Ryoji Noyori

My Long, Memorable Journey with the International Community

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Preface

Each country has its own culture to be proud of, and all people have distinctive values. As a scientist who loves Japan, I have always kept in mind the following famous words of Pasteur, who lived in the 19th century: “Science has no borders. But a scientist has a homeland.” Research activities are unique from nation to nation. I am truly grateful for the many lessons I have learned from meeting my friends across the world. Born and raised in Japan, I did not leave my home country until I was 30 years old. However, since 1968, I had the blessing to have many foreign friends and have visited many countries in America, Europe, and Asia. At international conferences, where leading researchers from diverse countries gathered, I presented my research achievements, and along with having them shared by the chemistry community, I was able to learn about the cutting edge and trends of research. On the other hand, I was often awarded special lectureships to visit specific universities and research institutes alone (and with my wife Hiroko in later years). On these occasions, I learned more about the unique characteristics of the institutions, local history and culture, and the personalities of many of the researchers, deepening our friendship and trust in each other. For my life, unexpected interactions with people from different backgrounds have been more valuable than encounters with universal scientific achievements. In Japanese tea ceremony, we often use the saying *ichigo-ichi-e* (once-in-a-lifetime meeting) that means “Treasure every meeting, for it will never recur.”

The world is one. In the 21st century, we live in an era in which all knowledge and all people in the world are connected in a way that has never been experienced before. While the future is full of uncertainties, it is clear that people desire a secure society and the promotion of peace and prosperity. As a nation, it is important to ensure international competitiveness, but at the same time, humanity as a whole faces serious problems such as the spread of emerging and re-emerging infectious diseases, global warming, energy depletion, loss of biodiversity, and natural disasters. The solution and alleviation of these enormous and serious common problems should gather the wisdom from the whole world. In the new century, there has been an “explosion of knowledge” and the amount of scientific knowledge, the common asset of humanity, has increased dramatically. The integration of all knowledge and technology is required, and the advancement of artificial intelligence (AI) will certainly contribute to this. However, its abuse causes serious social concerns. What is required even more is the integration of creative human intelligence (HI). This is because creativity requires the integration of existing knowledge as well as the cultivation of imagination for the unknown.

In order for humankind to adapt to the new environment and survive, it is not enough for each country and organization to individually develop and secure high-level human resources. There is no other way but to connect and utilize their diverse talents extensively. It is necessary for all nations and regions to go beyond “economic security issues” to have a long-term perspective and practice cooperation in research and development. The foundation of this is none other than personal trust, and in the midst of the severe conflict between Russia and Ukraine, and in the Gaza Strip of Palestine, the smiling expressions of good friends from different countries still come to my mind.

I would like to express my gratitude to the many friends who have enriched my life by sharing some of the memorable episodes together with the international conferences I attended, and honors I had received. I hope that the young researchers in Japan and other countries will further strengthen their friendship worldwide.

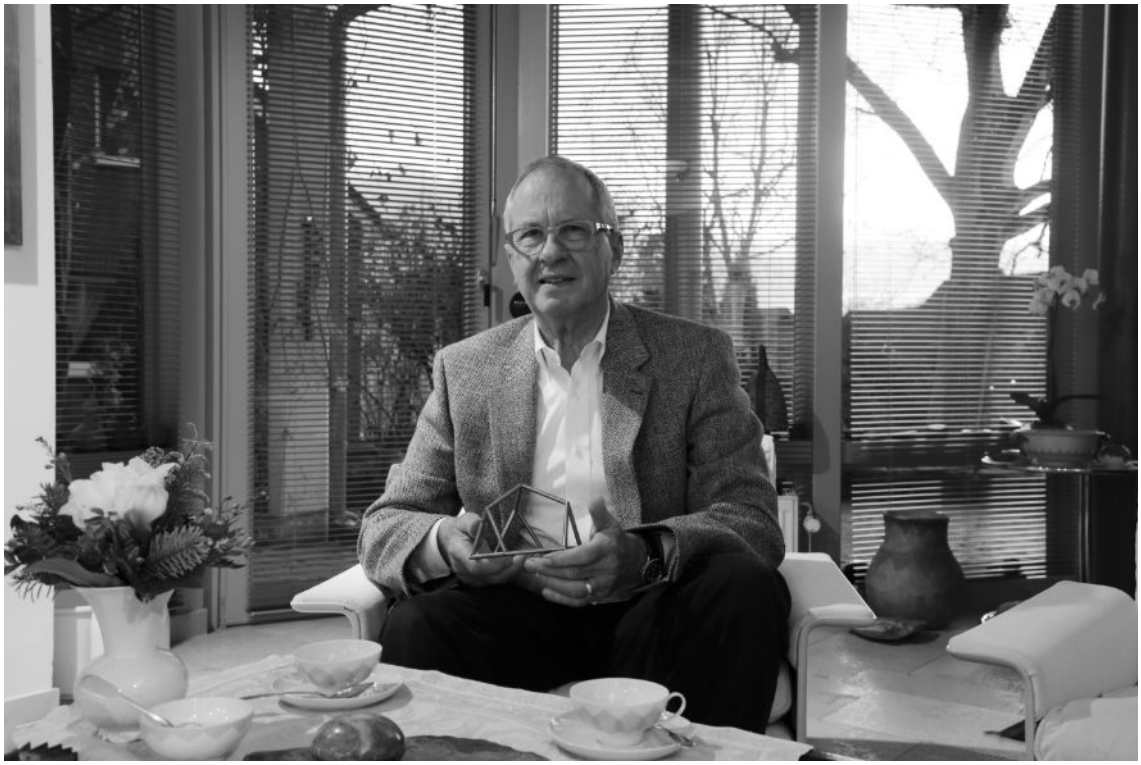
1 My Ties with Germany

For us Japanese, Germany is a special country and we have long admired the country's tradition in chemistry. Therefore, even when we were university students, some of our elementary analytical chemistry and organic chemistry classes were taught using German textbooks. Chemistry is Germany's national science, and the chemical industry is a national industry that has supported the German society. The characteristic feature of German chemistry is not only seen in its high level of academic creativity but also its strong contribution to industrial technology, as seen in the invention of the ammonia synthetic method developed by Fritz Haber and Carl Bosch. On the other hand, the trust that industry places in universities and the particular respect that industry has for basic science is also a characteristic of this nation of chemical power. Academic research and industrial activity go hand in hand and have created an impressive tradition that continues to this day. Before World War I, the country was founded on the chemistry of artificial dyes made from coal, followed by the petrochemical industry centered on polymer chemistry, and then by the agricultural chemicals and pharmaceutical industries, which led the world. I believe that chemistry will continue to develop in line with the advances in life sciences and materials engineering.

Chemistry in Germany has a long and glorious history, producing many great researchers, including 30 Nobel laureates. The Max Planck Coal Research Institute in Mülheim, where Karl Ziegler, the 1963 Nobel laureate in chemistry, was the second director, is an institution I admire and am familiar with. In 1971, at the age of 32, I visited the institute led by the dashing Günther Wilke, who is famous for the butadiene cyclic oligomerization and was amazed by its advanced research and magnificent facilities. German senior chemists are in general, serious and hardworking, with a dignified appearance, i.e., very German. Nevertheless, combined with these features, the younger generation also has a special gentleness and cheerfulness in their character, perhaps due to American influence. Manfred T. Reetz, who grew up under an excellent mentor, Reinhard W. Hoffmann, and was a promising chemist from his youth, is a prime example. When I first met Reetz in 1982 at Louvain-la-Neuve, Belgium, he was a talented man of only 38 years of age.

Author's first visit to the Max Planck Institute for Coal Research in August 1971. The Japanese organometallic delegate visited the Institute at Mülheim on the way to the 1971 Organometallic Chemistry Conference in Moscow. Back row from the right: The author (second) and Günther Wilke (seventh). Front row from the right: Akira Suzuki (second) and Hiroshi Yamazaki (fourth).

I had visited Germany more than 20 times and had made many friends. The first time I was invited to an international conference in Germany was in 1983, at the Hoechst Workshop Conference (organized by Wilhelm Bartmann and Barry M. Trost) related to organic chemistry at the Reisensburg Castle. At this conference, I met for the first time, Lutz-Friedjan Tietze, Gerhard Quinkert, and Rolf Huisgen, an intelligent and educated researcher whom I had admired for some time. Ekkehard Winterfeldt, who was also present at the conference, was a bright and outspoken leader. He took the opportunity to invite me to his home in Hannover, where I remember well that he had requested to his wife to serve a variety of dishes with unusual sausages, a national delicacy. At this meeting, I spoke on the chemistry of "tris(dialkylamino)sulfonium (TAS) enolates," but the topic later shifted to "Asymmetric Synthetic Chemistry." In 1989, I received the Merck-Schuchardt Lectureship, and one of the young leaders, Armin de Meijere, organized my visits to E. Merck KG in Darmstadt as well as the Technische Hochschule Darmstadt (hosted by Klaus Hafner), Technical University of Braunschweig (Karsten Krohn), University of Kiel (Dieter Hoppe), University of Hamburg (Armin de Meijere), and University of Hannover (Ekkehard Winterfeldt) in Northern Germany, and learned how chemical research was steadily conducted at German universities. On May 10 of the same year, Tietze from the University of Göttingen took me to the military border between East and West Germany and explained how strict the security was, but I had no idea that the Berlin Wall would fall six months later, on November 9. As a consequence, my German friends lived through a period of severe political upheaval.



Armin de Meijere.

Author (second row, fourth from the left) at the
Hoechst Workshop Conference at the Reisensburg Castle in 1983.

Front row, from the left: Michel Pereyre, Jiro Tsuji, Wilhelm Bartmann, and Rolf Huisgen. Back row, from the left: Hans Wynberg, Derek Barton, Robert Corriu, and Noel de Souza at the Hoechst Conference in 1983.

In 1990, I was invited to participate in the Organic Synthesis via Organometallics conference at the University of Marburg, organized by Karl H. Dötz and hosted by Reinhard W. Hoffmann. Unexpectedly, I reunited with Richard Schrock of MIT, who was a student of John A. Osborn at Harvard. Together with Jun Okuda, who was Schrock's postdoctoral researcher, we strolled around the city with its unique architectural beauty, reflected upon the episode of the new Rh catalyst, which he provided to me 20 years ago (chapter 4), and reminisced about our encounter in our younger years. In the following year, in 1991, I was invited to the IUPAC Symposium on Organic Chemistry: Technological Perspective in Baden-Baden. It was a conference on practical synthetic chemistry characteristic to Germany, organized by Hans Rudolph of Bayer AG, and I also enjoyed the beach-hotel like open atmosphere of the spa, which was different to what we have in Japan, where spas are indoors and for families. In 1996, Gerhard Erker of the University of Münster invited me to give a special keynote lecture at ORCHEM '96 in Bad Nauheim organized by the German Chemical Society. I fulfilled my role by giving my talk on Asymmetric Hydrogenation at 8:30 p.m. after the speakers' dinner. I saw many friends again, including Reinhard W. Hoffmann and Carsten Bolm.

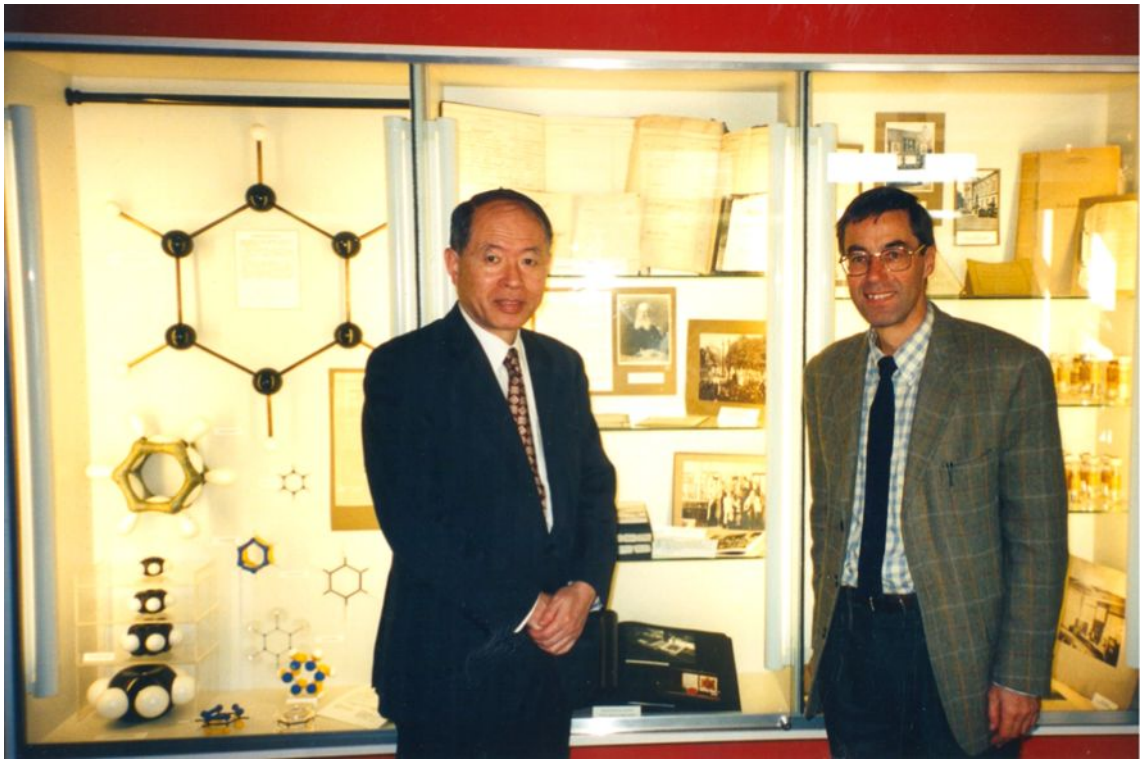
What I will never forget from this era is that in 1994, I received the title as the Karl Ziegler Guest Professor from the Max Planck Institute for Coal Research and gave a series of lectures at this institute that I admire. It was the period that Manfred Reetz had just taken over as director as Günther Wilke's successor and he served this role for

20 years. The conduct of the former and new directors was quite different. Wilke had been leading the institute like a commander and he had been a prominent figure in the German society for many years. On the other hand, Reetz, had followed the path of a university professor devoted to research. Reetz's main interests were to transfer the existing directorship to newly hired multiple directors and to deal with the change from an independent financial structure following the expiration of the Ziegler catalyst patent. Reetz, who has a strong sense of responsibility, was supported in his new role by his devoted wife, Elisabeth, who was a medical scientist. The couple's new home was the former Ziegler residence located next to the institute. I was given a tour of the entire house, including the study, and was given an explanation on how the great senior chemist, Ziegler was dedicated to research at the time. I was also welcomed by Ziegler's daughter, Dr. Marianne Witte, and her husband.

