Taking IUPAC Literally

An International Union of Pure and Applied Chemistry

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This essay brings together two of the fundamental products of IUPAC, namely its international symposia and its official journal, Pure and Applied Chemistry, as well as the consequential comradeship and documentation from such unions. Some of this sharing is illustrated in the Tetsuo Nozoe Autograph Books, including well-wishes and chemical pictography provided by meeting attendees and IUPAC officers.

1964 was an uplifting, transformative year in Japan. It was the year of the Summer Olympics, the opening of the super-high speed Tōkaidō Shinkansen train line and the Tokyo Monorail, and the end of the ban on overseas travel for Japanese citizens. To many Japanese, it was the beginning of the time of the Shinjinrui [1]. It was also the year of the Third IUPAC Symposium on the Chemistry of Natural Products, held in Kyoto in April.

Over 1500 scientists from around the world attended this chemistry symposium, one of the very first international chemistry symposia to be held in Japan. As described by one of the meeting organizers, Tetsuo Nozoe, who himself became one of Japanese chemistry’s most beloved senior figures,

The Symposium organized in Kyoto by Professor Munio Kotake and Kyoosuke Tsuda was a big event, which very much contributed to the development of Japanese organic chemistry. Many major chemists attended from all over the world and inspired young Japanese chemists; the meeting also made overseas participants appreciate the level of Japanese organic chemistry [2].

The International Symposia on the Chemistry of Natural Products (ISCNP), which continue to this day, were initiated by the International Union of Pure and Applied Chemistry in Sydney in 1960. The second symposium was held in Prague in 1962, and the third in Kyoto in 1964. The organizers for the 3rd ISCNP began their work four years earlier, before even the 1st ISCNP was held. Koji Nakanishi recalled that,

In preparation for the Kyoto symposium, I was sent [to the 1st and 2nd ISCNP in Sydney and Prague] by the seniors to study how symposia are organized and to check the names of active chemists in this field in each country. Thus in 1960, while in Tokyo, I was sent by the Science Council of Japan to attend the Sydney meeting, my first travel abroad since I returned from the United States. On the plane on the way to a presymposium meeting in Alice Springs, I was seated next to a middle-aged person reading a novel, who I guessed might be a British Bank Clerk; another passenger in the small plane, I guessed, was a German farmer. The former was Derek Barton, and the latter, Hans Brockmann! . . . With whom ever I met, I asked for the names of the younger generation of natural products chemists so that they could be invited to the Kyoto meeting [3].
Table 1 lists the 11 plenary speakers at the Kyoto meeting, the titles of their papers, which appeared almost immediately after the symposium in the September 1964 issue of Pure and Applied Chemistry, along with the Chair of their session. All 11 papers are available open access on the IUPAC website [4]. From a historical perspective, the paper by Shigehiko Sugasawa [5] is a rich summary of Japanese natural product research up to the early 1960s.

The gathering of participants in Kyoto was prestigious. One measure, illustrative but not completely reflective, is that three of the plenary speakers and at least one other participant would become Nobelists: they are Robert Burns Woodward (Nobel Prize 1965), Derek H.R. Barton (1969), Vladiir Prelog (1975), and Donald Cram (1987). A listing of the discussion leaders is found on page 48 of Nakanishi’s autobiography [3]. Nakanishi reflected on the meeting’s success:

Because the Kyoto meeting was one of the very first international symposia to be held in Japan, great care was taken by the organizing committee with all details, and a huge budget was made available by generous donations from companies. We asked all foreign guests to mingle with the younger generation, including the graduate students. The discussions, conversation, and excursions with overseas participants were very stimulating for us. The simultaneous announcement of the tetrodotoxin structure by Hirata, Tsuda, Woodward and their coworkers was one of the highlights of the meeting. The various lectures given by visitors around the world gave us an opportunity to evaluate our level. There is a Japanese saying, ‘Seeing once is better than hearing 100 times.’ The young Japanese chemists not only saw these distinguished foreign scientists but also discussed, ate, and drank with them. We also found that, although lagging, Japanese natural products chemistry was not that far behind. To see the gap narrowing gave us confidence, a factor that is very important for research, and I think the guests also went home with the same message. The

Dancing and singing at the Sakunami spa. Guy Ourisson is second from the left.

Table 1. Speakers, titles of papers as they appear in Pure and Applied Chemistry (open access) [4], and session chairs for the plenary lecturers at the 3rd ISCNP, Kyoto, 1964.

