

San-ichiro Mizushima and the Realignment of the International Relations of Japanese Chemistry

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Introduction

The period between the 1920s and the 1960s was transformative for both the history of chemistry in Japan and the history of chemistry worldwide. One key way to discuss the relationship between these two concurrent developments is to analyze how Japanese chemistry became connected to chemistry at large by focusing on the personal connections of key players, international congresses and organizations, and also on publications in this process. The question I hope to address here is how these three media together affected the realignment of the international relations of Japanese chemistry around the time of the Second World War.¹

San-ichiro Mizushima (1899-1983) is an ideal key player on whom to focus.² A notable Japanese physical chemist of international standing, Mizushima pioneered studies in quantum chemistry and conformational analysis, and around 1940 coined the “gauche” form of rotational isomers, a conformation where two vicinal groups are separated by a 60 degree torsion angle. He had extensive personal connections with top chemists and physicists around the world. For example, a picture was taken at the old shogunal capital of Kamakura on February 23, 1955, while Linus Pauling (1901-1994) and his wife, Ava Helen (1903-1981), were visiting Japan for the first time.³ It features the Paulings, the famous Great Buddha statue in Kamakura, and Mizushima who was their host during their Japan tour. This photograph suggests that he had strong connections with American scientists.

This was not the case at the beginning of Mizushima’s career. After training in chemistry at Tokyo Imperial University, he went through an overseas study with Dutch physicist Peter Debye (1884-1966) at the University of Leipzig between 1929 and 1931. Mizushima immersed himself in the German scientific world right after completing his university studies, publishing papers in the prestigious physics German journal, the *Physikalische Zeitschrift*.⁴

¹ For the history of internationalism in science, see, for example, Frank Greenaway, *Science International: A History of the International Council of Science Unions* (Cambridge: Cambridge University Press, 1996) and Geert J. Somsen, “A History of Universalism: Conceptions of the Internationality of Science from the enlightenment to the Cold War,” *Minerva* 46 (2008): 361-379. For examples in chemistry, see Roger Fennell, *History of IUPAC, 1919-1987* (Blackwell Science, 1994), Danielle Fauque, “French chemists and the International Reorganisation of chemistry after World War I,” *Ambix* 58 (2011): 116-135, and Yoshiyuki Kikuchi, “World War I, International Participation and Reorganisation of the Japanese Chemical Community,” *Ambix* 58 (2011): 136-149.

² For an outline of Mizushima’s life, work and their historical context in Japanese chemistry, see Yoshiyuki Kikuchi, “Mizushima, San-ichiro,” in *New Dictionary of Scientific Biography*, ed. Noretta Koertge (8 vols, Farmington Hills, Mich.: Scribner’s/Thomson Gale), vol. 5, 167-171.

³ One can browse this picture on the webpage (<http://scarc.library.oregonstate.edu/coll/pauling/calendar/1955/index-document.html>), last accessed May 1, 2015). The Ava Helen and Linus Pauling Papers, Oregon State University Libraries Special Collections and Archives, Corvallis, Ore., USA. This source is hereinafter referred to as “the Pauling Papers.”

⁴ San-ichiro Mizushima, “Anomale Dispersion und Absorption elektrischer Wellen,” *Physikalische Zeitschrift* 28 (1927): 418-421; and *idem*, “Streuung von Atomen,” *Physikalische Zeitschrift* 32 (1931): 798-803

However, after the end of the Second World War, he quickly established himself as one of the leading scholars in conformational analysis especially influential in the United States. He was offered the prestigious G. F. Baker lectureship at Cornell University and the P.C. Reilly lectureship at the University of Notre Dame, both in 1951. Mizushima published an English monograph based on the content of these lectures, published by the New York-based Academic Press in 1954.⁵

Significantly, Japan was readmitted to the International Union of Pure and Applied Chemistry (IUPAC) in 1951. Mizushima was one of the few Japanese participants in the 1951 IUPAC meeting in New York. Four years later in 1955, he became a bureau member of the IUPAC and stayed in this office until 1967. Japan's increasing standing in the IUPAC thus seems to have been entwined with the evolution of Mizushima's international relations from predominantly German to American connections.