Author awarded the title of the Karl Ziegler Guest Professor from Manfred T. Reetz, Director of the Max Planck Institute for Coal Research in December 1994.

In 1996, through the consideration of Karl Heinz Dötz, I was invited to the University of Bonn, which was the home to Kekulé, who had proposed the structure of benzene. There, I received the prestigious "The Bonn Chemistry Award" established in 1992 by the Chemistry Department of the University of Bonn. In 1999, I was awarded the Bohlmann Lectureship at the Technical University of Berlin on the recommendation of Siegfried Blechert and Helmut Schwarz. Subsequently, in 2000, I was awarded the Kurt Alder Lectureship at the University of Cologne by consideration from Albrecht Berkessel. Here, I met Emanuel Vogel and was impressed by the huge annulene synthesis plant he had built. Like the steeple of the Cologne Cathedral, his presence

resembles a legitimate German professor. The young Hans Günther Schmalz took us to a winery in the Rhine valley of Bacharach, where we enjoyed the beautiful scenery on a boat trip down the Rhine and the famous Loreley.



The author (on the left) and Karl H. Dötz at the University of Bonn in 1999.

Emanuel Vogel (left) and the author at Cologne in 2000.

More memorably, in 1999, I was selected as the first recipient of the Georg Wittig Lectureship, established by the University of Heidelberg with support from BASF. BASF, led by Stefan Marcinowski, is a respectful chemical company. Surprisingly, the golden cyclooctatetraene synthesized by Walter Reppe is stored in a large ampule placed in the wall of the reception room of its headquarters in Ludwigshafen, and when necessary, it is proudly displayed to the guests. The Ammonia Laboratory, dating back to Haber-Bosch, was also impressive, and Peter Hofmann organized a grand lecture series that was attended by Ernst O. Fischer (Nobel Prize in chemistry 1973), Leopold Horner, Günther Wilke, and many other distinguished researchers who listened to my lectures. Although I had never met Wittig in person during his lifetime, I was impressed by his words he spoke when he received the 1979 Nobel Prize in chemistry: “The paths of research rarely lead in a straightforward fashion from starting point to desired goal.... Although intention predisposes the route, chance or occurrences along the way often enforce a change of course.... Along the way, we come upon various points of interest which invite us to linger awhile. Ours, like all such rambling tours, possess that special attraction that comes from knowing that the landscape spread out before us will be opened to view, not by intention, but by chance and surprise” (*Chem. Eng. News* **1979**, *57*, 6–7). Applying the words of a great man to my own modest life of research, my wife and I enjoyed the beautiful autumn days along the Philosophers’ Path, the old castle, and the old town. All I have is gratitude. This event was later reorganized and developed into the Heidelberg Forum on Molecular Catalysis, to which I was invited again in 2007, together with Richard Schrock and others.

Inaugural Georg Wittig Lectureship at Heidelberg in October 27, 1999.
From the left: Peter Hofmann, Stephen Marcinowski (BASF), and the author.

The support of academia by German companies has been extremely generous. In 2004, I was invited by the German Chemical Society as a GDCh Lecturer and gave a talk on Asymmetric Hydrogenation at Bayer in Leverkusen, where I was welcomed by many people. I was presented with the company's large history book, "Milestones," and once again learned about the strong German corporate tradition. Also, in the same year, I was invited to the International Symposium on Homogeneous Catalysis, organized by Wolfgang A. Herrmann, the brilliant rector of the Technical University of Munich. K. Barry Sharpless had suddenly cancelled his opening lecture, but Henri Brunner took over the role of the opening speaker so elegantly, as if he had expected it to happen. As the inventor of chiral diphosphine Norphos, Brunner and I have been invited to many international conferences together, and I always thought that his research is rigorous and that he was well prepared for everything. As a student of Ernst O. Fischer, Brunner is a typical German inorganic chemist and is the author of a large "Handbook of Enantioselective Catalysis" (VCH, 1993). He sent me his book "Rechts oder links in der Natur und anderswo" (Wiley-VCH, 1999), which is witty and truly educational, also showing his flexible personality.

Henri Brunner on the Ferris wheel at the town square in Deggendorf, 2020 (photo by Eva E. Wille).

Perhaps my chemistry is compatible with German companies, I received the Ernst Schering Lectureship in 2006. In 2008, I was invited to give a commemorative lecture at the "Day of Catalysis" symposium in Ludwigshafen, celebrating the 120th Anniversary of Catalysis at BASF, together with Gerhard Ertl, who had just received the Nobel Prize in chemistry in the preceding year, and Hans-Joachim Freund (both from the Fritz-Haber Institute).

At the German Embassy in Tokyo, September 2005. Author in the middle with Jun Okuda (left) and Carsten Bolm (third from right).

At the Day of Catalysis of BASF in 2008. From the left, Reiner Diercks, the author, Gerhard Ertl, Andreas Kreimeyer, Hans-Joachim Freund, and Ewald Gallei.

In Germany, I have often spoken about my research achievements in asymmetric synthesis, but in 2006, I was invited to the IUPAC Green-Sustainable Chemistry meeting in the beautiful region of Dresden in Germany, where I gave a talk on a different topic. I had to learn not only about chemistry, but also about the culture of this

country. I also visited Meissen and enjoyed the hard white porcelain that my wife Hiroko fancies.

For a university academic, receiving an honorary doctor's degree (Honoris Causa) from a prestigious university is one of the greatest honors. I received my first honorary degree from the prestigious Technische Universität München in 1996. Wolfgang A. Herrmann, who later became president of the university, recommended me along with K. Barry Sharpless. I was approached by Horst Kessler on November 7, 1995. However, it was not possible for me to attend the ceremony on December 7 in the same year due to my tight schedule, and I accepted the invitation in September of the following year. In April 2004, I was awarded the Honorary Degree (Dr. Res. Nat. Honoris Causa) from RWTH Aachen University, another prestigious university, thanks to the recommendation of my friends, Dieter Enders, Jun Okuda, and Carsten Bolm. However, again, due to circumstances on my part, I was unable to attend the local award ceremony set for the following year. Fortunately, in September of 2005, another year later, President Burkhard Rauhut visited Japan on the occasion of the Year of Germany in Japan, and the German Embassy in Tokyo hosted a grand award ceremony for me to receive the honor. In 2010, I was finally able to fulfill my responsibility by visiting Aachen and giving the Julius Bredt Lecture.

Dieter Enders and the author in Aachen in 2010.

Mere research and education are not enough for a country to build a strong scientific foundation. In order to continuously promote this activity, a strong publishing business must be secured. In this respect, the German chemical community has made a significant contribution to its own country and to the global research community. In

particular, the journal *Angewandte Chemie* has played a very important role, and we must not forget the dedication of Peter Gölitz, who served as Editor-in-Chief. As a brilliant chemist educated by Armin de Meijere, he has followed the current trends in chemical research by attending multiple international conferences. By personally evaluating the abilities and achievements of researchers from various countries, and by expanding his contacts and collaborations, he quickly developed the journal from a nationally important German Chemical Society journal to a leading international journal. As a testament to its broad development, including Asia, the 50 Years Angewandte International Edition Symposium was held in Tokyo and Beijing in 2011. The Symposium on Catalysis & Synthesis, Advanced Materials & Chemical Biology at the Tokyo Institute of Technology was attended by Yasuhiro Iwasawa, President of the Chemical Society of Japan, Michael Dröscher, President of the German Chemical Society, the symposium included Alois Fürstner, Hideo Hosono, Hartmut Michel, Terunori Fujita, Akira Suzuki, Francois Diederich, Tohru Fukuyama, Helmut Schwarz, and Barry Sharpless, and I gave an opening lecture entitled "Asymmetric Hydrogenation: Our Three Decades with BINAP". Two days later, a similar symposium was held in Beijing in China at Tsinghua University.

The support of Wiley in strengthening the management contributed to this symposium, but I must mention the helpful advice by the brilliant Dr. Eva E. Wille. I first met Peter Gölitz, probably in 1988, in Geneva, at the Symposium on Stereoselectivity sponsored by the Swiss Chemical Society and organized by Günther Ohloff of the Firmenich Institute. I was invited together with Gerhard Quinkert, Frank H. Westheimer, Satoru Masamune, and Wolfgang Oppolzer, to give a talk about our results on Homogeneous Asymmetric Hydrogenation. This was a very high-level and productive conference, and the young Peter Gölitz was present at dinner that same day, where Duilio Arigoni, Edgar Heilbronner, and Albert Eschenmoser also joined us. Later, I would often run into Gölitz at the major conferences I attended. As a result, I was also on the International Advisory Board of *Angewandte Chemie*, for which he was the Editor-in-Chief for 35 years (1982–2017).

From the left: Satoru Masamune, Gerhard Quinkert, and the author in Geneva in 1988.

My ties to the publishing world in this country run deep. Germany has the most traditional journal in chemistry, Journal für praktische Chemie, which dates back to 1828, and my friend Joe Richmond wanted to publish a modern remodeled version of the journal, as *Advanced Synthesis & Catalysis*. I agreed to this plan and served as the first Chairman on the Editorial Board from 2000 to 2015. I believe that this plan has succeeded as expected.

Eva E. Wille and Peter Gölitz at the Max Planck Institute for Dynamics of Complex Technical Systems 2023, photo by Michael Huenerbein.

Germany has a vast reservoir of chemical knowledge, and Georg Thieme Verlag planned the compilation of *Science of Synthesis*, led by Barry Trost, as a successor to Houben-Weyl, *Methods of Organic Chemistry*, which represents the German chemical tradition. Agreeing to Trost's spirit of contribution to the chemical community, I had previously been involved in the editing of *Comprehensive Organic Synthesis* (1987–1991) for Pergamon Press in the UK, which he and Ian Fleming had led, and I was again involved in the editing of *Science of Synthesis*, this time under the leadership of Barry Trost. I have been a member of the Board of Editors since its launch in 1992. But the road to its completion was very long. After 15 years of collaboration among researchers from more than 10 countries, in 2008, a huge masterpiece consisting of 48 volumes was finally completed. From these endeavors, organic chemists around the world are now able to enjoy the benefits of this devotion.

Thieme's *Science of Synthesis* Editorial Board Meeting in January 2002 in Stuttgart. From the left: Ichiro Shinkai, Steven V. Ley, Barry M. Trost, Daniel Bellus, the author, Ernst Schaumann, Eric N. Jacobsen, and Eric J. Thomas.

We had invited many leading German chemists to international conferences in Nagoya or Japan to discuss and deepen our understanding of each other, but in the early 1980s, it was still rare for young researchers to come to study in Japan. In 1985, I hired my first postdoctoral researcher, Hans-Joachim Weintz, coincidentally from the Max Planck Institute for Coal Research. Since then, 14 German postdoctoral researchers have joined my laboratory at Nagoya University and the ERATO Noyori Project (chapter 7). Just as I, as a young man, learned a lot from Germany, now they have come to Japan to work on catalytic chemistry born in Japan, make friends, and enjoy a different culture before going back to their home country. I was impressed by their sincere and legitimate research attitude, as well as their common politeness, probably the result of a sound German family upbringing. I am grateful to the Alexander von Humboldt Foundation, Deutscher Akademischer Austauschdienst (DAAD), Japan Society for the Promotion of Science (JSPS), and various academic societies for providing me with this opportunity to get to know not only senior researchers, but also these young people in Germany. In 2002, as the President of the Chemical Society of Japan, I attended the C6 Meeting of Major Chemical Societies in Frankfurt and heard various opinions. During the meeting, I reaffirmed my recognition that multilateral exchange of opinions and personalities is the beginning of all problem-solving. Since Germany and Japan have much in common, it is important to continue the cooperation in both research and education. Since receiving the Nobel Prize in chemistry in 2001, I have often attended the Nobel Laureate Meetings organized by Countess Sonja Bernadotte (and by her daughter Bettina Bernadotte since 2008) in the beautiful city of Lindau on Lake Constance, where I have renewed old friendships with fellow laureates and encouraged aspiring young people from all over the world. I have also learned a lot from them.

56th Lindau Nobel Laureate Meeting, June 2006. Front row, from the left: Richard. R. Schrock, Robert F. Curl, Jr., Countess Sonja Bernadotte, Jerome Karle, and Walter Kohn. Second row, from the left: William N. Lipscomb, Richard R. Ernst, Werner Arber, Paul J. Crutzen, Rudolph A. Marcus, and John E. Walker. Third row, from the left: Kurt Wüthrich, Peter Agre, Ryoji Noyori, F. Sherwood Rowland, Roy J. Glauber, John L. Hall, and Theodor W. Hänsch. Back row, from the left: Aaron Ciechanover, Roald Hoffmann, Johann Deisenhofer, and Hartmut Michel.

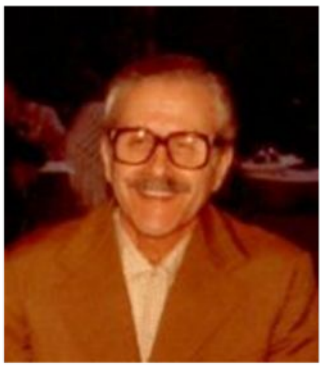
During my tenure as RIKEN's President from 2003–2015, I have worked beyond my position as a researcher to promote bilateral cooperation between Germany and Japan more broadly. In 2010, I delivered a speech at the Embassy in Berlin in support of the Japanese-German Center in Berlin, in which I stressed the need to deepen Japan-German relations. Helmut Schwarz of Technische Universität Berlin, an old acquaintance of mine, also came to listen to the speech. Personally, I have deepened my friendship with Peter Gruss (a developmental biologist), President of the Max Planck Society. In particular, in the Year of Germany in Japan (2005), I actively promoted joint research between leading German and Japanese research institutes. RIKEN, which is positioned in Japan as the little brother of the Max Planck Society, at the time had about 50 German researchers in various fields. Gruss served as the President of the Okinawa Institute of Science and Technology (OIST) in 2017–2022, and I have supported him as the Member of the Board of Governors.

My life as a scientist would not have been possible without my ties to Germany, the great nation of chemistry.

2 My Deepest Respect and Gratitude to Italian Scientists

Italy is the cradle of modern science, and in the field of chemistry, Amedo Avogadro was the founder who proposed the hypothetical theory of atoms and molecules in 1811. In 2006, I was fortunate enough to be awarded by the Italian Chemical Society, the Avogadro Gold Medal, named after the father of chemistry. I delivered the Avogadro-Minakata Lecture on asymmetric hydrogenation at this meeting, which was chaired by Francesco De Angelis and organized by my friend Alberto Brandi. In fact, the origin of my research on asymmetric catalysis can be traced back to the guidance of the Hugo Schiff school in Florence, particularly Luigi Sacconi, one of his successors who synthesized the Schiff base-Cu(II) complex.[1] In 1966, I used its chiral version as a catalyst resulting in the discovery of the memorable asymmetric carbene reaction (chapter 2). Later, in 2002, I was invited to the Inorganic Chemistry Congress of the Italian Chemical Society in Modena and was awarded the Luigi Sacconi Medal, named after the originator, on the joint recommendation of Ivano Bertini and Luigi Busetto, who were both leading figures of the Sacconi school. I am grateful for their warm consideration of my youthful curiosity in a different country and research field.

