dating back to his time at a Japanese college of technology, or "*kosen*." From strategies on how to survive as a researcher, experience on how to get out of tight spots, and an understanding of how to produce results, Kawakami's skills are on constant display in his work at Keio University.

After middle school, you ended up going straight to a "college of technology," or "*kosen*," right? (For our international readers, *kosen* refer to five-year programs or engineering schools that middle school graduates can attend to get an associate degree.)

Honestly, my first preference was to continue my education at a high school, but one of my middle school teachers told me that my grades would make that difficult, so somewhere along the way I ended up choosing to go to a *kosen*. I didn't really know what type of place it would be, but after I started attending, it ended up fitting me perfectly. There were a lot of atypical students, so I managed to fit in pretty easily. I was at home with them.

Also, the *kosen* teachers were like college professors. They each had their own specialties, and whenever they talked about things in their personal area of expertise, you could really tell that they had fun explaining what they were teaching us. Whenever I expressed confusion, they would take my questions seriously when answering. If there was no clear answer, they would suggest potential thought strategies about the topic so that I could get my head around everything. It was also a lot of fun watching the teachers interact with each other. I remember thinking "this is how science gets done, by people working like this."

That was a big moment for me. Up through middle school, I always thought that "studying" meant memorizing the information in textbooks and then filling it out on answer sheets. But as I listened to my teachers' conversations, I was able to come to terms with the idea that the things being taught might be useful. As I kept working to understand the things that interested me, my grades in those subject areas steadily increased.

Why did you decide to pursue research as a career?

Kosen are designed so that their main programs last for five years, but for students who are interested in pursuing a higher level of education, they also offer 2-year majors. A lot of *kosen* students end up entering the workforce after they've finished their core coursework, but I felt like if I had come this far, I might as well continue to do a major course.During my time at the school, I studied ceramic water filtration and other water purification methods and was greatly influenced by my then-advisor, Dr. Shiro Kubuki (who now works as an associate professor at Tokyo Metropolitan University.) When I was unsure about what I should do after graduation, especially since I had realized how much I enjoyed research, he was the one who recommended that I go to graduate school.

At the time, I remember him nonchalantly saying that he would like to collaborate on a project together if I made it as a researcher, but it felt like a bit of a pipe dream to me back then. As it turns out, in addition to my soccer ball nanoparticle project, I'm also working on some research on biological evolution using Escherichia coli which seems like a good match for Dr. Kubuki, so I think that a joint research collaboration might be a very real possibility in the near future.

So, after that, you completed your program at Hiroshima University and started your postdoc at Nagoya University.

That's right. In graduate school at Hiroshima University, I studied chrysanthemums and ascidian. After that, I was hired as a postdoctoral fellow at Nagoya University in the Laboratory of Bioinorganic Chemistry, which focuses on proteins. However, I spent all my time at Hiroshima University researching biological systems, so I had not been involved in chemistry research since I was in my *kosen* program. I didn't even know where to start to get involved in a research topic. I decided to ask the other students what was the most difficult or interesting chemical reaction they knew about at the lab. If I was somehow able to produce a chemical reaction that everyone else thought was impossible, I figured it would benefit both the lab and my ability to survive as a researcher.

As luck would have it, we did manage to produce exactly such a chemical reaction. The only problem was that there was a German research lab which had submitted a research paper on the same topic at the same time. If our paper's submission was even slightly later than theirs, the chemical reaction would be credited to the German researchers. If that happened, I feared that I might reach the end of the road in my research career.

And this research experience is what later led to your success in creating the soccer ball-shaped nanoparticles?

Well, actually, after I came to Keio, I was working on another molecular design project before the soccer-ball nanoparticles, but I just couldn't get it right. It was one failure after another. I had a professor at Tohoku University analyze some of the molecules I had created so that I could learn about their structures. They told me that "it's pretty much garbage" after their observations revealed that the particles were all a bunch of different sizes.