This narrative of realignment away from German connections to those American around the time of the Second World War is well-known among historians of science in Japan and possibly elsewhere in the world.⁶ The key question here is *whether and how* these international functions and personal connections were related to each other. To answer to this question, I shall focus on the year 1951, when Mizushima made his first overseas trip after the outbreak of the Second World War. What factors made this trip possible? Did Mizushima's participation in the IUPAC international functions affect the evolution of his personal American connections, or was it the reverse? I shall first look at the respective roles of Pauling, Debye and others in Mizushima's 1951 trip to the United States. I will then address the question of why Mizushima was involved in the IUPAC's business. In conclusion, I will discuss the need to reconsider the very notion of being *international vis-à-vis transnational* in order to understand Mizushima's behavior in the post-Second World War world.

Pauling, Mizushima, and "a symposium"

In one of his first letters written after the end of the Second World War, in September 1950, Mizushima told Pauling:⁷

I have been recently invited to participate in a symposium on "Bond Energies, Force Constants and Bond Distances" to be held in New York next September and to talk to the seminars of some laboratories about the research works of our laboratory.

On this occasion I should like to realize my dream of visiting your very excellent laboratory of structural chemistry, if you would kindly allow me to do so. I would be very grateful, if any member of your laboratory would discuss on our works on internal rotation or on our infra-red investigation of proteins, [...]

To which Pauling replied that he looked forward to seeing Mizushima in the symposium, adding that "we have discussed your papers in the Journal of Chemical Physics and the

⁵ San-ichiro Mizushima, *Structure of Molecules and Internal Rotation* (New York: The Academic Press, 1954).

⁶ See, for example, Shigeru Nakayama, Kunio Gotō, and Hitoshi Yoshioka, eds., *A Social History of Science and Technology in Contemporary Japan* (4 vols., Melbourne: Trans Pacific Press, 2001), Vol. I: The Occupation Period 1945-1952, pp. 249-260.

⁷ Letter from Mizushima to Pauling, September 10, 1950, the Pauling Papers.

Journal of the American Chemical Society a good bit,” and suggesting that Mizushima visit Pasadena after the symposium.⁸

These letters strongly suggest that the symposium they mentioned would be the primary trigger for Mizushima’s visit to the United States in 1951. What was this symposium, and who organized it?

Debye and Mizushima’s growing reputation in the postwar United States

The correspondence between Mizushima and his old teacher, Peter Debye tells us much more. Debye had immigrated to the United States and took up a professorship at Cornell University in 1940.⁹ In a letter written a couple of weeks before, in August 1950, Mizushima told Debye:¹⁰

About ten days ago I received a letter of invitation from Dr. Glockler of Iowa to a symposium on “Bond Energies, Force Constants, and Bond Distances” to be held at the time of the meeting celebrating the 75th birthday of the Am[erican] Chem[ical] Society. I am asking our government to send me to the meeting.

This excerpt shows that the symposium Mizushima mentioned to Pauling was part of the *American Chemical Society* meeting also in New York, and that its organizer was a person named Glockler. I shall return to Glockler’s identity and his connection with Mizushima a bit later. Mizushima continues:

This would be the best chance to realize my dream to see you again in your laboratory. Would you kindly help me to do so?

As you know, Japan is economically in bad condition and our government will not allow me to visit your laboratory, unless I can convince it of the necessity of seeing you. The best way of convincing our government is to receive a letter of invitation from your laboratory in which you make me a request of reporting our works in your laboratory, [...]

Debye accepted Mizushima’s request by writing a letter of invitation for him to present at Cornell’s Department of Chemistry, showing the importance of Debye’s role in Mizushima’s visit to Cornell.¹¹ It would have been natural for Debye to be desirous to see his old student again after years of separation due to the war. This patronage was therefore quite predictable.

Debye’s patronage went far beyond that predictable level. In Mizushima’s follow-up letter in November, he further asked Debye:¹²

You know that the 12th International Congress of Pure and Applied Chemistry will be meeting in New York at the same time and I was told by our

⁸ Letter from Pauling to Mizushima, September 20, 1950, the Pauling Papers.

⁹ Debye’s career in the Third Reich and his subsequent immigration to the United States was a topic of recent controversies, especially in the Netherlands. See, for example, Martijn Eickhoff, *In the Name of Science: P. J. W. Debye and His Career in Nazi Germany* (Amsterdam: Aksant Academic Publishers, 2008) and Jurrie Reiding, “Peter Debye: Nazi Collaborator or Secret Opponent?” *Ambix* 57 (2010): 275-300.