Hugo Schiff
1834 – 1915



Luigi Sacconi
1911 – 1992

2002 Luigi Sacconi Medal
to Ryoji Noyori

Appreciation to giants of the Florence School.

My first visit to this fascinating country was at the Seventh International Conference on Organometallic Chemistry in Venice in 1975. Since then, I have made many acquaintances, including Giorgio Modena, who was leading Italian organic chemistry at that time. Among the most memorable conferences was the 1986 Ischia Advanced School of Organic Chemistry co-organized by the University of Naples and the Italian Chemical Society, Organic Division. This meeting at the beautiful resort island was chaired by Romualdo Capto and was attended not only by domestic active chemists such as G. Modena, Carlo Scolastico, Achille Umani-Ronchi, and F. Naso, but also from abroad. D. Enders, D. A. Evans, R. W. Hoffmann, R. E. Ireland, A. Krief, A. McKillop, A. I. Meyers, W. Oppolzer, L. A. Paquette, R. Rossi, C. J. Shi, M. R. Uskovovic, and others were also invited to this conference. I delivered a talk on asymmetric catalytic

1 L. Sacconi, M. Ciampolini: 45. Pseudo-tetrahedral structure of some α-branched copper(II) chelates with Schiff bases. *J. Chem. Soc.* **1964**, 276–280.

reactions. Many attendees brought their family members to the meeting, as a tour to Capri and the Blue Grotto was included as an excursion. The dinner party lasted until midnight, and various conversations other than research-orientated took place among the influential people who had gathered on this occasion.

In addition, since I wanted to learn more about the situation of Italian universities, I visited the University of Milan (Scolastico), the University of Parma (Casnati, Chinsoli, Casiraghi), and the University of Florence (Ricci) for a week before the conference to deliver some lectures. I was invited to dinner at the homes of my hosts and had a nice conversation with their families and was reminded of the differences in research life in countries with long histories, and of the beauty of the cities. Time passed by slowly in this Latin country. We were flexible in our visiting plans, which changed quite often and the lunch breaks were long. I enjoyed not only science but also traditional culture, wine and food with my new friends.

In 1989, I was invited to the Fifth IUPAC Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS) in Florence organized by Giusppe Casnati, Alfredo Ricci, and Piero Salvadori, where I presented a paper on Organometallic Methodology for Nucleic Acid Synthesis. I also visited Siena and Pisa, again enjoying the wonderful culture of the ancient cities. Even in the 20th century, Italian chemistry has maintained its unique traditions, as symbolized by Giulio Natta's Nobel Prize in chemistry in 1963, but there is no reason why this flexible cultural sensitivity should not be transferred to scientific ideas.

Ischia Advanced School of Organic Chemistry, May. 1986. From the left going clockwise: Bernard Waegell, David Evans, Hiroko Noyori and author, Wolfgang Oppolzer and Mrs. Oppolzer in the red dress.

The major international conference in this country was the Second European Catalysis Symposium organized by Piero Salvadori in Pisa in 2001. This meeting in historically

fascinating Pisa brought together prominent organic synthesis scientists such as Matthias Beller, Erick Carreira, Pierre H. Dixneuf, Ben Feringa, Istvan T. Horvath, Manfred T. Reetz, Masakatsu Shibasaki, Victor A. Snieckus, Antonio Togni, Barry M. Trost, and others. I gave a talk on “Asymmetric Hydrogenation” and received a commemorative medal from the university.

P. Salvadori (right) organized a European Catalysis Symposium in Pisa in 2001.

One of the Italian people who understood my chemistry most deeply was Alfredo Ricci of Florence. He later moved to the University of Bologna, which was founded in 1088 and has a history of 900 years. Gratefully, in 2002, I was awarded the prestigious title of Laura Honoris Causa by the world's oldest university by his recommendation. Upon experiencing the traditional award ceremony in the auditorium of the Industrial Chemistry Faculty, and the presence of the historic laboratory in its original state, made me reflect on the hectic pace of daily life in Japan.

Author receiving the Laura Honoris Causa from University of Bologna, September 20, 2002. From the left: Alfredo Ricci, author, Pier Ugo Calzolari, and Agostino Trombetti.

In the same year, 2002, I was selected as a Member of the Pontifical Academy of Sciences by John Paul II of Vatican. Immediately, I was asked to submit an Italian biography for publication, and I sought the help of Bianca Bonini, a female professor I had met in Bologna a few months earlier. The Academy was founded in 1936 by Pope Pius XI. In November, I was invited to stay at the elegant Hotel Domus Sanctae Marthae in the Papal Palace, where I was impressed with the hall of knowledge as I watched the speakers discuss the issues on sustainability of modern civilized society in addition to various fundamental aspects of science. The power of a statement made in the name of the Vatican is immense.

The following year, in November 2003, I participated in the 400th anniversary of the Academy originally founded as the Accademia dei Lincei. The front of the medallion in silver shows God setting alight the torches of reason and faith held by two maidens, and the back side shows the image of the Holly Father John Paul II and Galileo Galilei (1564–1642), one of the first members. This time, along with many other giants of knowledge, I was guided through the interior of the Papal Palace and was allowed a special visit to the Basilica of Sistine, where I met Tsung-Dao (T.D.) Lee (1957 Nobel laureate in physics) of Columbia University. Lee is a brilliant physicist who was awarded the Nobel Prize at the young age of 31 for his work on the violation of parity law, which is closely related to my work in chemistry on asymmetric synthesis, viz., chemistry-induced violation of molecular symmetry. In fact, I had just been appointed President of RIKEN in October and was not yet fully aware of the activities of my own institute, but I then learned that he served enthusiastically as an advisor of RIKEN's Brookhaven National Laboratory (BNL). This unexpected encounter now convinced me

that “science is one” and “everything, everybody is connected deeply beyond time and space.” (chapter 1, page 30; chapter 9, page 283; and the Chinese section).

God setting alight the torches of reason and faith

The Holy Father John Paul II and Galileo Galilei

The Pontifical Academy of Sciences since 1603 and pictures of the medallion.

3 Belgian and Dutch Connection

Belgium

After leaving Rome on November 12, 2003, I was in Namur, Belgium, to give a series of lectures as the First Eli Lilly European Distinguished Lecturer at the request of my intimate friend Alain Krief. He asked Manning P. Cooke (Washington State University), my lab mate in the Corey group at Harvard, to be the moderator. However, Krief, who usually likes to joke, looked serious this time and said that something terrible had happened. In fact, Paul Janssen, with whom I just had lunch two days earlier at the Pontifical Academy of Sciences Conference in Vatican (Italy section), died suddenly of a heart attack there (I had left Rome without knowing about it). He was a well-known physician and the founder of Janssen Pharmaceutica.

Belgium is one of the centers of European synthetic organic chemistry, and this leading company has continued to strongly support its activities. In fact, my relationship with Belgium goes back about 40 years from now. Chemistry in this country has been led by Leon Ghosez, who had a wide network of contacts around the world (and whom I first met in Nagoya in 1979), and by Heinz G. Viehe, who is famous for his captodative concept on radical stability. They organized the EUCHEM Conference on Methods in Organic Synthesis in 1982 at Louvain-la-Neuve, and their invitation to this conference introduced me as a promising asymmetric synthesis chemist to the leading figures in Europe. At this conference, I met again with the great Derek Barton and Satoru Masamune of MIT, and got to know active chemists such as Ferdinand Bohlmann (Berlin), Ekkehard Winterfeldt (Hannover), Mieczysław Makosza (Warsaw), Daniel Bellus (Ciba-Geigy, Basel), Bernard Waegell (Marseille), Bertram Fraser-Reid (Maryland), Michael O'Donnell (Indianapolis), W. Nico Speckamp (Amsterdam), Jean François Normant (Paris), Giorgio Modena (Padova), and made young friends such as Manfred T. Reetz (Marburg), Anthony G. M. Barrett (Imperial College London), and Alain Krief (Namur), who were leading the next generation. I enjoyed the friendly atmosphere of a multinational culture, which was different from what I had experienced in the US. From my perspective, the US is a multinational country, but I feel that it is not multicultural. The atmosphere of the country is "American." On the other hand, Europe enjoys a well-mixed culture, where people's life styles, cuisines, and the researchers' ways of thinking are different.

Leon Ghosez is both a sociable and a capable organizer. He selected me as the Merck-Schuchardt Chair for 1990. Consequently, he asked me to come to the Belgian Organic Synthesis Symposium (BOSS) in Louvain-la-Neuve to give "five" lectures on Asymmetric Synthesis from 9 a.m. to 6:30 p.m. It was a request that was difficult to turn down, and in front of an audience of 350 participants, and with my friend Daniel Bellus as the moderator, I finally fulfilled my duty. I was quite exhausted, but I was somewhat reinvigorated by the hospitality of Leon and Monique Ghosez and Bellus's daughter, who was studying French and home staying at the Ghosez residence. Other guests included leading chemists from around the world, such as Albert I. Meyers, Alain Krief, Guy Solladié, Scott Denmark, Stephen G. Davies, Peter G. Schultz, Robert Jacquier, Pierre Vogel, Barry M. Trost (winner of that year's Paul Janssen Prize), Samuel Danishefsky, Hisashi Yamamoto, and Albert Eschenmoser, where they provided a broad

overview of trends in synthetic organic chemistry. I was also invited to the Sixth European Symposium on Organic Reactivity in 1997, where I gave a talk on Asymmetric Transfer Hydrogenation.The conference was attended by researchers from diverse fields, including Stephen J. Benkovic, François Diederich, Jean M. J. Fréchet, Bernd Giese, Yoshito Kishi, Martyn Poliakoff, Paul von Ragué Schleyer and others. I truly respect Leon Ghosez's magnificent management skills in putting together this symposium.

From the left: the author, Leon Ghosez, and Daniel Bellus. Alain Krief is sitting behind. At the BOSS conference in Louvain-la-Neuve, 1990.

One of the leaders of the next generation was Alain Krief, who was a Corey lab member and he was one of my closest friends. He often visited Japan and we were together at many international conferences in Europe. I was invited to his symposium at the University of Namur in 1988. I was also welcomed to his home, which he and his wife Anne had built themselves. In his later years, Krief has been active not only in academia but also in industry-academia collaborative programs. In 2001, it was just after the September 11 terrorist attacks by Islamic extremists in New York, but he organized the NIAF-MeRinOS (**N**oyori **I**ndustry and **A**cademia **F**orum and the **Me**ase-**Rhin**e Network on **O**rganic **S**ynthesis) Joint Meeting in Houffalize, near the Luxembourg border. Several Japanese companies participating in the "Noyori Forum" also sent their researchers there. In 2012, I participated in the Joint IOCD-NARC (**I**nternational **O**rganization for **C**hemical Sciences in **D**evelopment and **Na**mur **R**esearch **C**ollege)

Symposium in Namur and enjoyed a barbecue party with Don Hilvert, Klaus Müllen, Peter H. Seeberger and others at the Krief residence.

Alain Krief (left) and the author at the OMCOS conference at Versailles in 1999.

The Netherlands

I first visited Belgium's neighboring country, the Netherlands in 1971 and stopped by TNO Utrecht (Netherlands Organization for Applied Scientific Research), when Gerrit J. H. van der Kerk held its chair. After moving to Moscow, I met Gerard van Koten (organocopper chemistry) for the first time at the Fifth International Conference on Organometallic Chemistry during its excursion. He was a student of van der Kerk and later became a leader in the field of inorganic chemistry and we met frequently at major international conferences thereafter.

From the left: Shun-Ichi Murahashi, the author, and Gerard van Koten
in 1996 at the excursion of a Princeton Meeting in the US.

In the field of synthetic organic chemistry in the early 1980s, I was particularly impressed by the work of Hans Wynberg of Groningen; he was one of the founders of chiral organocatalysts and first discovered asymmetric 2 + 2 addition of ketene and chloral in the presence of quinine. Bernard L. Feringa and E. W. "Bert" Meijer, and others grew up under his influence. In 1990, I was invited by Johan Lugtenburg of the Organic Chemistry Division of the Royal Netherland Chemical Society to the Symposium on Selective Transformations in Organic Chemistry in Wageningen, where I gave a lecture titled "An Organometallic Way to DNA Oligomers." Other speakers, including Paul M. Cullis (Leister), Manfred T. Reetz (Marburg), K. Peter C. Vollhardt (Berkeley), Carlo Scolastico (Milano), Steven V. Ley (Imperial College London), Daniel Bellus (Ciba-Geigy), and Peter Dervan (Caltech) gave invited lectures. The day before the conference, Nico Speckamp, a friend of mine since the 1980 Gordon Conference, invited me to the University of Amsterdam to give a lecture on asymmetric organozinc catalytic reactions, along with viewing of the special Vincent van Gogh exhibition. Looking back on my visits, I had learned a lot from this country, which has many creative organic chemists.

Front row, from the left: the author and Manfred T. Reetz. Back row, from the left: Steven V. Ley, K. Peter C. Vollhardt, Paul M. Cullis, Daniel Bellus, and Carlo Scolastico. At the organic synthesis symposium at Wageningen in April 1990.

From the left, Nico Speckamp, the author, and Stuart Schreiber, in Kyoto, June 1994.

4 Taking Lessons from Swiss Organic Chemistry

I had once visited the ATRAS experimental facility at CERN, a representative scientific center of Europe, located near Geneva, which is also the setting for the movie Angels & Demons starring Tom Hanks, and I was overwhelmed by the sheer scale of the facility. Nevertheless, Switzerland itself also has one of the world's best basic science research infrastructures. In June 2010, after attending the Nobel Laureate Meeting at Lindau, I visited the advanced facilities of the Paul Scherrer Institute in Villigen, which reassured me of this fact.

I believe that the core of university research activities in this country is at ETH Zürich. As part of my travel in 2010, I had also visited the Campus Science City in Hönggerberg, a suburb of Zürich. Guided by Gerhard Schmitt, Vice-President for International Institutional Affairs of ETH Zürich, who was a world-renowned architect known for his sustainable urban planning, I was impressed by the energy and water efficiency of the entire campus. I then moved to the Central campus for a long meeting with President Ralf Eichler, who had a clear strategy of the university's management, looking at the future without relying on past glories.

