

## Passport to an international career—True globalism

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The Nobel Prize in Chemistry 2010 was awarded jointly to Richard F. Heck, Akira Suzuki, and Ei-ichi Negishi for their contributions to the development of organic synthesis that is also important industrially. Since palladium-catalyzed cross coupling is an area in which Japan is strong and for which it had been widely expected that someday someone would receive the award, I honor the three winners and at the same time appreciate having the opportunity to learn of the achievements made by many researchers engaged in this area of study. It is well known that many of the Nobel Prize winners pursue their research work in the United States, and Japanese winners are no exception. Among the fifteen winners up to 2010, the five winners of Ei-ichi Negishi (Nobel Prize in Chemistry 2010), Osamu Shimomura (Nobel Prize in Chemistry 2008), Yoichiro Nambu (Nobel Prize in Physics 2008), Susumu Tonegawa (Nobel Prize in Physiology or Medicine 1987), and Reona Esaki (Nobel Prize in Physics 1973) have placed their research positions in the United States.

### Brain drain to the United States

Many of these winners started their research career in the difficult years after the Second World War, and voluntarily sought a better research environment in the United States. They are pioneers of the so-called “brain drain” to the United States. While the word “brain drain” may have a somewhat negative sound, the researchers who left for the United States during this period have contributed greatly to the globalization of Japanese science. Differing from a few years of study abroad, these researchers have headed up research laboratories at overseas universities and research institutions, gathering many young Japanese researchers and providing them with opportunities to meet and become better acquainted with researchers from other countries during their overseas study. In the field of experimental physics, research activities are carried out globally especially in areas that require large research facilities. Gen Shirane (deceased 2005), who left for the United States around the same time as Yoichiro Nambu and was leader of the neutron experiments at Brookhaven National Laboratory, promoted Japan-U.S. projects undertaking collaborative research with the support of both countries, and contributed to the advancement of our nation’s science beyond the scope of an individual. Even today in the field of physics, it is not rare for young researchers to establish themselves in the United States. The achievements of Hitoshi Murayama of elementary particle theory, who assumed his post as professor at the University of California, Berkeley in his mid-thirties in 2000 and was later appointed as the first director of the Institute for the Physics and Mathematics of the Universe established at the University of Tokyo in 2007 still remain fresh in my mind.

In chemistry, where many receive their Ph.D.s in Japan, obtain a position temporarily at the university, and then leave for the

United States, it is rare for one to earn one’s Ph.D. in the United States like Ei-ichi Negishi. Satoru Masamune left Japan to study at the University of California, Berkeley in 1957 as a Fulbright scholar, and later became professor at Massachusetts Institute of Technology (MIT) nurturing many organic scientists. Hiroaki Suga of the Department of Chemistry, School of Science, The University of Tokyo, and Yukishige Ito of RIKEN, who is presently working on glycotriology at Exploratory Research for Advanced Technology (ERATO), have both studied at MIT’s Masamune Laboratory. Kazuo Nakamoto (Professor Emeritus at Marquette University in the United States, deceased June 2011) of infrared or Raman spectroscopies left for the United States in 1958, and is famous for his editions of “*Infrared and Raman Spectra of Inorganic and Coordination Compounds*,” with which I am sure many of you are familiar. Takeshi Oka (Professor Emeritus, The University of Chicago), engaged in interstellar spectroscopy research such as elucidation of the structure of  $\text{H}_3^+$ , left for the United States in 1963, a year before the Tokyo Olympics, which led to Japan’s entry into a period of rapid economic growth.

If the post-war reconstruction period is considered the first generation, then the period around 1970 may be said to be the second generation. Major organic chemists, recognized for their achievements, started to be invited as faculty members for overseas universities. In 1969, Koji Nakanishi of Nagoya University was asked to become professor at Columbia University. In 1972, Yoshito Kishi, who was assistant professor of the Faculty of Agriculture, Nagoya University, was invited as visiting professor to Harvard University. He later became professor at Harvard University succeeding Robert B. Woodward, and nurtured many Japanese researchers. Postdoctoral fellows who studied under Kishi are Tamejiro Hiyama (Kyoto University), Shunichi Hashimoto (Hokkaido University), Tadashi Nakata (RIKEN, currently Tokyo University of Science), Masaaki Suzuki (RIKEN), and Tohru Fukuyama (Faculty of Pharmaceutical Sciences, The University of Tokyo) who was Kishi’s favorite disciple. Just before the renewal of the Japan-U.S. Security Treaty in 1970, student protest movements broke out, ignited by the medical students at the University of Tokyo in 1968. Just about the time of the fall of the Yasuda Auditorium in 1969, universities were in the midst of reformation and probably in no condition for researchers to continue their studies. A further decade later in 1983, Iwao Ojima of Sagami Chemical Research Institute was invited to the State University of New York at Stony Brook, and has been professor there since 1984. After the mid-1980s, as Japan’s research environment improved, major trades in the field of chemistry have not been heard of. As I mentioned above, researchers residing abroad, said to be part of the brain drain from Japan, have received young Japanese researchers and contributed greatly to nurturing young human resources. Moreover, before universities were turned into independent administrative corporations, many young Japanese researchers were dispatched overseas while