¹⁰ Letter from Mizushima to Debye, August 30, 1950. Box 21, Folder 5, Correspondence letter M., Archief prof.dr. P.J.W. Debye, (code 21.318A), Regionaal Historisch Centrum Limburg, Maastricht, the Netherlands. This source is hereinafter referred to as “the Debye-Mizushima Correspondence.”

¹¹ Letter from Debye to Mizushima, October 20, 1950, the Debye-Mizushima Correspondence.

¹² Letter from Mizushima to Debye, November 14, 1950, the Debye-Mizushima Correspondence.

Government that it can give me the travelling fee more easily, if I can be invited also by the international congress.

I should be very grateful, if you would kindly write Dr. Harry L. Fisher, National Research Council, [...] or any other suitable person and ask to invite me to a section or sections of the international congress suitable to me (e.g. Physical Chemistry, Structural Chemistry, Protein Chemistry, High Polymers).

The circumstance of Mizushima's trip in 1951 has become all but clear: 1) The symposium which triggered the whole event was part of the *American Chemical Society* meeting also in New York; 2) The symposium organizer was "Dr. Glockler of Iowa"; 3) Mizushima's G. F. Baker lectureship of Cornell University and his participation in the IUPAC business relied on Debye's patronage. The question that remains is: Who was "Dr. Glockler of Iowa"?

The answer lies in Mizushima's first paper, published in 1941 in the *Journal of Chemical Physics*, "Molecular Configurations in Rotational Isomerism."¹³ This was the second of Mizushima's papers that carried the term "*gauche*" in which he and his coauthors claimed priority to the discovery of the *gauche* form against W. F. Edgell and George Glockler of Iowa State University, who had been performing similar research.¹⁴ So, Mizushima's invitation from Glockler to an American Chemical Society symposium likely signals the growing importance (if not acceptance) of Mizushima's work on rotational isomers among American physical chemists such as Glockler.

This sequence of events shows the crucial importance of Mizushima's 1941 paper, published in the *JCP* just before Japan entered the Second World War, leading to his rising reputation in the postwar United States. How was it possible for Mizushima to publish it? In short, it was the result of Debye's timely intervention. In the first surviving letter to Debye dated January 18, 1950, Mizushima told his mentor:¹⁵

Since you kindly sent my first manuscript to the editorial board of the *Journal of Chemical Physics*, the same editorial board as well as that of the *Journal of the American Chemical Society* accepted many our manuscripts [sic] for publication. I thank you very much.

It would not be surprising to learn that Debye viewed Mizushima as his old student and supported the development of Mizushima's international career. What is interesting is the variety of forms in which Debye's patronage was bestowed upon Mizushima.

Mizushima and Japan's Readmission to the IUPAC

Thus far I emphasized the importance of Mizushima's personal connections to Debye. I am not arguing, however, that his participations in international conferences were not important. Mizushima badly needed to get invited to the IUPAC meeting primarily because it would make it easier for him to get funding from the Japanese government.

¹³ San-ichiro Mizushima, Yonezo Morino, and Masatami Takeda, "Molecular Configurations in Rotational Isomerism," *Journal of Chemical Physics* 9 (1941): 826

¹⁴ Walter F. Edgell and George Glockler, "Rotational Isomerism in the Alkyl Halides," *Journal of Chemical Physics* 9 (1941): 375-376. Edgell and Glockler used the term "the C₂ form." The first of Mizushima's papers carrying the term "the *gauche* form" is: Mizushima, Morino and Shizuo Nakamura, "Raman Effect and Dipole Moment in Relation to Free Rotation. XII. Raman Spectra of Ethylene Chlorhydrin, *n*-Propyl Chloride, and *n*-Butane in the Liquid and Solid States," *Scientific Papers of the Institute of Physical and Chemical Research* 12 (1940): 205-215; on p. 213.

¹⁵ Letter from Mizushima to Debye, January 18, 1950, the Debye-Mizushima Correspondence.

To understand the context of its importance, we need to know that, first of all, Japan's poor economic situation just after the end of the Second World War heavily restricted scientists' travels abroad, as Mizushima explained to Debye. Japan became a member of the World Bank (WB) and the International Monetary Fund (IMF) in August 1952 and borrowed a total of US\$863 million from the WB spread out as 31 loans between 1953 and 1966, mainly for financing foreign exchange expenditures.¹⁶

Also significant was the issue of the readmission of Japan *and* West Germany to the IUPAC, which was discussed as a whole between June and November 1950 by the IUPAC's Executive Committee. The committee decided that, because of certain oppositions from Israel, Poland and the Soviet Union, it would defer the question of readmissions until the IUPAC meeting in New York in 1951, though German as well as Japanese chemists would be allowed to participate in this meeting "as individuals,"¹⁷ a typical Cold War solution.