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Title</th>
<th>Session Chair</th>
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<tbody>
<tr>
<td>S. Sugasawa</td>
<td>History of Japanese natural product research</td>
<td>H. G. H. Erdtman</td>
</tr>
<tr>
<td>G. Büchi</td>
<td>Chemistry of some dimeric indole alkaloids</td>
<td>E. Lederer</td>
</tr>
<tr>
<td>D. H. R. Barton</td>
<td>Some studies in the biogenesis of plant products</td>
<td>T. A. Geisserman</td>
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<tr>
<td>R. B. Woodward</td>
<td>The structure of tetrodotoxin</td>
<td>O. Jeger</td>
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<tr>
<td>M. M. Shemyakin and V. K. Antonov</td>
<td>Intramolecular rearrangements in peptide systems: hydroxy- and amino-acyl incorporation into peptides</td>
<td>C. Schöpf</td>
</tr>
<tr>
<td>K. Biemann</td>
<td>High resolution mass spectrometry of natural products</td>
<td>T. R. Sheshadri</td>
</tr>
<tr>
<td>V. Prelog</td>
<td>Specification of the stereospecificity of some oxido-reductases by diamond lattice sections</td>
<td>W. Cocker</td>
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<tr>
<td>G. Stork</td>
<td>Progress in the synthesis of polycyclic natural products</td>
<td>G. Fodor</td>
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<tr>
<td>Th. Wieland</td>
<td>Peptides of Amanita phalloides</td>
<td>E. R. H. Jones</td>
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<td>C. Djerassi</td>
<td>Isotope labelling and mass spectrometry of natural products</td>
<td>V. Herout</td>
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<td>J. M. Robertson</td>
<td>Recent advances in X-ray analysis of natural product structures</td>
<td>C. W. Shoppee</td>
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majority of the Japanese natural product chemists agree this symposium was a turning point [3].

Tetuso Nozoe hosted one of the three post-symposia at the Sakunami spa outside of Sendai. The events included a special banquet in which everyone wore kimonos, sat on tatami mats, and enjoyed sake, singing, and other jovial activities. Several photographs of the event are shown which clearly testify that the Sakunami post-symposium event was a memorable experience!

Nozoe, himself, was an eminent chemist. He discovered and identified the first non-benzenoid aromatic compound, hinokitiol, in Taipei in the 1940s, simultaneous with related research by Holger Erdtman in Sweden and Michael J. S. Dewar in England. And for several decades, Nozoe and his co-workers investigated the chemistry of the tropolones, leading the research in the field that he had discovered [2, 6, 7]. The field of aromaticity was never the same [8].

The Nozoe Autograph Books

As word of non-benzenoid aromaticity spread, Nozoe began to receive invitations to lecture in Europe and the United States. Beginning in 1953 and continuing almost to his death in 1996, Nozoe carried an autograph book with him on his many trips to scientific meetings, as well as to chemistry departments and centers of industry around the world. The autograph books—ultimately nine in all, containing 1179 pages of autographs, chemical pictography [9, 10], well wishes, poetry and puzzles [11]—have now been published in their entirety in The Chemical Record [12]. These autograph books must be viewed as a primary historical resource, in that they document both the nature of international communication among chemists [13], as well as the chemistry of many of the signatories.

Nobelist Vladimir Prelog’s entry on 7 April 1964 in Sendai (on page 149 of the Nozoe Autograph Books) is the first autograph attributable to the IUPAC symposium discussed herein. Roger Adams’s entry on 28 April 1964 (page 159) appears to be the last entry from this symposium. Adams—the recipient of the US National Medal of Science, the Priestley Medal of the American Chemistry Society, and for whom the Roger Adams Award is named—was one of chemistry’s preeminent scientists in the 1930s and 1940s. In between Prelog and Adams can be found many notable signatories. Entries from five plenary lectures and two others are reproduced herein.
An unusual steroid (I) was recently synthesized at Tokyo University, where bombarded with electrons the molecular ion underwent an unusual fragmentation-cum-rearrangement including the unprecedented incorporation of a new element Z into the most abundant fragment ion. High resolution measurements established the transparency of the resulting species as well as its elementary composition. 

Carl Djerassi

Many entries in the Nozoe Autograph Books are creative. Gunhild Aulin-Erdtman's entry to the left is a touching summary of the event, including, perhaps, a pictograph of Tetsuo Nozoe himself with his glasses. Aulin-Erdtman's entry captured the general mood of the meeting with the timeless happy face while 'coming to Japan' and sad face while 'leaving again'. The phrase "Domo arigato" means "Thanks a lot" in Japanese.

Gunhild Aulin-Erdtman

Enfin, je peux signer ce livre à Sendai, avec un groupe de vieux amis, et en compagnie du Professeur Nozoe. Avec mes remerciements pour votre invitation.

