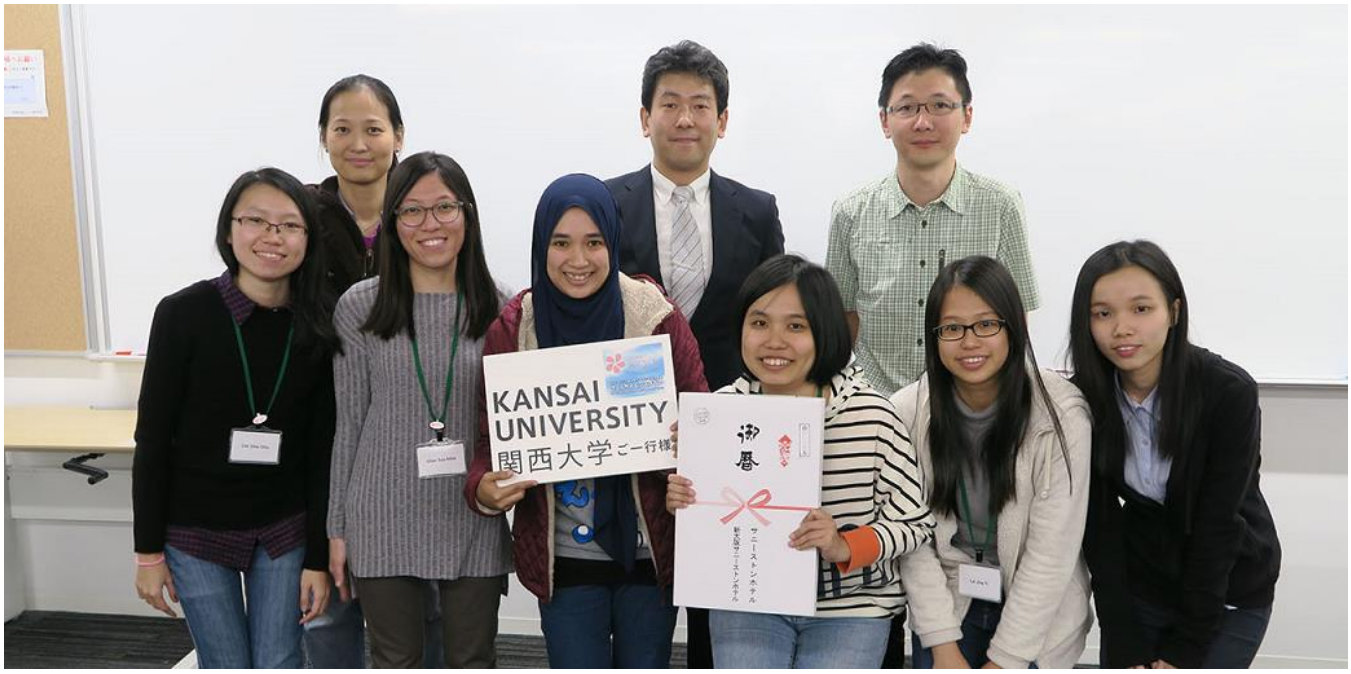
[Example of international activities at Kansai University]

Sakura Exchange Program in Science (University of Science Malaysia)

Associate Professor Akinori Kuzuya
Faculty of Chemistry, Materials and Bioengineering



At the completion ceremony

[Activity Outline]

Main activity	Student exchanges with universities overseas
Related organizations	University of Science, Malaysia (Universiti Sains Malaysia)
Duration	November 27 to December 10, 2016
Number of participants	8 students from USM

[Interview with Associate Professor Kuzuya]

—Could you tell us how this activity started?

Associate Prof. Kuzuya:

Well, it's a long story, but this activity started from a research project I was involved in with a teacher at the University of Science Malaysia (USM) some years ago. I met this teacher through the introduction of a prominent professor in my research field. In the course of the joint research, Kansai University (KU) exchanged students with USM, sending two KU students to USM for about a month and then accepting one USM student to KU for a month. While continuing our research, I often heard the USM students saying that they had some difficulties using the equipment to conduct their research, because in terms of facilities, KU was relatively well-equipped, but USM was not. This led me to think about inviting all students of our counterpart laboratory at USM to KU so that they could use all the equipment of our laboratory as a training course. Then an idea came to me—why not do this through the Sakura scheme, a student exchange program in science?

—Could you elaborate on the activity?