The level of basic and applied research in chemistry in this country is among the highest in the world. I had been admiring the activities of Swiss chemists for many years since I was young. The tradition was established particularly at ETH by Leopold Ruzicka and was followed by producing many Nobel laureates such as Vladimir Prelog, Richard R. Ernst, and Kurt Wüthrich. In addition, Albert Eschenmoser, Jack D. Dunitz, Duilio Arigoni, and Dieter Seebach are giants in our research field and guided our generation in a decent manner. Swiss organic chemistry has been a national science in a similar way as Germany, but also paved the foundation of pharmaceutical industry, which in turn supports basic academic science. Unlike in other countries, the organic chemists I know in this country all take pride in the fundamentals of their science, and I have never heard them complain about the lack of funding for basic research. Thus, the Swiss chemistry community has been acting as a role model of science and technology-oriented states worldwide. I observed their high quality of research and education through my frequent visits to academic centers and industries in this gifted country.

My first Swiss friend was Manfred Schlosser (Lausanne), whom I met in Montreal in 1977, and he visited us at Nagoya in 1980. He was a fellow member of the OMCOS conference, and we had a lot of interaction ever since. Educated by Georg Wittig, he was a perfectionist and a determined German chemist, and known to maintain a certain doctrine as a scientist. Although he had a reputation as having a rather unique character, I kept a relatively good relationship with him. I found it hard to turn down his requests because he values individual trust above anything else. I first visited this country in 1982, and travelled around the country lecturing on the theme of enolate chemistry and Fe carbonyl synthetic chemistry. During my trip, I met again with Manfred Schlosser, and made new friends with Pierre Vogel (Lausanne), Wolfgang Oppolzer, Peter Kündig (Geneva), and Valentin Rautenstrauch (Firmenich).

Author with Manfred Schlosser (right) at a picnic in Lausanne in 1982.
Photo taken by Manfred's wife Elsbeth.

In April 1983, I was invited to one of the most important conferences in Switzerland, and indeed in Europe, the Bürgenstock Conference. This wonderful conference was held at the Park Hotel, a chic hilltop resort hotel near Luzern. The conference was held during the off-peak season for tourists, and many of the hotel's employees were replaced with young staff, who were said to be under training with us as guests. The conference is said to have been started on the initiative of André S. Dreiding at the University of Zurich (inventor of the molecular model named after him) with the help of chemists at ETH Zürich (Vladimir Prelog, Albert Eschenmoser, Jack Dunitz), and has been chaired by a number of well established European scientists. In the early days, stereochemistry was the main topic, but later on, a wide range of topics were consciously taken up. Even the greatest scientists are invited only once in their lifetime to give a lecture. This meant that the lecturers had to be well prepared to give a fulfilling talk. The 100 participants of the conference were balanced in terms of age, nationality, university, company, etc., but they were not informed in advance of any of the speakers, topics, or names of the other participants, which made me very nervous. The meeting I attended was chaired by Jack Baldwin of Oxford University, and in addition to Dreiding, Rolf Scheffold (Berne), M. Schlosser (Lausanne), and others served as hosts. I was invited along with Paul A. Bartlett, Andrea Vassela, Gordon Lowe, Wolfgang Steglich, Daniel Mansuy, Joseph Kraut, Gordon Roberts, Ernst Schumacher, Peter Wachter, Daniel S. Kemp, W. N. Speckamp, and John K. Stille. In addition, Sir Ewart Jones of Oxford and Vladimir

Prelog were present and the conference was a great success. I was selected as the final speaker and gave a talk on the chemical synthesis of prostaglandins, which was nearly complete at the time. Lectures were limited to the mornings and evenings, with the afternoons being devoted to poster sessions, individual free discussions, and recreations including the participant's families. With no proceedings, and prohibition of photography and unauthorized citation of content, the conference is similar in that sense to the Gordon Conferences held in New Hampshire in the USA, but this conference had a sophisticated atmosphere, which is understandable as it is hosted by a "country that values quality". The view over the Lake Lucerne (Vierwaldstättersee), and the mountains Pilatus, and Rigi was truly spectacular. Much later in my life, I took my wife Hiroko on a private trip to this place and told her about the wonderful things that happened there in the past. The place offers a unique environment to deepen friendships beyond academia. I will never forget learning from the great Prelog, who was openhearted, how to eat raclette and how to "drink white wine quickly so it doesn't curdle in the stomach," instead of talking about stereochemistry. Paul Bartlett, my brilliant friend from UC Berkeley, took me alone on a long drive to the Lake Como area, and the two of us enjoyed a long drive and conversation. We became very close friends after this drive. After the meeting, I visited ETH, the hall of fame of organic chemistry, and met Dieter Seebach (a senior member of the Corey group and my academic elder brother) for the first time in person, and I gave a lecture on molecular design for asymmetric synthesis.

The 1983 Bürgenstock conference. Front row, from the left: Jack and Mrs. Baldwin and Ewart and Mrs. Jones at Oxford. Author at the center of the second row behind Baldwin. V. Prelog behind the author in the third row and J. K. Stille next on the right

In May 1988, I was asked by my friend Schlosser, to be the Western Switzerland 3e Cycle Lecturer, touring Swiss universities. I visited Neuchatel (hosted by Raphael Tabacchi), Lausanne (Manfred Schlosser, Hugo Wyler), Fribourg (Albert Gossauer), Berne (Rolf Scheffold) and gave lectures on asymmetric hydrogenation, menthol asymmetric synthesis and prostaglandin synthesis. I also spoke at Hoffmann-la Roche and met with Klaus Müller, who was working on vitamin E synthesis and was interested in my asymmetric hydrogenation of allylic alcohols, and at Ciba-Geigy (Hp. Fischer) led by my friend Daniel Bellus. Hiroaki Suga, a 2023 Wolf Prize recipient, was then a graduate student at Okayama University (Japan) who was studying under Schlosser in Lausanne, and he took me to Zermatt to see the Matterhorn. During the trip, I seemed to have strongly encouraged him to leave Japan and study in the US. Afterwards, he received his degree from MIT under the guidance of Satoru Masamune, joined the faculty of University at Buffalo, and became a professor at the University of Tokyo. He is a very successful entrepreneur launching Peptidream Inc. and also serves as the President of the Chemical Society of Japan from 2022 to 2024.

Just around the time of this trip, the Symposium on Stereoselectivity in Organic Synthesis was organized by the Swiss Chemical Society in Geneva. I was invited together with Gerhard Quinkert, Frank H. Westheimer, S. Masamune, and Wolfgang Oppolzer to give a talk on homogeneous asymmetric hydrogenation. I was impressed by Westheimer's talk on “Bio-Organic Chemistry in Retrospect,” which strongly encouraged my later work on Ru-catalyzed asymmetric transfer hydrogenation (chapter 7).

The Swiss pharmaceutical industry is a strong supporter of the domestic and global chemical community. My collaborator, Hidemasa Takaya and I were awarded the Fluka Prize, Reagent of the Year 1989, for our invention of BINAP/$Ru(OAc)_2$, a general-purpose olefin asymmetric hydrogenation catalyst. The Swiss industry was interested in my chemistry, and I had an earlier appointment with Rolf Scheffold at Berne to give a lecture at the Fifth International Seminar on Modern Synthetic Methods in Interlaken in April of that year. This was a conference supported by the Association of Swiss Chemists, and indeed, it was well attended by researchers from the pharmaceutical industry. I was asked to introduce not only my research achievements but also on my research on enantioselective catalysis with metal complexes in general and to compile them into a book. Other two main invited speakers were David H. G. Crout (biotransformation) of the University of Warwick (UK) and John M. Thomas of the Royal Institution of Great Britain, an authority in solid state catalytic chemistry, who continued to follow my research warmly for a long time afterwards. I was fortunate to be recommended by Sir John as a Foreign Fellow of the Royal Society in 2005 (UK section). At this seminar, Scheffold also wanted to introduce me to Andreas Pfaltz, who was a rising star studying under Eschenmoser at ETH, before starting his military service. At the time, Pfaltz had just achieved remarkable results on chiral semicorrin/Cu-catalyzed asymmetric synthesis of cyclopropanes. In fact, he had grown to become one of the leading chemists in Switzerland and Germany, particularly at the Max Plank Institute for Coal Research. We enjoyed the meeting during the asparagus (the size of which is somewhat too big for me) season at the beautiful Victoria-Jungfrau Hotel.

In September 1989, I was invited as a keynote speaker together with Herbert C. Brown, Louis S. Hegedus, Jean-Marie Lehn, and Piero Pino to the Symposium on Progress and Prospects in Organic Synthesis in Champéry, famous for its beautiful scenery, organized by M. Schlosser. I spoke about the organic synthetic method for prostaglandin synthesis. In 1993, Schlosser again invited me as a Western Switzerland 3e Cycle Lecturer, as which I had already served five years before. His planning was so well prepared that it was hard to turn down his offer. This was his way. I gave five talks at the University of Lausanne on Metal Mediated Asymmetric Reactions and Catalysis, covering basic chemistry and applications. This time I also had in-depth discussions with Pierre Vogel's group and saw his family's extensive winery. I last saw Schlosser in 2008, when he visited me at RIKEN, and we enjoyed our reunion. I was shocked to hear of his sudden disappearance in the mountains where he was hiking in June of 2013. I have learned a lot from this determined chemist.

Since my younger years, Wolfgang Oppolzer (1937–1996), a renowned synthetic organic chemist who died at a young age, and myself had often been together at international conferences. In memory of his work, the University of Geneva established the Oppolzer Lectureship. In 2000, I was invited by Peter Kündig to participate in the symposium together with Larry Overman (UC Irvine), Andreas Pfaltz (University of Basel), and Paul Knochel (University of Munich), and gave the opening lecture on Asymmetric Hydrogenation. Kündig had planned to take us to see the beautiful Alps, waterfalls, and glaciers in autumn. He advised me to learn about the history of the region from visiting old castles and monasteries. He also told me that I was working too hard, but due to my tight schedule, I returned home after a two-night stay.

W. Oppolzer and K. B. Sharpless at the Hoechst Conference at the Reisensburg Castle in 1983.


At the Oppolzer Lecture at the University of Geneva in 2000. Left: Peter Kündig. Right (from left): Larry Overman, Paul Knochel, the author, and Andreas Pfaltz.

In July of 2001, I was awarded the Novartis Chemistry Lectureship by the Novartis (formerly Ciba-Geigy and Sandoz) Institute in Basel, which Daniel Bellus (1938–2011) led for many years, and gave a lecture on Asymmetric Hydrogenation. I enjoyed a long conversation with Bellus and the new director, Dr. Karl-Heinz Altmann and their families. Ulrich Schopfer, who was a postdoctoral fellow in Nagoya, was also active at Novartis. Bellus, a European industrial researcher who was born in the same year as myself, has been an exceptionally close friend for more than 30 years. Since meeting him at the EUCHEM conference in 1982 in Louvain-la-Neuve, we have frequently met at international conferences in Europe and Japan. We were both involved in editing Thieme's *Science of Synthesis*, and when he assumed the role of leading Ciba-Geigy's Takarazuka Laboratory in Japan, I had provided advice to help him understand the Japanese research culture. During my repeated visits to Basel, he invited me to various unique restaurants, and I was warmly hosted by his wife, Mrs. Mirka Bellus at their house. I also remember that I was often given a room at the Hotel Drei Könige, R. B. Woodward's regular lodging on the Rhine River, where I had sometimes wondered what this giant was thinking about in this pleasant hotel room.

Dieter Seebach is one of the leading chemists of my generation. In a similar sense to myself, he was actively engaged in OMCOS research until he developed β-peptide chemistry. As a German researcher, his research is profound, and the synthetic methods he developed are highly reliable. He and I also have in common that we studied under Corey, and I also recall that I attended the Corey Symposium at Harvard in 1988,

organized by David A. Evans and Yoshito Kishi, to celebrate his 60th birthday. Moreover, what I remember the most is that we were jointly awarded the King Faisal International Prize for Science from Saudi Arabia in 1999. I was very surprised to hear this news because this country is distanced away from Japan in terms of science and I had no acquaintances there. The reason we received the prize was for “Developing new methods for the preparation of organic chiral molecules and for the achievement of selective and efficient chemical synthesis.”

Dieter Seebach (right) and author shared the 1999 King Faisal Prize presented at Riyadh.

Respect for Albert Eschenmoser

I also have a great deal of respect for Albert Eschenmoser (1925–2023), who was contemplating the philosophy of chemistry. After he and Woodward had achieved the famous total synthesis of vitamin B_{12}, I was grateful to have the opportunity from time to time, to listen to his dignified lectures on his life-long research on the “Chemical Origin of Life.” He was interested in the relationship between the stability of the double helix structure of DNA and the function of genetic information transfer, and the topic of his talks was often: “Why Pentose- and not Hexose-Nucleic Acids?” The unparalleled accuracy, voluminous experimental facts, objective explanations without exaggeration, and conclusions were understandable. However, as stated in the famous Chinese saying, “Ask not the sparrow how the eagle soars," we cannot grasp the full picture of his magnificent philosophy of chemical evolution. Chemical evolution is a process that precedes the evolution of life. There is no doubt that he is the chemist with the deepest understanding of the molecular science of life, and his talks always made me humble. His talks at international conferences would leave the audience in the aftermath of

admiration and I often felt sorry for the speaker who had to speak after him (fortunately, I have never had to do this). Therefore, he was often assigned as the final speaker. When I congratulated him on receiving the American Chemical Society's Roger Adams Award in the summer of 2002, his response was, "Let's not forget: prizes are good, discoveries are better." This is completely true.

I often met Eschenmoser, but the last time was in 2000 at the Balticum Organicum Syntheticum conference at Vilnius University in Lithuania. I was honored to have him listen to my overview lecture on asymmetric organozinc chemistry titled, "Lessons from the Oldest Organometallic Compounds" and to participate in a panel discussion alongside him. Hiroko, my wife with a very Japanese character, accompanied Eschenmoser's clever wife Elisabeth, on a sightseeing tour of the beautiful city, and asked her how she had supported her great husband, which is an important learning that I hope she would not forget. This international conference of the Baltic States was specially organized by Victor A. Snieckus of Queens University, Canada, in collaboration with John V. Dunica, and Jaan A. Pesti, both originally from Lithuania, working at DuPont. The purpose of this event was to resume the Lithuanian science tradition, which had been lost during the Soviet occupation, and the BOSS-2000 was an opportunity to invite top-line Western speakers (I wonder whether I am one of those Westerners) to open doors to the world. I think it is important for researchers, who are working actively in a foreign country, to think about the restoration of their home country. Ivar Ugi, Robert H. Grubbs, Anthony Barrett, Irina Beletskaya, Matthias Beller, Edwin Vedejs, and others were also invited to the conference. The conference was well attended by 100 participants from Western countries and 50 from the Baltic states. The media was also interested in the event, but the headline was, "For chemists there is no vacation time," as if they did not understand the behavior of researchers.

Author (left) and his wife Hiroko, learning something important
from Elisabeth and Albert Eschenmoser (right) in Vilnius in 2000.