This happened after putting a little over a year of work into that project, so it was really discouraging. My contract at the time could only last up to three years. I remember thinking that I had finally reached the end of my time as a researcher, but as soon as I came to this conclusion, I realized that I might as well go out on a high and work on the molecular design I wanted to do. On the bullet train ride home from Tohoku University, I turned to one

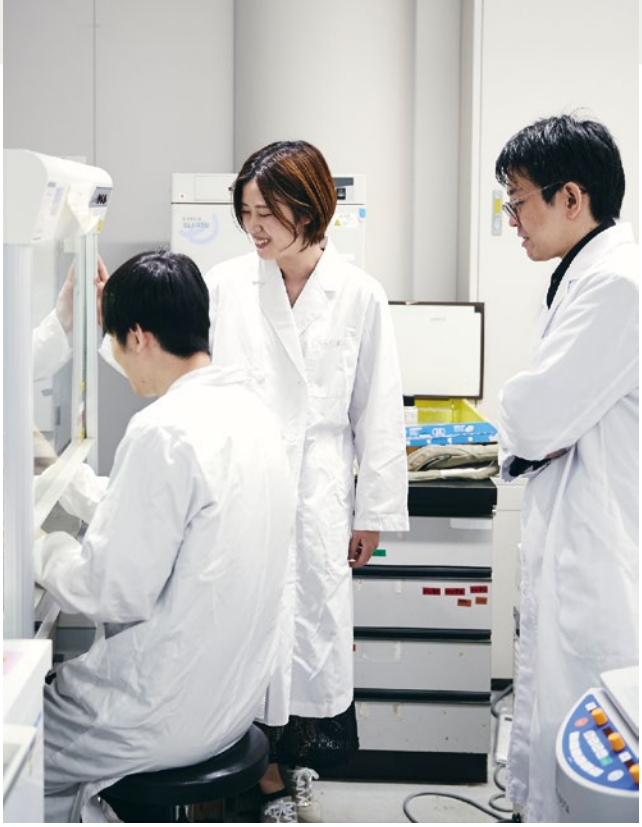
of my students and said enthusiastically, "We're going to make a soccer-ball shaped molecule." I'm not really the type to dwell on things. I think that's one of the reasons I've been able to come this far.

I have a strong desire for my research to be useful to other people, but when it comes down to it, I create what I want to because it brings me a sense of self satisfaction. For me, molecular design is like the feelings a person might get from working on a painting. While it is demanded that research be functional in our day and age, I also want to prioritize my personal interests and the internal inquisitiveness that research elicits.

Since coming to Keio University, what is your impression of the atmosphere here and in your laboratory?

Compared to the national universities, I would say students are given a large degree of freedom. Students are very honest and upfront with the teachers, so it's easy to talk with them, get an idea of their personalities, and provide guidance as necessary.

I've experienced quite a few different laboratories and the atmosphere in the lab can drastically influence the level of motivation everyone feels towards the research. This is why I want to prioritize making the workspace as inviting as possible. I make a point of talking to the students regularly as a part of my teaching philosophy.



◎ **Some words from students . . .** ◎

● I am working on the E. coli biological evolution research project. I chose this laboratory largely because of Professor Kawakami's personality. He's enthusiastic about answering any questions I have and keeps things light by joking around with us a lot of the time, so it's really easy to approach him for advice. He'll discuss things with us until we're all satisfied with things, so I feel like I can be proactive in making progress on the research (2nd year master's student).

(Interview and text writer: Chisato Hata)

For the full text of this interview
https://www.st.keio.ac.jp/en/kyurizukai/

It is important that research be useful, but the ultimate goal is for it to bring personal satisfaction.

Norifumi Kawakami

Specializations in protein science, enzyme engineering, and the bio-metal science . 2004 graduate of the National Institute of Technology, Ube College (NITUC) with a degree in Chemical and Biological Engineering. In 2009, he completed the coursework for a Ph.D. at the Department of Biological Science, Graduate School of Science, Hiroshima University. Ph.D. in Science. After working as a postdoctoral researcher at the International Research Center for Materials Science and at the Department of Biological Science at Nagoya University, he became a project assistant professor at Keio University's Department of Biosciences and Infomatics in the Faculty of Science and Technology in 2014, and a senior assistant professor in 2017, a position he still holds.