Associate Prof. Kuzuya:

On the first day, a welcome party, organized mainly by me, was held for the participants from USM. Other faculty members from the Faculty of Chemistry,

Materials and Bioengineering and students from my laboratory also joined the party to deepen the exchange with them.

Welcome party

On the second day, after an orientation session and tour of the research facility at Senriyama Campus, we shared basic knowledge on methods for the chemical synthesis of DNA. On the third to the seventh day, we conducted hands-on experiments on chemical synthesis of DNA, as well as purification and analysis of the obtained DNA. Firstly, we had the students use an automated DNA synthesizer to chemically synthesize DNA. Then, using polyacrylamide gel electrophoresis (PAGE) and high performance liquid chromatography (HPLC), both of which are used daily at our laboratory, we purified the obtained DNA samples and analyzed them using mass spectrometry.

The USM participants are basically biology students, who rarely have the chance to learn about the chemical aspects of the techniques they are familiar with. So this joint session seemed to have inspired them a great deal.

Preparing polyacrylamide gel

—What do you mean when you say, "the USM participants are basically biology students, who rarely have the chance to learn about the chemical aspects of the techniques they are familiar with"?

Associate Prof. Kuzuya:

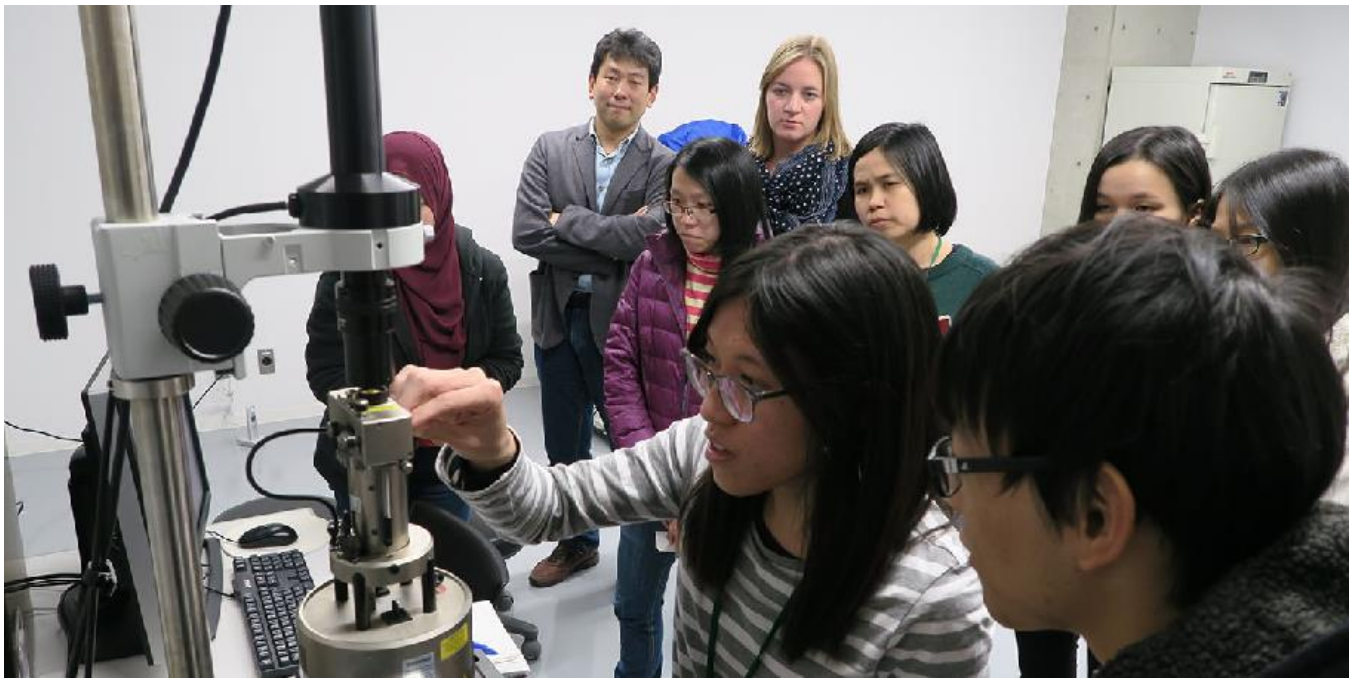
What I mean is that at USM, their studies center more on biology while we focus more on chemistry. So this program originally began to complement each

other's specialties. We take DNA exclusively as a substance or a material. On the other hand, biologists use DNA as something that plays a role in organisms. Normally, DNA is mentioned in the context of genes or genetic information inherited from parents. But in our research, DNA is a substance, totally separate from organisms. This point is where we differ from biologists.