5 Descendants of Louis Pasteur

My Relationship with Henri Kagan

The significance of Pasteur's discovery of molecular chirality is unmeasurable. France has produced countless scientists in this field, and among them was Henri B. Kagan, who was an outstanding figure during our time. His invention of the C_2-chiral diphosphine ligand DIOP ((–)-2,3-*O*-isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphino)butane) in 1971 paved the way for the development of Rh-catalyzed asymmetric hydrogenation. I met him for the first time in 1975, when he visited us in Nagoya with his wife, Mrs. Claude Kagan, and this was also the time when I was still struggling with the synthesis of the BINAP ligand. Since then, we have met more than 20 times in different countries around the world and have developed a long-lasting friendship. While many of my French friends have the habit of expressing their dissatisfaction with political administrations and fancy debates concerning the reputation of researchers, Kagan is a quiet man whose interest centers only on academic discipline. I have been impressed by his manner where he never lost his curiosity and always faced the basic issues of molecular chirality. He once said, "to foresee and then to realize is exciting, but even more rewarding is to discover the unforeseeable." We all respect him for his sincerity. His focus was more on the concept rather than technical applications. Although he remained a major speaker at many conferences, he actually preferred dialogues and discussions at the table with me and our students based on detailed experimental data rather than debates with a large audience. I can well understand the feeling of this scholar.

I have tackled common problems like Kagan including the asymmetric hydrogenation and non-linear phenomena in catalysis, and I would like to thank him for the useful advice he had always given me like an elder brother. He liked to quietly concentrate on his research and did not seem to participate in operation meetings, which were usually favored by influential professors. When Kagan was elected as a member of the prestigious French Academy in 1992, a grand Kagan Day was organized by Gilbert Balavoine at the Paris-Sud University. He received a beautiful Academic Sword, and I delivered a congratulatory lecture with my peers, K. Barry Sharpless, John M. Brown, Jean-Pierre Sauvage, and Lionel Salem. I also participated in the commemoration symposium at the ACS meeting in Washington D.C. when Kagan was awarded the Tetrahedron Prize in 2000. One of the happiest moments for me was when the three of us, Kagan, Sharpless, and myself were jointly awarded the Wolf Prize in 2001. From Japan, we also awarded the Nagoya Gold Medal in 1998 and the first Ryoji Noyori Prize (The Society of Synthetic Organic Chemistry) (chapter 9) in 2002 to honor Kagan for his many years of contribution to chemistry.

The 2001 Wolf Prize recipients. Front row, from the left: K. Barry Sharpless, center: the author, fourth: Henri B. Kagan. Back row: the fourth from left, Avram Hershko (2004 Nobel laureate in chemistry). At the Chagall Hall of Knesset, Jerusalem in May 2001.

From the left: author and Hiroko Noyori, Claude and Henri Kagan.
At Jerusalem in May 2001.

A Journey to France, a Country of Science and Culture

My interaction with the French chemistry community began in 1984. I was already acquainted not only with Kagan but also with Derek H. R. Barton, Jacques M. Mathieu, Marc Julia, Jean F. Normant, John A. Osborn (old friend at Harvard), Bernard Waegell, and many others. However, at the time I was working on organosilicon catalytic chemistry along with some other subjects. It was Robert J. P. Corriu, a prominent silicon chemist of the University of Montpellier visiting Japan, who offered me an invitation for a somewhat extended stay in France. His request to me was: (1) to deliver a lecture at the Fifth FECHEM Conference on Organometallic Chemistry at Cap d'Agde in the south of France, in which he was an organizer; (2) to be a Visiting Professor at the University of Montpellier, and; (3) to visit and give lectures at many universities around the country in accordance with the program of the French Ministry of National Education. This proposal seemed quite packed. However, I thought this would be a good opportunity to learn not only about science, but also about the art, food, and culture of the country. Therefore, I decided to be in France with my wife and two sons, aged 10 and 5 at the time, for six weeks from the end of September to mid-November 1984. My colleagues at Nagoya took care of my duties while I was away from the university. On a personal note, this was my wife Hiroko's first trip abroad. Our older son was in fifth grade of elementary school, but we gained permission for him to take a short break from school by taking some schoolwork with him to study abroad. Although this was exceptional, we thought this experience would be far more educational for our son.

Our stay in the south of France was arranged by Corriu and his wife, and the other half based in Paris was arranged by Kagan's colleague, Claude Agami of the University of Paris VI (now known as Pierre and Marie Curie University). In Paris, we decided to stay at a simple, long-term lodging near the Quartier Latin, where my family could learn about daily life in France. While I was traveling to give lectures, Hiroko learned so many new things from many people, and the children experienced daily life in a way that would have been impossible at a Japanese school or kindergarten. My older son often went to Notre Dame Cathedral to see the rose windows, and he was able to ride the subway by himself to certain places such as the Louvre Museum. At first, our family was puzzled by the fact that, unlike in Japan, dinner in France was served only after 8:00 pm, instead of 6:00 pm.

My lecture contents covered prostaglandin synthesis, organometallic molecular design for asymmetric synthesis, asymmetric reduction, silicon science for organic synthesis, and enolate chemistry (chapter 5). Visits were made to Bordeaux (hosted by Michel Pereyre, Jacques Dunogues), Poitiers (Jean-Claude Jacquesy), Rhone Poulenc-St Fons (Gerard Soula), Lyon (Jacques Gore), Marseille (Maurice Santelli). I then went to Montpellier (R. Corriu, Joel Moreau, Jean-Louis Imbach), visited Strasbourg (Guy Ourisson, Yoichi Nakatani, Guy Solladié, Yoshinori Asakawa, Michel Franck-Neuman), and returned to Paris. I also visited Ecole Normale Supérieure (Marc Julia), Roussel-Uclaf, Romainville (J. Wel-Raynal), Paris VI (C. Agami), the CNRS Natural Products Chemistry Laboratory in Gif-sur-Yvette (D. H. R. Barton, Hugh Felkin), CNRS laboratories (Francois Mathey), Orsay (H. B. Kagan and his family), and Rouen (Pierre Duhamel). My itinerary was also very full with visits to Reims (Jean-Pierre Pete) and

Rennes (Daniel Carrie, Pierre Dixneuf). Barton, a strong Englishman, made a joking remark that French professors are more proud of their beautiful cathedrals than of their chemistry and would definitely take us to have a look around them, but of course there is a lot of good research going on in France. I learned that also in France, as in Italy, food culture is extremely important and that lunch as well as dinners are long, so you have to be a hearty eater to travel for lectures in order to be a successful chemist. Interestingly, Barton certainly fulfilled this requirement.

This tour was followed by an invitation to the EUCHEM Conference on Applications of Transition Metal in Organic Synthesis organized by B. Waegell of Marseille at Toulon and the European Council's Intensive Course of Molecular Aspects of the Chemical Processes Involving Transition Metal Complexes in September 1986. Malcom L. H. Green, Stephen G. Davies, Louis S. Hegedus, Alexandre Alexakis, Henri B. Kagan, Henri Brunner, Karl H. Dötz, Helmut Bönnemann, Maurice Brookhart, and Gerard Jaouen were also invited to the conferences. I gave a comprehensive talk on the synthesis of prostaglandins employing organometallic chemistry, which had been completed at this point (chapter 5).

At Toulon in 1986. From the left: Hegedus's wife,
Bernard Waegell, the author, and Louis Hegedus.

In addition, in 1988, I was invited to the Seventh IUPAC Conference on Organic Synthesis, organized by Paul Caubère, at Nancy located in northern France. I attended this conference as I was also attracted by the city famous for its art nouveau glassworks. The invited guests were Derek H. R. Barton, Samuel Danishefsky, James B. Hendrickson, Satoru Masamune, Manfred T. Reetz, Manfred Schlosser, Barry M. Trost, and Heinz G. Viehe, all of whom were eminent chemists. I was just beginning to deeply

understand asymmetric Zn chemistry, especially about the asymmetric amplification phenomena. I gave a lecture titled "Enantioselective Alkylation of Carbonyl Compounds. From Stoichiometric to Catalytic Asymmetric Induction," and I believe that the scientific importance of this topic was recognized during my talk.

The visiting professor system in France was very well-developed and meaningful. I stayed at the Pierre and Marie Curie University (Paris VI) for two weeks in September 1988 at the invitation of Jean-Pierre Genet. I also visited Jean Francois Normant, Alexandre Alexis, Marc Julia, Pierre Sinay, and Claude Agami in Paris, and of course Henri Kagan at the Paris-Sud University, where I gave lectures on asymmetric Rh and Ru catalysis and Zn chemistry.

In addition, in March 1995, I was invited by Pierre H. Dixneuf to serve as a Visiting Professor at the University of Rennes. Ever since meeting him during my family excursion to France in 1984, I have developed a close relationship with him through the IUPAC OMCOS meetings and other events. During my stay this time, Christian Bruneau (CNRS) provided me with detailed assistance. Dixneuf is a rare academic socialite and also a cooking expert. Not only does he produce nice research achievements, but he also makes creative recipes, goes to the market early in the morning to buy the ingredients, and cooks them himself at home. On weekends, he turned into a professional travel guide, taking me to Brittany, where we enjoyed oyster dishes. I also had the pleasure of visiting the Rennes Market, Mont Saint-Michel, Cancale, Saint Malo, Loire Valley, as well as wine tasting and gastronomy. It was a truly amusing stay.

Our friends in France seem to manage the community more flexibly and collaboratively with their peers than in other countries. On this occasion, I visited Lyon (Jacques Gore) and Rouen (Pierre Duhamel) to give talks on asymmetric hydrogenation and terpene synthesis, and gave a keynote lecture on asymmetric hydrogenation at the French Chemical Society, of which Genet was the new president at that time. In addition, Dixneuf organized in Rennes, the Scientific Day on Asymmetric Catalysis symposium making the centennial of Louis Pasteur's death, which was attended by H. Kagan, J. M. Brown, J.-P. Genet, Stanley M. Roberts, and other university academics. He also invited leading industrialists such as Rolf Schmid (Hoffman-La Roche), Susumu Akutagawa (leader of BINAP chemistry at Takasago), and others. I delivered a lecture on "Self and Nonself Recognition of Asymmetric Catalysts" (organozinc chemistry). We were pleased to receive a medal that carries Pasteur's words, "Le Savoir est le Patrimoine de L'Humanite (The Knowledge is Humanity Heritage). At the dinner party of this productive conference, we talked about the giant with Valentin Rautenstrauch of Firmenich, a long-time acquaintance of mine. I wondered where the phrase "la chance ne favorise que les esprits prepares" came from, and learned that it was quoted in Jean Jacques's "La Molecule et son Double", Hachette 1992. This book was written by this authority, who was also Kagan's mentor, to inform the public about the importance of molecular chirality. According to him, the book had not sold well, but an English version was being created. These private conversations were actually more interesting than research discussions.

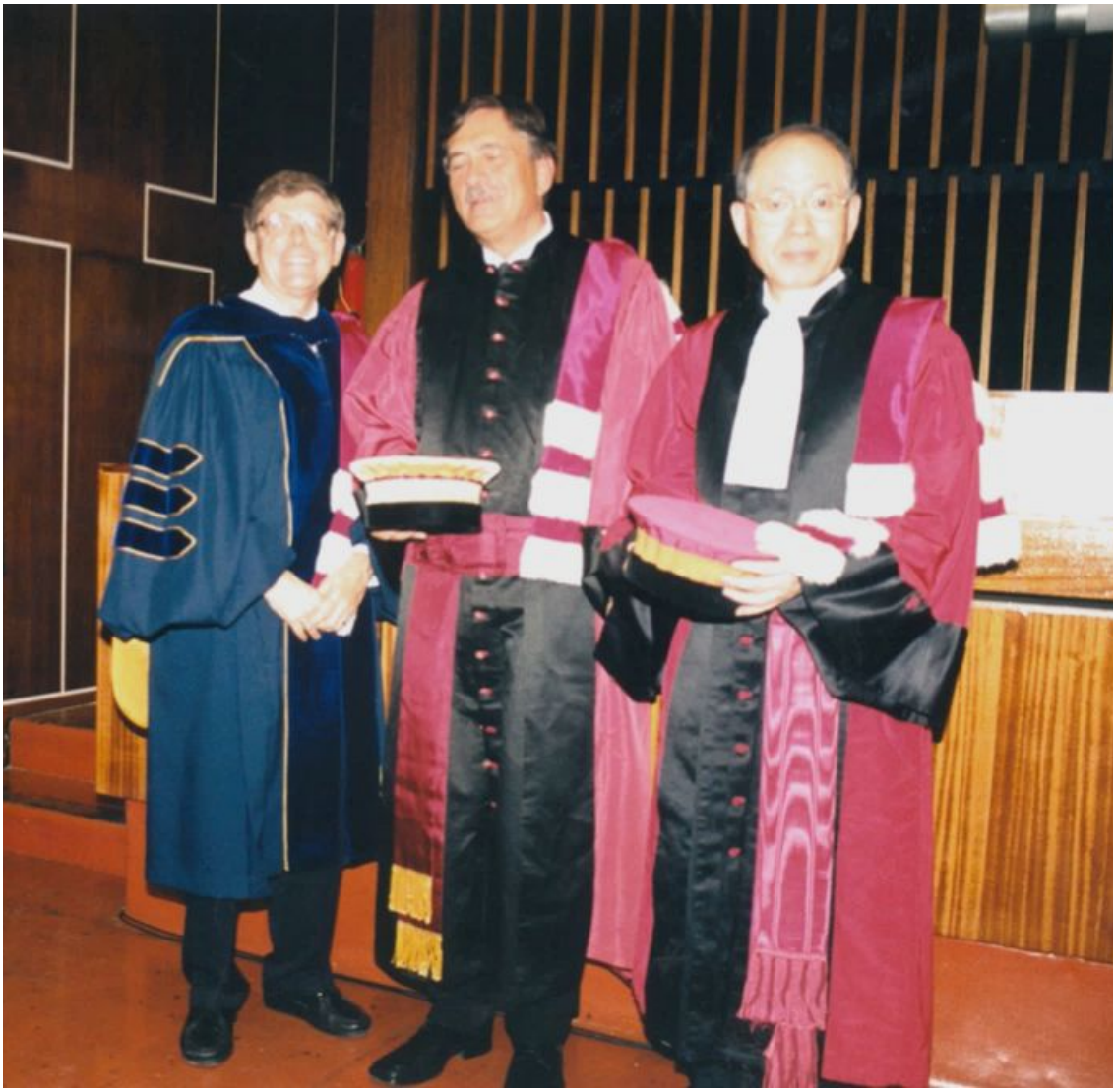
In 1999, Jean-Pierre Genet (École Nationale Supérieure de Chimie de Paris (ENSCP), who became a major figure in the country's chemical community, was putting in a lot of

effort to organize the 10th IUPAC Symposium on Organometallic Chemistry Directed Toward Organic Synthesis (OMCOS) in Versailles. I have been involved in this conference for 20 years even before its establishment (the US section), so all the keynote speakers were familiar to me. This time the plenary speakers were David Evans, Manfred Reetz, Victor A. Snieckus and myself. I gave a lecture titled “Rapid, Productive, and Stereoselective Hydrogenation” and gave an update on the progress of asymmetric hydrogenation. Jiro Tsuji gave a passionate recap of his research life in a talk titled “Recollections of Organopalladium Chemistry.” The conference was a great success, partly due to the popularity of the venue, and Genet as the chairperson who put in a vast amount of effort into organizing the conference, must have been very satisfied with the outcome.