keeping their position as a university teaching assistant or research institute staff, which also served as a driving force in nurturing human resources of this generation. Today's universities cannot afford to send assistant professors abroad. Overseas study in the middle of a five-year fixed-term employment would be unreasonable to an employer and probably uncomfortable for the employee also under the present system of repeated short-term employment.

The brain drain to the United States had once been an issue that attracted media attention. Japanese people still hold a somewhat narrow view that people who have received education sponsored by the government using a considerable amount of taxpayers' money should remain in Japan and work for domestic society and that this is the proper way of using taxes. We must once again remind ourselves that the brain drain, which was an issue, has contributed greatly to the improvement our country's scientific education and research level as well as its globalization.

#### **New type of brain drain**

In 2002, at the invitation of the Singapore government, Yoshiaki Ito, a world authority in cancer genetics research and former director of the Institute for Virus Research, Kyoto University, moved to Singapore after reaching the retirement age of sixty three, bringing along with him nine staff members of his own research lab. This unprecedented brain drain of a whole lab threw the academic world into an uproar. In Japan, researchers are forced to scale down their research group and reduce research activities after retirement. In contrast, Ito assumed the posts of director of Oncology Research Institute, National University of Singapore, and professor of Institute of Molecular and Cell Biology. He has been given by the Singapore government an environment in which he can concentrate on his research activities, and is expected to make further contributions. Also in the field of chemistry, an increasing number of researchers reaching retirement age are transferring to overseas universities and institutions in order to ensure their research activities. In 2007, Koichi Narasaka, after retirement from the University of Tokyo, moved to Singapore also as professor of Nanyang Technological University (NTU), and continues to be active in the front line of research. Motoki Yamane and Shunsuke Chiba, who moved to NTU with Narasaka, are currently assistant professors and, together with Narasaka, strive to strengthen NTU's synthetic chemistry. In 2002, Hisashi Yamamoto transferred from Nagoya University to the University of Chicago just before turning sixty. He earned his Ph.D. at Harvard University under Elias J. Corey, and, after working at Toray's research lab and Kyoto University, spent a few years from 1977 on the faculty of the University of Hawaii. Being an international researcher, Yamamoto probably could not fit into the Japanese unified employment system.

In the field of physical chemistry, the College of Science,

National Chiao Tung University (NCTU), Taiwan, is gathering researchers in molecular science. Hiroshi Masuhara (guest professor at Nara Institute of Science and Technology) promotes research in bio-molecular probe at the Masuhara Lab of the Center for Interdisciplinary Science, apart from teaching as chair professor in the Department of Applied Chemistry. Hiroki Nakamura, former director general of the Institute for Molecular Science, and Yuichi Fujimura of Tohoku University have also joined the Department of Applied Chemistry, assuming responsibility for an area of the Department. Takayoshi Kobayashi, former professor of the Department of Physics, Faculty of Science, The University of Tokyo, is active in the area of quantum science. The new pattern of globalism can be said to also have an important role in supporting the rapid growth of the research market in Asian countries.

#### **As a member of the international science community**

I wonder why the Japanese mass media do not show interest in incidents in which Japan or its people have little direct involvement. I have no objections to foremost reporting the earthquake of March 11, which was one of the worst disasters Japan has experienced, or the subsequent Fukushima radiation issue, which is a global concern. But, when we take a look around the world, a wave of big political changes is spreading across Arabian countries and about to change world history. It is my hope that morning shows recognize the significance of these incidents to a greater extent. Similarly, scientists also tend to see things through the Japanese perspective of whether or not Japanese people are active abroad or on par with international standards. In order for the Japanese scientific community to truly globalize, Japan's positioning in the global circulation of human resources is an important factor. How much merit as a career passport would there be for world-class researchers to experience research work at Japanese research institutions? This point would not be missed should young researchers from abroad wish to study in Japan. The main reason for a leading German academic to gain research experience as a postdoctoral fellow at a top U.S. university or institution is probably because the experience is required in further developing his/her research career in Germany.