Guy Ourisson
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Other IUPAC-related entries in the Nozoe book

Within the Nozoe Autograph Books are many entries having to do with IUPAC—not surprising, given that thousands of chemists participate in IUPAC activities as officers, organizers and participants [14, 15]. In 1953 and 1957, on Nozoe’s first two travels to Europe, Arthur Stoll, President of IUPAC from 1955-1959, signed the autograph books. The 1957 entry was recorded during the IUPAC Congress in Paris and is signed by Stoll as IUPAC President. Nozoe was a plenary lecturer at the 1957 IUPAC Congress [16].

Guy Ourisson—IUPAC Secretary General from 1975-1983—signed the Nozoe Autograph Books in 1964 while participating in the 3rd ISCNP in Kyoto (see above).

Rudolf Morf, Secretary General of IUPAC from 1955 to 1971, made two entries in the Nozoe Autograph Books. The first, on 10 October 1966, marks the occasion when Tetsuo Nozoe visited Morf at his IUPAC office in Basle (below). According to Ted Becker, himself IUPAC Secretary General from 1996 to 2003, “Morf was the last Secretary General to handle all IUPAC ‘business’ himself before a full time Secretariat was set up at Oxford in 1968.” [17] The second entry by Rudolf Morf came 11 years later in September 1977 (page 582 in the Nozoe Autograph Books) and was recorded during the 26th IUPAC Congress in Tokyo. Morf noted the “First International Congress in the House of the Rising Sun” and commented on the “wonderful tea ceremony in the gardens” and the “sophisticated dishes and drinks.”

Georges Smets, IUPAC President in 1977-1979, also signed the book during the 26th IUPAC Congress in Tokyo in September 1977, with a very hearty cheer for IUPAC (below).

We could continue to fill this issue of Chemistry International with fascinating entries from chemists at various IUPAC meetings. Given the space limitations and the fact that the entire Nozoe Autograph collection is available online along with relevant essays and perspectives [12]—and free for at least three more years—we shall consider this article an appetizer rather than as a meal.

Now, to tie up some loose ends

The IUPAC Symposia on the Chemistry of Natural Products continues to this day. The 27th International Symposium on the Chemistry of Natural Products and the 7th...
International Conference on Biodiversity (ISCN-27 & ICOB-7), were jointly held in Brisbane, Australia, on 10-15 July 2011. The 24th, 25th, 26th, and 27th ISCN all featured biodiversity. IUPAC continues to champion international connectivity of people and the union of science. The ISCN-28/ICOB-8 was held in Shanghai 19-24 October 2014, and the ISCN-29/ICOB-9 will be held in Turkey in 2016. The progress of chemistry continues, marked by continuous reinvention [18, 19], as old challenges become textbook classics and new opportunities—or crises—arise.

Even the Nozoe Autograph Books continue, nearly 20 years after Nozoe’s passing! While it is true that the entire Nozoe Autograph Books collection has now been published in The Chemical Record [12], Brian P. Johnson, Managing Editor of TCR, and I are organizing a ‘new volume’ of autographs. Autographs will be collected at this summer’s International Symposium on Novel Aromatic Compounds (ISNA-16, in Madrid from 5-10 July 2015), and these will be collated, bound, and presented to Tohoku University, which houses the original nine volumes. All who wish can send in their autograph along with their favorite structures, poems, or chemical pictographs. Full details are found online in our recent essay titled “The Nozoe Autograph Books: “It Ain’t Over ‘Til It’s Over” [20], or by following these directions:

1. Write on a white sheet of paper using black ink. You may optionally use your personal or organization’s letterhead. Importantly, please both sign and date the entry and also clearly print your name.
2. Send your inscription in one of the following ways: (a) Scan your inscription (≥300 dpi for best reproduction) and e-mail to ChemicalRecord@wiley-vch.de as a graphics file or PDF. Please include in the subject line of your e-mail: NOZOE INSCRIPTION. (b) You may mail your inscription to Brian P. Johnson, Wiley-VCH Verlag, Boschstr. 12, 69469 Weinheim, Germany.
3. The deadline for receipt is June 30, 2015.

Conclusions

The sound of “IUPAC” easily rolls off the tongue as a three-syllable acronym that chemists around the world recognize. Happily, IUPAC succeeds beyond being “a scientific, international, non-governmental and objective body . . . serving to advance the worldwide aspects of the chemical sciences and to contribute to the application of chemistry in the service of Humankind.” [21] The stories told in this report, and countless more, reflect the special union between people and their passions fostered by this Union. IUPAC transcends national boundaries and temporary disciplinary distinctions, for the well-being of all.

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References