From the left: Erick M. Carreira, the author, and Jean-Pierre Genet at the 1999 OMCOS meeting in Versailles.

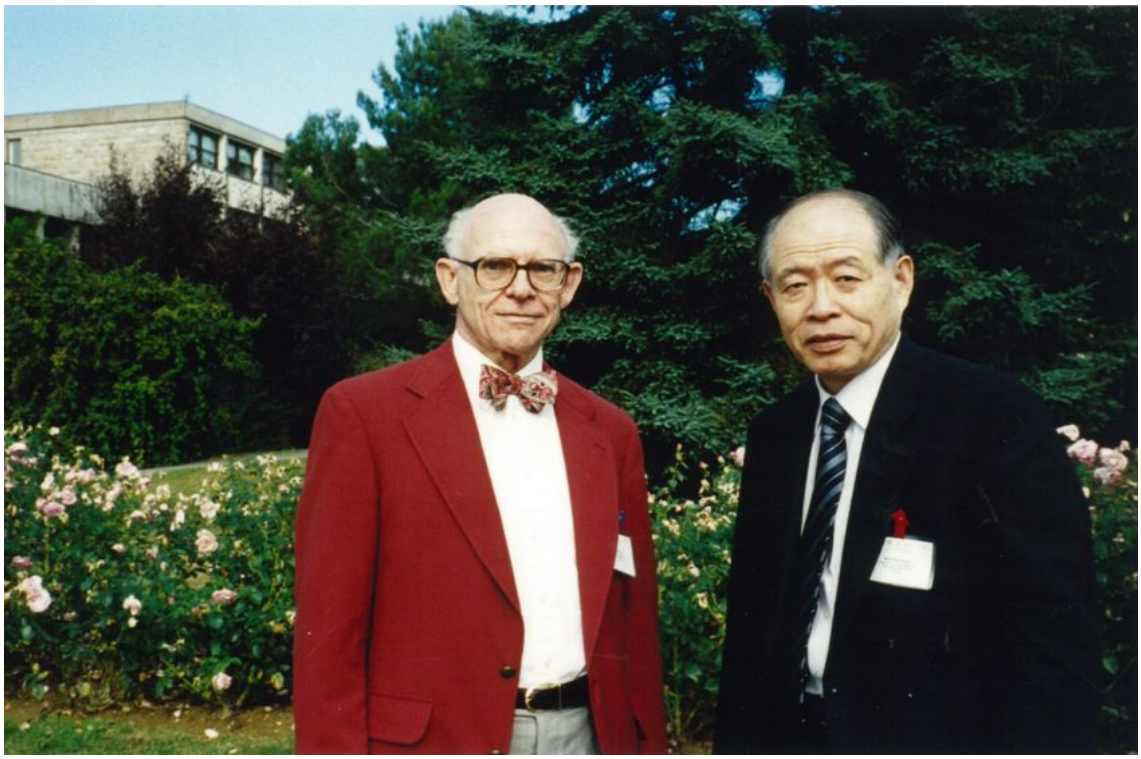
From the left: David Evans, Jiro Tsuji, Anne Krief (Alain's wife),
and the author at the 1999 OMCOS meeting at Versailles.

In 2000, thanks to the generosity of my friend Pierre Dixneuf, I received a honorary degree, Doctor Honoris Causa, from the prestigious University of Rennes I in France for the first time. Maurice Brookhart of the University of North Carolina and Wolf Peter Fehlhammer of the Deutsches Museum in Munich were also nominated together at the same time. In my case, my contribution to the cooperation between France and Japan was mentioned, but I am indebted to my many friends, and I must continue to cherish our relationship. Universities everywhere are highly selective and cautious in awarding honorary degrees, and this process took four long years from the initial application. According to the regulations of the Department of National Education, Research and Technology, the recipient cannot receive an honorary degree from any other French university for five years. At the ceremony, I wore the customary gown, but was presented with a special fur-covered hat. I was told that this was symbolic and was asked to bring it with me when I next visited the university. In my acceptance speech, I was asked to include a word of appreciation in French. I had a French postdoctoral fellow to help me prepare the speech in Nagoya, but I am sure my speech was inaudible to the attendees. On the same occasion, the Congress of the French Chemical Society (President Phillipe Desmarescaux and Vice President Igor Tkatchenko) was held, and I was invited by Michael Pereyre, Head of the Organic Chemistry Department, to give the opening lecture.



Author awarded the Doctor Honoris Causa at the University of Rennes I in 2000. From the left: Maurice Brookhart, Wolf Peter Fehlhammer (Deutsches Museum), and the author.

From left, Daniele Olivie (Director of a CNRS Institute), Gilbert Balavoine, Pierre Dixneuf, and the author. At the Congress of the French Chemical Society at Rennes in 2000.



F. Albert Cotton and the author at Rennes in 2000.

A Treasure of the French Chemistry World

I met Jean-Marie Lehn, whose creative intelligence was outstanding even as a young man, for the first time in person in 1991 at an international conference at the 150th

Anniversary Congress of the Royal Society of Chemistry in London, which was attended by great representatives from many countries (UK section). Later, I had the opportunity to meet him in various places, including in Strasbourg, and hear him speak about his pioneering work in supramolecular chemistry. Nagoya University honored him with a Goto Memorial Lectureship (1997) and awarded him an honorary doctorate degree (2000). One memorable event was the "2004 BioVision Alexandria's Nobel Day" hosted by the Egyptian sage Ismael Serageldin (Director of the Bibliotheca Alexandria, former Vice President of the World Bank), which was a conference that discussed the future of civilization. President Mubarak was also invited to the conference, together with Lehn, Ahmed H. Zewail and F. Sherwood Rowland. The modern Bibliotheca Alexandria was built in 2002 on the site of the former Library of Alexandria, a temple of knowledge dating back to 1600. Lehn himself served as the first president of the Library of Alexandria. His global leadership was extremely significant, which even went beyond chemical research.

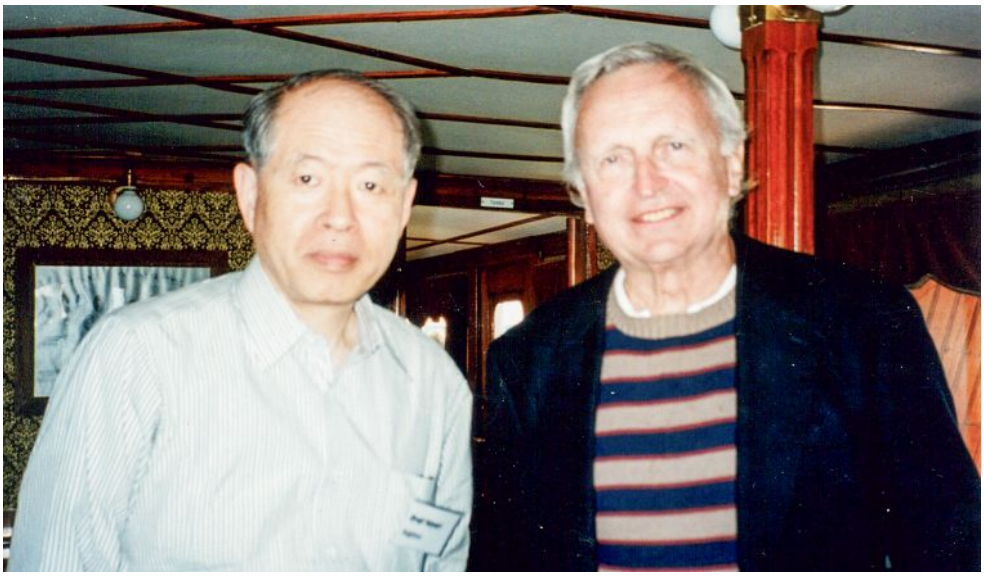
At the BioVision Alexandria in April 2004. From the left: Jean-Marie Lehn, Ismael Serageldin (Director of the Bibliotheca Alexandria), the author, and Sherwood Rowland.

6 Scandinavia (Sweden, Norway, and Denmark)

The Nobel Foundation invited me twice to their symposia on asymmetric organic syntheses in 1984 and 1996, and conferred me the 2001 Nobel Prize in chemistry. These honorable events are detailed in chapter 8 of my book.

In addition, I have a close relationship with the prestigious University of Uppsala in Sweden, where in 1994, I was invited by Jan E. Bäckvall to give a lecture on asymmetric hydrogenation reactions as a Pharmacia Lecturer. On this occasion, I visited Pharmacia (Bahram Resul, Head of Medicinal Chem) and they were very interested in our prostaglandin collaboration with Teijin (chapter 5). After some time, in 2003, Rector Bo Sundqvist granted me the title of Honorary Doctor (honoris causa). With the beginning of the US war in Iraq and the spread of SARS in Asia, my schedule often changed, and air travel was chaotic, but my friend Bengt Långström welcomed me in Uppsala and served as my host. The order of the ceremony was strictly defined. After a careful rehearsal, the master of ceremony conducted the ceremony, and the students wore formal academic dress (trail with white tie and black waistcoat) in the magnificent main hall, Aula Magna (university hall). I received my degree and gold ring, together with a laurel wreath (plant crowns). The spouses and guests then joined in for dinner at Uppsala Castle, a place that I was already familiar with when I received the Nobel Prize two years earlier. Långström took me to the Uppsala Imanet Research Institute, the successor to Uppsala University's PET Center. Afterwards, I gave a lecture on Asymmetric Hydrogenation, which was moderated by Per G. Andersson at the university.

I also remember the Symposium on Organic Chemistry in Göteborg organized by Per Ahlberg in 1999. There were many researchers involved in physical organic chemistry and reaction mechanisms, and I gave a detailed talk on the reaction pathway of "Green" Oxidation with Hydrogen Peroxide. I happened to be joined by Ronald Breslow, a debater, at dinner and enjoyed a lively conversation with him.



The author (left) and Ronald Breslow at Göteborg in 1999.

In the late 1990s, I was involved in the Japanese academic administration (chapter 9). Unfortunately, there was still a feeling within the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) that the reality of science in Japan was not well known in Europe and was underevaluated. To overcome this problem, in 2001, MEXT finally established the Liaison Office (Director Yoshiro Shimura) in Stockholm to build closer ties with the Royal Swedish Academy of Science, The Karolinska Institute, The Royal Institute of Technology, and others. I also participated in the First JSPS (Japan Society for the Promotion of Science) Science Forum to celebrate its inauguration.

I was somewhat distanced away from Norway. However, in 1996, I visited the University of Oslo to hold the Industry Lectureship from The Norwegian Chemical Society, which honors a chemist each year for his or her contributions to industrial applications. I was invited by Lars Skattebøl, whom I had hosted in Nagoya in 1986, and he had been familiar with the literature on dibromocyclopropane chemistry since the 1960s, when I was involved in carbene chemistry (chapter 2). I gave a lecture titled "Asymmetric Catalysis: Science and Opportunities," to introduce the industrial applications of asymmetric hydrogenation. I was warmly received at Skattebøl's home, but since it was my first visit to Oslo, I visited many famous places in the city by myself, including the painting, "The Scream" at the Munch Museum.

I also had no connection to Denmark, but in September 2003, I received a Holm Lectureship from the Technical University of Denmark/Danish Chemical Society. I was invited by David Tanner of this university located in the suburbs of Copenhagen, and gave a commemorative lecture for the Holm Foundation titled "Molecular Catalysis: Today and Tomorrow."

This was my last day as a professor at Nagoya University, and I arrived at Narita airport in Japan in the early morning of October 1. I visited MEXT and received a letter of appointment from Minister Takeo Kawamura, assuming the position of President of RIKEN in Wako, Saitama Prefecture. This was the beginning of my new role (chapter 9).

7 Learning the British Tradition

I learned a lot from the British chemical community, which boasts a glorious tradition and is legitimate in many ways. I also learned the scholarly custom of making concrete arrangements via air mail, which takes two weeks to-and-from, and always to keep records. Unlike the French and Italians, who from my point of view, are flexible in their responses to situations, I considered Britons as systematic as the Germans and Swiss. Since the mid-1970s, I had been acquainted with leading British chemists at international conferences, and among them was Ian Fleming of Cambridge, a brilliant gentleman and an excellent educator, as he published the textbook *Frontier Orbitals and Organic Chemical Reactions* (Wiley-Interscience, 1976), and we worked together as Foreign Editors of *Organic Syntheses* from 1983. The following year, he visited me in Nagoya, and in July 1987 he invited me to the Tenth International Symposium on Synthesis in Organic Chemistry at Churchill College, which he organized. This was a major conference founded by the Perkin Division of the Royal Society of Chemistry (RSC) in 1969 and has been held in turn at Oxford and Cambridge. Steven V. Ley, Alan P. Kozikovski, Guy Solladié, George W. J. Fleet, W. Clark Still, Eric J. Thomas, David A. Evans, Frederick E. Ziegler, Dieter Seebach, Lutz F. Tietze, Bernd Giese, and Gilbert Stork were also invited to attend the symposium. I spoke on the status of the new developments with Ru catalysts replacing Rh in Homogeneous Asymmetric Hydrogenation. We were all invited to Alan R. Battersby's house, where he opened his backyard for a barbecue-style lunch cooked by himself, and I was impressed by the elegant behavior of the Cambridge Chair Professor.

In 1988, I was invited to the prestigious Royal Society Discussion Meeting in London, organized by Stephen G. Davies and Malcolm Green (both of Oxford University). The title of my talk was "The Influence of Organometallic Chemistry on Organic Synthesis: Present and Future", and I spoke on the application of organometallic chemistry to prostaglandin synthesis. Lectures were also given by many leading figures, including Louis S. Hegedus, Barry M. Trost, Anthony J. Pearson, G. Richard Stephenson, Alexandre Alexakis, Richard Taylor, Manfred T. Reetz, John M. Brown, David Widdowson, Susan E. Thomas, Stephen G. Davies, Steven V. Ley, and Philip D. Magnus. Along with the discussions with Henri B. Kagan, Jack E. Baldwin, and Bernard T. Golding, the conference was extremely intensive. The resulting papers were published in *The Philosophical Transaction of the Royal Society of London*, the world's first periodical academic journal, launched in 1665.