The Japanese chemical community was well informed of this situation. Naoto Kameyama (1890-1963), a Japanese electrochemist and the president of the Science Council of Japan (Nihon Gakujutsu Kaigi or SCJ, which had officially represented Japan at international events since 1949) wrote in November 1950 to Harry L. Fisher (1885-1961), whom Mizushima mentioned in his November letter to Debye above. Fisher was an American organic chemist at the National Research Council in charge of organizing the IUPAC meeting in New York.

Kameyama expressed the SCJ's wish to send official delegates to the New York meeting, and Fisher replied by informing Kameyama of the IUPAC decision above and added that "[it] is our hope that Japan will be well represented at the Congress."¹⁸ In short, the SCJ would need to secure a decent number of participants in the IUPAC meeting for this historic moment. West Germany and Japan were indeed officially readmitted to the IUPAC in the New York meeting in 1951.¹⁹ Mizushima's participation in the IUPAC meeting was thus beneficial to both himself and to the SCJ, and, again, Debye made it possible.

*Conclusion: International or transnational?*²⁰

To put Mizushima's behavior into a more extensive historical context, it would be useful to compare his with those of his academic "grandfather," Joji Sakurai (1858-1939), who also

¹⁶ Yoshiaki Abe, "Japan and the World Bank, 1951–1966: Japan as a Borrower," *Journal of Asia-Pacific Studies* (Waseda University), No. 17 (October 2011): 217-244.

¹⁷ Letter from R. Delaby (IUPAC Secretary General) to J. Timmermans (President, Belgian National Committee of Chemistry), November 4, 1950. Folder October-December 1950, Box II.8 Bureau Correspondence 1950-1951, International Union of Pure and Applied Chemistry (IUPAC) Archive, Othmer Library of Chemical History, Chemical Heritage Foundation, Philadelphia, Penn., USA. This source is hereinafter referred to as "the IUPAC Papers."

¹⁸ Letter from Naoto Kameyama to Harry L. Fisher, November 30, 1950; and the letter from Fisher to Kameyama, December 7, 1950. Folder: Correspondence re readmission of West Germany and Japan into IUPAC, Box XIX.A1 Conference, NYC, 1951. the IUPAC Papers. See also the letter from Delaby to Fisher, December 16, 1950, confirming Fisher that his reply to Kameyama was perfectly in line with the position of the IUPAC. Folder October-December 1950, Box II.8 Bureau Correspondence 1950-1951, the IUPAC Papers. Delaby added that Yuji Shibata (1882-1980), member of the Japan Academy and senior Japanese chemist who spoke French, visited him in Paris, and he explained about the IUPAC's position to Shibata who, according to Delaby, "seemed satisfied with the position of the Union."

¹⁹ Fennell (note 1), p. 100.

²⁰ Discussion in this section was inspired by the conversation with Susan Lindee, Betty Smocovitis, and Kenji Ito during the SOKENDAI "Science and Society" Workshop (No. 2) on "The Cold War and Science" (December 13 and 14, 2014), Hayama, Japan, in which I participated as a discussant.

had numerous international connections and was a vice-president of the IUPAC twice, 1923-1925 and 1928-1930.²¹

For Sakurai, the most important issue was how the Japanese chemical community could and should be represented at international conferences. His answer was to establish a National Research Council of Japan (Gakujutsu Kenkyū Kaigi, the predecessor of the SCJ), thereby creating a system in which the Chemistry Division of the National Research Council of Japan, not any of the chemical societies in Japan, represents a national chemical community. In short, being *international*, or the act of representing a nation, was crucial and primary to Sakurai's international activities.

This role of representing a nation seems to have mattered less in Mizushima's international activities after the Second World War. He rather casually used international functions for his own purposes, to fund his trips to attend whatever conferences he preferred or to take up visiting lectureships. It is in this sense, using his casual attitude towards being international, that we can discuss Mizushima's *transnationality*, his going beyond national frameworks.

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²¹ Kikuchi (note 1), pp. 146-147.