In other words, in biology, DNA is used as a medium for recording genetic information, like DVD-ROMs, CD-ROMs, or Blu-ray discs. So, in their laboratories, it is like purchasing DVD-ROMs inscribed with information and playing them. This is how they use DNA in biological labs. What we do at our laboratory is like building DVD-ROMs from scratch—not only preparing information to be recorded but also producing the material itself. So, it must have been a good experience for the USM students to learn how to make discs and actually be engaged in the making process.

Associate Prof. Kuzuya:

On the ninth to the twelfth day, I lectured on the origami structures of DNA and their application, followed by practice in the creation of DNA origami structures and analyzing them. We firstly confirmed how DNA origami structures were formed and purified them using agarose gel electrophoresis. We then observed the created structures by using a transmission electron microscope (TEM) and an atomic force microscope (AFM). Through the AFM, we obtained clear images of DNA origami structures. We had the students use these microscopes repeatedly so that they could get used to their operation. We then wrapped up the program, and presented certificates to the participants at the completion ceremony.



Handling an atomic force microscope (AFM)

— Could you explain more about origami structures in such a way that liberal arts majors like me can easily understand?

Associate Prof. Kuzuya:

Well, in my lectures I often liken it to weaving bamboo baskets or bamboo sieves. Just imagine that you are making something as small as a molecule, using DNA, instead of bamboo. If it was bamboo weaving, you could use your hands. But you cannot use your hands in making a molecular-scale structure because molecules are too small to touch. So we write sequence information on DNA and let it automatically build up in accordance with the blueprint. Roughly speaking, we use this mechanism of DNA for making origami structures.

In my research, the characteristics of DNA that organisms take advantage of, such as its information storage ability or tidy string-like structure, are utilized outside the body of an organism in the form of materials.

— Does this expertise help improve diagnostic techniques in the medical field?

Associate Prof. Kuzuya:

Yes, I hope it will in the future. Still, it may take 50 more years or so.

—The program you carried out by using the Sakura Exchange Program in Science consisted of two parts; in the former part, namely the third to the seventh day, participants practiced the chemical synthesis of DNA, and in the latter part, they learned how to create DNA origami, your specialty. The first part seems like a preparation for the latter. What did you expect the USM students to learn?

Associate Prof. Kuzuya:
The latter part was basically on DNA nanotechnology, exactly my research theme. It's difficult to liken it to anything else, but think of cooking in a cooking class. The hands-on experience of the chemical synthesis of DNA in the former part is comparable to growing ingredients in our own farm for a cooking class: "Let's grow vegetables for the class."
This program would work perfectly well without the first part. However, I believe the strength of our university lies in our capacity for going through the whole process, from the first step of producing materials on our own. Researchers in other fields sometimes say that we are acting cunningly, like creating a new kind of card and making new functions for them, while playing a card game named "research." Surely that is our strength. That's why I included the experimental part in the program, hoping it may help students develop new ideas in the latter part. A full-course-like program was thus designed, considering that two weeks would be enough to cover all processes.

—Have you experienced any difficulties in organizing the activity?

Associate Prof. Kuzuya:
Thanks to the support of the staff members of the Research Support Division, I didn't have much difficulty. I am truly grateful to them.
If any, a part that was a little tricky was the program's rules that specify "only foreign nationals with no experience of residing in Japan are eligible." Among prospective participants, there happened to be one student who studied at KU for a month just before the program. Confirming whether or not each participant ever visited Japan was troublesome.
Furthermore, although the rules also specify that exchange students should be only from Asian countries, our counterpart laboratory at the USM had a long-stay German student. As we invited all the students of the laboratory, handling the case of this student was a bit complicated; in fact we had to use our own funds for her.

—How would you like to develop this program from now and into the future?

Associate Prof. Kuzuya:
Every year, students of our laboratory make up a team to participate in an international students' contest, a science version of the Robot Contest (Robocon). As part of this, we hold a domestic preliminary annually with Osaka University, Tohoku University, and other universities in Japan. Now a plan to expand it to an Asian-wide preliminary is under consideration. So by using this Sakura Science scheme, we are working out how to invite student teams from China, Hong Kong, and Taiwan. I truly felt that the Sakura Exchange Program in Science was very beneficial, I hope we can make more use of it for academic and educational exchanges with universities overseas.

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