Subsequently, in 1989, I was honored to receive the Centenary Medal from The Royal Society of Chemistry and to participate in the New Methods for Organic Synthesis symposium at Burlington House together with S. V. Ley, who received the Tilden Medal. I was also invited by Sir Jack Lewis for a two-week lecture tour as a Centenary Lecturer giving a lecture titled "Chemical Multiplication of Chirality". During my tour, I visited the University of Wales, Cardiff (hosted by A. H. Jackson), Leicester (T. J. Simpson), and Liverpool (Ian O. Sutherland) and learned about the cultural diversity of the UK. In Ireland, I visited the University of Dublin and Trinity College (A. Frank Hegarty), where I learned about the close relationship with Japanese pharmaceutical

companies. The visit to Oxford was excluded this time, as it was assumed that I would surely have a chance to visit there in due course.

In 1991, I was invited to one of the most prestigious organic chemistry gatherings of my experience, the 150th Anniversary Congress of The Royal Society of Chemistry, organized by Charles W. Rees of Imperial College London. The theme was set as Organic Chemistry: Meeting Future Challenges, and it was a large Perkin Division meeting with a large audience of 650 people. Speakers included A. R. Battersby, S. V. Ley, J. E. Baldwin, Jeremy R. Knowles, Derek Barton, Elias J. Corey, Gerald Pattenden, Pierre Potier, G. Stork, Jean-Marie Lehn, Ronald Breslow, Rolf Huisgen, Philip J. Kocienski, and Albert Eschenmoser, all of whom I admired. E. J. Corey, who had just received the Nobel Prize in chemistry four months earlier, gave a talk on the Corey-Bakshi-Shibata asymmetric reduction with his lecture titled "Molecular Robots," and following his talk, I gave a lecture titled "Asymmetric Catalysis: Science and Opportunities." I felt especially honored to be selected from among the many Japanese chemists. However, I also felt that the contents of my lecture were a bit too technical compared to others, especially from hearing Knowles' talk, "Enzyme Catalysis: Are We Starting to Understand?", which was very much in line with the conference objectives, and Huisgen's talk "Has Chemistry Reached the Post-Mechanistic Era?", which had a philosophical structure. I regretted my lack of education. Before the reception on the previous day, Sir John Cadogan (Director, BP International) invited the speakers to his private club, The Athenaeum. As I expected from a country of gentlemen (old boys), I learned that the customs of academia in the UK are quite unique.

In July 1993, I was invited by the RCS Dalton Division, chaired by David J. Cole-Hamilton of the University of St Andrews, to the Fifth International Conference on the Chemistry of the Platinum Group Metals. I gave an opening keynote lecture on the progress of Ru-catalyzed asymmetric hydrogenation.

I had already heard that the Ciba Foundation was helping the British chemical community, but the support of The Fine Chemicals Group of the Society of Chemical Industry, which includes SmithKline Beecham, Glaxo, Rhone Poulenc, Pfizer, and others, was also substantial. In March 1994, a meeting on the Reduction in Organic Synthesis in London was organized, which involved practical reduction reactions, and I was invited along with Herbert C. Brown (chiral boranes), Edward J. J. Grabowski (oxaborolidines) of Merck, Nicholas Turner (biochemical reduction) of Exeter, and K. M. Griffin (catalytic hydrogenation) of Johnson Matthey. I talked on asymmetric hydrogenation. Hearing my lecture, Herbert C. Brown suddenly stood up with a blue-covered book in his hand and congratulated me with a loud voice. It was my book "*Asymmetric Catalysis in Organic Synthesis,*" which was written as part of the Baker Lecture at Cornell in 1990 and published by Wiley (my pleasant experience described in the US section). This was probably because his record publication at the 1969 Baker Lecture "Boranes in Organic Chemistry" (1972) had brought him worldwide recognition for his achievements in boron chemistry. In addition, I recall that at that time, unlike in Japan, British pharmaceutical companies were beginning to have difficulty in responding to protests by animal rights groups.

The 1969 and 1990 Baker Lecturers at Cornell University gathered at the Nobel Prize Centennial Cerebration in Stockholm in 2001. From the left, Hiroko Noyori, Sarah and Herbert C. Brown, and the author.

In May of the same year, I was awarded the Merck Lectureship (established in 1987 from the initiative of Professor Ray Baker and Merck Laboratories in Harlow) and stayed in Cambridge. I had the opportunity to learn about the traditional academic climate of the region through the generosity of Andrew B. Holmes (who had visited Nagoya in November 1993 and had a strong interest in our supercritical fluid chemistry), Ian Fleming, Ian Paterson, and others. At Cambridge, I gave lectures on "Asymmetric Hydrogenation" and "Self and Nonself Recognition of Asymmetric Catalysis," and at Harlow, I gave talks on "Asymmetric Terpene Synthesis". During my stay, I had fruitful conversations with Alan B. Battersby, Anthony J. Kirby, Jonathan M. Goodman, Malcom H. Chisholm, and others. Unfortunately, one of the leading figures, Steven V. Ley, was away in Switzerland for the Bürgenstock Conference, but he was kind enough to let me use his office (with his secretary) for the week. The most useful thing for me was to stay in the Fellow Guest Room at Clare College, where Andrew Holmes belongs to, and to get a glimpse of the interaction between Fellows and elite students. Fellows were allowed to walk on the grass, but not the students. However, they were told to become respectable enough to be able to walk on the grass in the future. At Pembroke College with Ian Fleming, I learned that formal dinners are held at the high table with the distinctive black gowns. This was to nurture well-educated English gentlemen, and the atmosphere of academia was unique and different from that of other European countries as well as the US.

In September 2002, a large meeting of the Merck Lectureship Reunion was held in Cambridge, with Andrew Holms inviting Ray Baker as the Guest of Honor to celebrate

the 15th anniversary of the Lectureship. He had asked for a reunion of past Merck Lecturers on the occasion of the retirement of Ian Fleming, Tony Kirby, and Jim Staunton, who had worked with him. Originally, I was invited in 1994 to the meeting and attended this anniversary meeting as well. I attended the dinner party at Clare College, where I had previously stayed, and gave a lecture on Asymmetric Hydrogenation. Upon my return to Japan, Steven Ley, as the Chair Professor of Cambridge, arranged a drive for me to Heathrow Airport in a luxury car with a chauffeur, who proudly called Ley the King of Chemistry. I envied the high status of professors at prestigious universities in the UK, where intellectual traditions are firmly inherited.

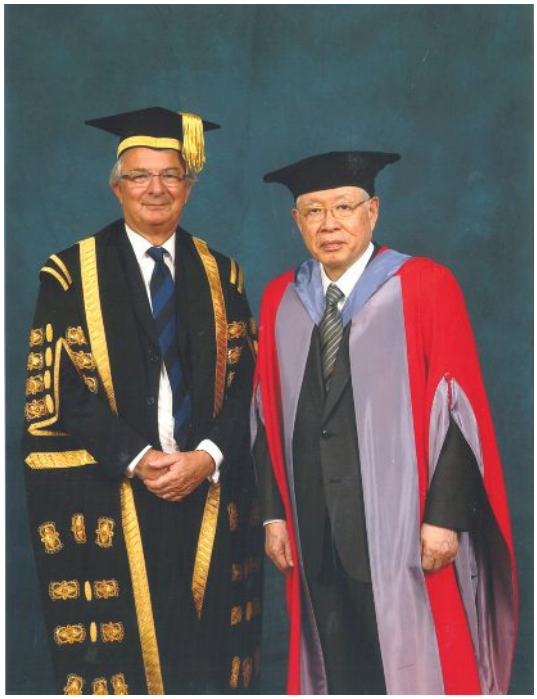
The Merck Lectureship Reunion at Cambridge in September 2002. Front row, from the left: P. G. Schultz, D. E. Cane, K. C. Nicolaou, the author, D. A. Evans, I. Fleming, J. Staunton, A. J. Kirby, A. Fersht, and S. V. Ley. Back row, from the left: I. Peterson, C. Abell, Don Hilbert, D. Seebach, C. T. Walsh, L. E. Overman, J. Knowles, E. M. Carreira, A. B. Smith, III, and Chi-Huey Wong.

From Oxford, I was invited to the 17th Symposium on Synthesis in Organic Chemistry organized by my old friend Stephen G. Davies in July 2001. Mike Doyle (Arizona), Alois Fürstner (Max Planck Institute for Coal Research), Dan Kahne (Princeton), Koichi Mikami (Tokyo Institute of Technology), Sam Gellman (Wisconsin), and Miguel Yus (Alicante) were also invited, but David Evans and I were asked to give the open-ended (unlimited) “Evening Lecture” from 8:30 p.m. I was filled with deep emotion to think that we, who have been working together for many years, are now in the older generation among our colleagues.

I have special memories of Liverpool, having visited Ian O. Sutherland in 1989 as a Centenary Lecturer. In 1997, from the consideration by Stanley M. Roberts (whom I met in Exeter in 1987) and John Fischer, I received the George Kenner Award (G. W. Kenner was a Royal Society Research Professor at the same university). The award was given in recognition of my work on asymmetric hydrogenation reactions, and this university is home to the renowned catalytic chemist, Brian Heaton. A biotechnology

specialist, Roberts and his colleagues also wanted to make use of this opportunity to promote cooperation in catalyst science (homogeneous and heterogeneous metals and biomaterials) between Japan and the UK. Today, I am happy to see that Jian-liang Xiao, who was a postdoctoral researcher of my ERATO project, is now a professor there. I became President of RIKEN in 2003, and we have further deepened our collaboration with the university in a wide range of fields, including life sciences and accelerator physics. I received the prestigious Science and Society Lectureship in 2010 and Chancellor Sir David King and Vice-Chancellor Sir Howard Newby awarded me the prestigious title of Degree of Doctor of Science (Honoris Causa) in 2013.

Receiving the George Kenner Award from University of Liverpool in 1997.
From the left: Stanley M. Roberts, the author, and John R. Fisher.



Author (right) granted the title of Doctor Honoris Causa
from Vice-Chancellor Sir Howard Newby (left) in 2013.

In fact, one of the audience members at the 1997 Kenner Lecture was the strategist, Ray McCague from Chiroscience (Chirotech), a venture company in Cambridge. He had long been examining the potential for my asymmetric hydrogenation and had been exploring licensing opportunities. He had sent a young researcher (Antonio Zanotti-Gerosa) to Nagoya to learn my technology, followed by hiring my British postdoctoral researcher, Williams Hems, to develop the business. His action was much more swift than those of Japanese companies. In 1999, he organized the International Symposium on Chirality, an industry-academia collaboration in Cambridge, and I was asked to present an opening lecture titled "Rapid, Productive, and Stereoselective Hydrogenation". University academics, including Eric Jacobsen, Barry Trost, Stanley Roberts, Nick Turner, Amir Hoveyda, Pierre Dixneuf, Antonio Togni, Donna G. Blackmond, and Eric M. Carreira, were invited together with industrial researchers including Paul Reider of Merck, Joel Hawkins of Pfizer, V. Rautenstrauch of Firmenich, Chrocep R. A. Duval, and Ton Vries of Syncom BV in the Netherlands, to this meaningful asymmetric synthesis conference.

In 1999, I visited Oxford Asymmetric International plc, founded by the entrepreneur Steven Davies. I took the opportunity to continue my trip to Southampton to attend the First International Conference on Oxidation in Organic Chemistry—Potential Industrial Applications, organized by Roger Sheldon (Delft U, editor-in-chief of *Green Chemistry* in the RCS), a leader in green chemistry and the founder of the term, "E-factor". My keynote lecture titled "Green Oxidation with Aqueous Hydrogen Peroxide" (chapter 7) was of compelling interest to the industry, and I received several inquiries from Degussa and others. I was impressed by DuPont's George E. Parshall's powerful lecture titled "Use of Supercritical Water Oxidation (SCWO) of Disposal of Organic Wastes." Just

prior to departing from Japan, I was feeling ill with a high fever, but I made the trip as usual. During my lifetime, I have never cancelled a lecture that I had promised to give. The following year, in 2000, I was elected as an Honorary Fellow of the RCS.

I have long been interested in OMCOS targeting bioactive compounds, but I am also interested in molecular catalytic chemistry, especially in the reaction mechanisms themselves. In this connection, in June 2004, Robert Mason FRS, M. Wyn Roberts, John M. Thomas FRS, Robert Williams FRS organized a Royal Society Discussion Meeting (which I attended in 1988) in cooperation with the Novartis (formerly Ciba and Sandoz) Foundation. The topics were heterogeneous, homogeneous, and enzyme-catalyzed reactions involving the activation of H_2, N_2, O_2, CO, and CH bond, and I was invited to give a talk titled "Metal-Ligand Bifunctional Catalysis for Asymmetric Hydrogenation." The conference was of a very high standard, with other speakers including Gabor A. Somorjai, K. Barry Sharpless, Gerhard Ertl, Richard R. Schrock, and Stephan Lippard. I always found British conferences orderly and dignified.

In 2005, the Royal Society, the head home of the British scientific community, of which Lord Robert May was President, granted me the prestigious title of Foreign Member of the Royal Society of London for Improving Natural Knowledge (ForMemRS). Six new foreign members, including Hartmut Michel and Harold Eliot Varmus, were elected. It has been a long road and an honor that I could not have imagined when I first visited this country in 1970 on the way back from Harvard to Japan. I should mention here that it was Sir John Meurig Thomas (Royal Institution of Great Britain, FRS and FREng), a great authority on high-performance solid catalysts, who recommended me, along with my friend Steven Ley (CBS and FRS) in the field of synthetic organic chemistry. Sir Thomas, although in a different field, must have recognized the power of asymmetric molecular catalysis when he met me at the Fifth International Seminar on Modern Synthetic Methods organized by Rolf Scheffold (Bern) in Interlaken in 1989 (see the Switzerland section for details), and he warmly followed my research after that event. Andrew B. Holms, who returned from Cambridge to his home country, Australia to work at CSIRO Molecular Science, also expressed his special congratulations on this honor. After the New Fellows Seminar, the next day was the Admission Day awarding ceremony. The Royal Society of London boasts 350 years of history, having been proposed by Christopher Wren and Robert Boyle in 1660, and founded two years later by Charles II. I signed my name with both alphabetical letters and Japanese *kanji* at the end of a large book of signatures signed by Michael Faraday, Isaac Newton, and Charles Darwin. Once again, I appreciate the generosity of the many gentleman scientists who have guided me.

The author was appointed as a Foreign Member of the Royal Society by the President Lord Robert May (left) in May 2005.

From the left: Kenzi Tamaru, Sir John Thomas, Maki Kawai, Toyoki Kunitake, Hiroko and Ryoji Noyori at the author's home in 2005.