When considering our country's globalization, the brain drain phenomenon mentioned above makes a significant contribution. Inviting foreign researchers from countries that do not yet have a well-resourced research environment is exactly the situation Japan experienced in the first generation of its brain drain. On the other hand, in inviting foreign researchers from countries that have well-resourced research environment, we should bear in mind the roles assumed by the second generation of the brain drain. In other words, researchers who come to Japan as a postdoctoral fellow and achieve excellent results should be given the

environment and position to carry on research in Japan. They will no doubt foster young talented people of their country and eventually function as a core of the global research network. In inviting researchers from developed countries of Europe and the United States, we should choose young talented researchers who have already made or are expected to make notable achievements, and hope that they will further their research. The most important point would be not to confine their activities within Japan but to make arrangements so that they may be able to acquire enviable positions when leaving Japan. While the style of the government in recent years is to set numerical goals, for globalization (I think the very existence of the term shows that Japan still has a long way to go), it is important that various actions are taken so that research experience in Japan would become a passport to an international career.

Around the 1960s, an interesting attempt was made at Kyushu University. It was a strategy, put forth by a chemistry-related department at the Faculty of Engineering, Kyushu University, to have promising students complete their Ph.D.s in the United States after receiving their master degrees at the university. The attempt was proposed by the late Professor Saburo Akiyoshi who had felt that Japan's graduate education, despite its research education, lacked real education and academic training. The proposed attempt was to practice the American way of doctoral education at Kyushu University by having its graduates experience firsthand doctoral programs in the United States. As more and more graduates educated abroad returned to Kyushu University, another attempt was made at the newly-founded Department of Synthetic Chemistry, Faculty of Engineering, Kyushu University. While researchers tend to confine themselves within the domain of their research themes in Japan's graduate education, Akiyoshi required comprehensive subjects compulsory for the master course, had graduate students write review papers on subjects beyond their research themes, and established an education system heading to acquiring broad knowledge. He also helped Kyushu University become the mecca of physical organic chemistry. The strategy to have graduates complete their Ph.D.s in the United States produced many renowned professors, among whom are Toyoki Kunitake (currently President, Kitakyushu Foundation for the Advancement of Industry Science and Technology; Professor Emeritus, Kyushu University), Taku Matsuo (Professor Emeritus, Kyushu University), and Yukito Murakami (Professor Emeritus, Kyushu University). It is fascinating to learn that such strategic development of human resources had been pursued with high aspirations, earning Fulbright scholarships, etc. to cover the high travel expenses of the time, which alone cost many times the annual income of a salaried worker.

### Long stay by distinguished professors

When I was a graduate student, leading researchers made long stays at the lab from time to time, providing students with the opportunity to talk directly with great professors. Some noteworthy persons are Professor Gerhard Ertl of the Fritz Haber Institute of the MPG (Max-Planck-Gesellschaft), who won the Nobel Prize in Chemistry 2007, and Gabor A. Somorjai, professor at the University of California, Berkeley, who won the Wolf Prize in Chemistry in 1998. They both were researchers considered founders of the field surface chemistry, and stayed at the Tamaru Lab of the Faculty of Science, The University of Tokyo, for a few months around 1977-78 using the sabbatical program. For young students, the experience of having been able to discuss directly with such scholars who have founded a certain field of research was one that might change their future research careers. It has an advertising effect essentially different from those of reading research literature and listening to academic lectures from a distance. The opportunity to talk directly with well-established researchers, even if they are not so renowned, is a valuable experience for students. In other words, the best way to find young competent researchers is to go out and advertise directly. In recent years, the situation in Japan has become difficult for researchers to leave Japan for a few years due to their busy schedule of teaching and university management. I think the time has come to review the system. I do not appreciate a situation in which all generations whether young or older are tightly bound. Isn't it time to switch over to a wider strategy to create a world trend? We must improve our system to enable extended overseas stays using such systems as the sabbatical system so that researchers may take the initiative in advertising and carrying out collaborative research work outside the country. Furthermore, efforts must be made to position Japanese research institutions and universities within the global flow of human resources. I believe that is the path to true globalism.

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