I have invited many eminent British chemists to Nagoya to give prestigious and educational lectures. On the other hand, I had accepted only a few postdoctoral researchers to my group. I would have liked to have had more young people from the UK to come to know more about the chemistry research environment in Japan. I am not very familiar with the behavior of the students, but in 2005, the University of Bath, which values the autonomy of young people, granted me the Millennium Lectureship, which is completely managed by postgraduate students, and I had a rare experience of having discussions with many students.

I have visited the UK more than 20 times, but the greatest honor of all was when I was selected to be the Head of the Official Suite of the Visit of the Emperor and Empress (Akihito and Michiko) to Europe in 2007 (chapter 9), commemorating the 300th anniversary of Linne's birth, and on the occasion of their visit to the Linnean Memorial Society in London via Sweden I had the opportunity to meet Queen Elizabeth II and His Royal Highness Prince Philip at a banquet held in Buckingham Palace. I never forget the greatest honor being seated next to Her Majesty the Queen.

Sir Derek Barton, a Paternal Presence

Professor Derek H. R. Barton (1918–1998), who of course has a very different background and is 20 years apart in age from myself, has remained to be a fatherly figure to me. I knew this giant merely as the director of the CNRS Natural Products Chemistry Laboratory in Gif-sur-Yvette, France, from 1978, and then as a distinguished professor at Texas A&M University in the US from 1986 onwards. However, he was a proud British chemist and never acted like a French or an American. I, on the other hand, am a traditional Japanese, even though my country has become considerably westernized, and I have learned many things from him.

The first time I "saw" this teacher that I admire was on stage at the opening ceremony of the IUPAC Conference on Natural Products Chemistry in Kyoto in 1964, some 60 years ago (chapter 2, page 44). The first time I "shook his hand" was in 1980 at the IUPAC Conference on Organic Synthesis organized by Barry M. Trost at the University of Wisconsin (the US section). He warmly encouraged me for my presentation on New Methodologies Related to Prostaglandins. I met him soon again in 1982 at the EUCHEM Conference in Louvain-La-Neuve (chaired by Leon Ghosez) and in 1983 at the Hoechst Workshop Conference at the Reisensburg Castle in Germany (organized by B. M. Trost and W. Bartmann), where he listened to the progress of my research.

We were both good travelers and met each other again in the following August of 1984 at the Asian Symposium on Medicinal Plants and Spices in Seoul. We went sightseeing together to an old village to learn Korean culture. While drinking gin and tonic with him, he gave me a lecture that the bitter taste of tonic water is quinine, which was used in the British colonies to prevent malaria. When he asked about the schedule of my next visit to Europe, I told him that I was actually going to France in two months for a long lecture tour (French section). He remembered this conversation and I was able to visit his Natural Products Chemistry Laboratory in Gif to give a lecture. I was invited to dinner at the Barton home with his colleague Hugh Felkin (known for the Felkin–Anh transition state model for stereoselectivity) and Mr. and Mrs. Keith U. Ingold (whose father is Christopher K. Ingold), who were traveling in France from Canada, and we had

a nice chat. Barton was a well-known gourmet and wine lover, and many fine wines are stored at the chateau and sent to his home on special occasions such as this one.

D. H. R. Barton (left) and the author in Seoul in 1984.

I have been a keynote speaker with Derek Barton at more than 15 international conferences around the world. Barton's particular role at every meeting was to be in the front row and "ask the first and best questions," and so I believe that he heard almost every presentation I spoke. His questions are short and tough, but my view is that he doesn't like long, convoluted explanations; rather, he wants people to be clear about their point. He appeared to be (and maybe he was) a very determined, responsive and influential person, who had long led the world's organic chemistry community and he clearly behaved differently from the other intelligent chemists. In the past, I have heard that many people were immediately told off. Fortunately, he was always supportive of my chemistry, perhaps because it was simple enough and therefore easy to understand. Barton casually exchanged letters with me and often encouraged me with short letters at every milestone of my work.

In 1988, we were together at the IUPAC ICOS Conference held at the University of Nancy in France. On the last day of the conference, he asked me which university in France I would be visiting this time. I told him that I would be immediately returning home from Charles de Gaulle Airport the next day and promised that I would meet him again. However, Prof. and Mrs. Barton were very kind. They called me late at night and said, "It would not be good if you miss the train in Paris, so let's go back together

tomorrow morning." He must have wanted to tell something to me, an oriental who was not familiar with the history of chemistry. In the cabin with just the three of us, he told me about the old days of British organic chemistry, such as the behavior of the emperor Robert Robinson and the perfect lecture by Christopher K. Ingold. I should have listened more attentively than I did at the time. I often met with his friendly wife, Christiane, who always brought an album of the 1969 Nobel Prize in Chemistry in her handbag, which she proudly explained to the younger generation at dinner tables. Her husband was just smiling as she did so. She did the same when I visited their home in South Paris in 1984, and later in the US when I was a visiting professor at Texas A&M University in College Station in 1991 at the request of Ian Scott and others.

My meeting with Derek Barton led to the IUPAC Conference on Natural Products Chemistry in Karachi in 1994, where the organizing committee was headed by Atta-Ur-Rhaman, the most influential person in Pakistan. It was there that the Tetrahedron Prize for Creativity in Organic Synthesis was jointly awarded to me and K. Barry Sharpless (he was absent at the event), and the jury was chaired by Barton.

In 1995, I was invited to the W. S. Johnson Symposium at Stanford University (organized by Paul A. Wender, Carl Djerassi, and Barry Trost in honor of WSJ's 50 years of contribution), which was my last meeting with him (the US episode). Here, Barton gave a lecture titled "Oxygen and I" and told us that "In Chemical Sciences, the distant past, the near past and the present join together in continuous harmony." These words strongly encouraged me to write this autobiography. He passed away at age 79 on March 16 in 1998, while he was still active in his research until that day. (J. I. Seeman, Working with Sir Derek H. R. Barton. Chemistry, through Chemistry and For Chemistry, *Tetrahedron* **2019**, *75*, 57–69) He was 79. But the story doesn't end here.

The Royal Society of Chemistry established The Sir Derek Barton Gold Medal in 2001 to honor the life of this great chemist. The eligibility of this award is limited to publications after the age of 60. In the past, the medal has been awarded to active chemists such as Gilbert Stork, Teruaki Mukaiyama, and Jack Baldwin, all of whom met the criteria. In 2010, at the age of 71, I received this most significant award. I was exceptionally moved by this honor because of the circumstances I mentioned above. Most importantly, at the request of the British great chemist, a gourmet and a cynic with a sense of humor, the award ceremony was to be held in London with a "special dinner" prepared by the RSC. In fact, the venue for the dinner, Burlington House, was told later being awarded three stars by the Michelin Guidebook, which his spirit must have congratulated. I had a pleasant discussion with Anthony G. M. Barrett, a former student of Barton, who holds the title of the Sir Derek Barton Professor at Imperial College London, in memory of our mutual mentor of the past, which lasted until late at night.

Author receiving the Sir Derek Barton Gold Medal from RSC President David Phillips (left) at the Burlington House, London, in 2010.

8 Iberian Peninsula (Spain and Portugal)

In 2003, I unexpectedly received the prestigious Doctor Honoris Causa from the University of Alicante, a leading university in Spain. The invitation came from the Vice-Rector, Reque Moreno Fonseret, and it was Miguel Yus, who visited me in Nagoya three years earlier, that had recommended me for this honor. The previous award was granted to E. J. Corey, whom we shared as our mentor. As a fellow alumnus, he must have felt a sense of affinity with me and kept an eye on my research. In Alicante, official documents are written in both Spanish and Catalan, in a similar manner to Canada where they are written in English and French. The protocol for the award ceremony was completely fixed, and I was to address the general audience in English, which would be translated; only twice I was instructed to say, “Asi lo prometo y quiero (I promise and I will).” As Yus had requested, I gave the Nobel lecture on “Asymmetric Catalysis: Science and Opportunities”. On my way home, I was invited by Jaume Vilarrasa of the University of Barcelona to give the same talk. During my stay, I was also able to meet David Panyella, who was a postdoctoral researcher in my lab in Nagoya and was involved in the research on the green epoxidation of olefins.

Miguel Yus and the author at Nagoya in 2000.

In 2007, I visited the University of Zaragoza, a prestigious institution founded in 1542 where Santiago Ramón y Cajal, who was considered the father of neuroscience, carried out his research. I was invited by the famous organometallic chemist Luis Oro and was awarded the Bernal-Castejón Chair. This lectureship was endowed by the foundation, which was established through the donation based on the will of the analytical chemist Julián Bernal, and I had the pleasure of meeting Bernal’s wife, Lady Enriqueta, an energetic and charming widow who, at 91 years of age, still runs a pharmacy. I gave a

lecture titled, “Asymmetric Catalysts: Structural and Functional Engineering.” My wife and I strolled around the beautiful city, but the sun was so strong here that I longed to be under the shade. Also, the nights are long in this country as dinner starts at 9:00 p.m. at the earliest.

The author, Lady Enriqueta, and Luis Oro in Zaragoza in 2007.

In July of 2012, I visited Tarragona, where I was invited to attend a major gathering “Nobel Campus: Chemistry for Life”, organized by Francesc Xavier Grau Vidal, President of the Campus of International Excellence Southern Catalonia (CEICS) and Rector of the Rovira i Virgili University. Sidney Altman, K. Barry Sharpless, Aaron Ciechanover, Richard R. Schrock, Ada E. Yonath, and myself were the speakers and I chose to give a lecture titled “Facts are the Enemy of Truth,” which I thought was appropriate for Spain as it is a quote from Don Quixote. Tarragona is a center of the chemical industry, a place where Roman cultural heritage is preserved, and a region with a strong independent spirit. One of the organizers of the meeting was Kilian Muñiz, Research Professor at the Institute of Chemical Research of Catalonia, who took good care of us as we learned about the characteristics of the region and enjoyed the excellent Mediterranean food and wine. He was once a postdoctoral researcher in my laboratory and made a great contribution to the research on asymmetric hydrogenation reactions, and after returning to Europe, he also worked to establish friendly relations with Japan. He was a promising catalytic chemist recognized internationally, who unfortunately suddenly passed away unexpectedly in 2020. It is painful to lose a young and trustworthy friend.

From the left: Carsten Bolm (Muñiz's mentor at Aachen),
author, and Kilian Muñiz at Nagoya in 2000.

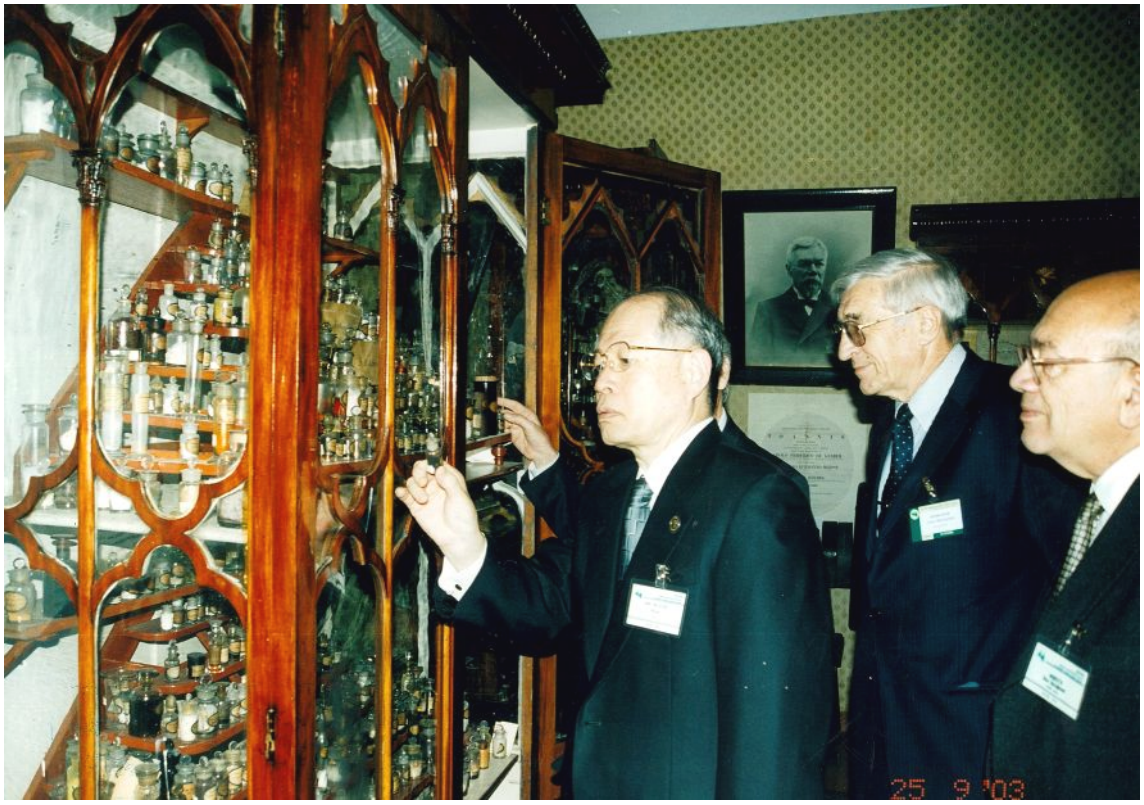
Two months later, in September, I visited Lisbon, the capital of Portugal, for the first time, because I was invited to the 25th International Conference on Organometallic Chemistry (ICOMC). I gave a lecture titled "Asymmetric Hydrogenation: Our Three Decades with BINAP." Since the day of the conference was actually my birthday, the entire audience congratulated me at the beginning of my lecture. This surprise was arranged by my friends Pierre H. Dixneuf (Rennes) and Kazuyuki Tatsumi (Nagoya), who were also present at the conference, and I thank them for their continuous kindness.

9 Russia: Cradle of Organo-element Chemistry

My first visit to Moscow was in August 1971 to attend the Fifth International Conference on Organometallic Chemistry to present about the 3 + 4 reaction using Fe carbonyls. It was still the era of the socialist Soviet Union, and having arrived via free cities such as London, Amsterdam, Düsseldorf, Mülheim, and Zurich in Western Europe, we felt somewhat cramped in this capital city, escorted by a local tourist company, and our activities being observed at our accommodations and restaurants. The international conference, led by Alexander Nesmeyanov, a leading figure in the USSR Academy of Sciences, was well organized and successful, but at the same time we were surprised to learn that the country's activities are supported by "selection and concentration" under a centralized research system, and that the allocation of precious metals and other resources is concentrated in the Academy of Sciences and other few organizations.

After that, I did not have the opportunity to visit this place for a long time, although I met M. E. Volpin famous for nitrogen fixation, and Irina P. Beletskaya, a female organometallic chemist, at international conferences on organometallic chemistry in various countries. However, after more than 30 years, in September 2003, I was unexpectedly invited to the 17th Mendeleev Congress on General and Applied Chemistry held at the University in Kazan Federal University, Russia, in September 2003. This conference was founded in 1907 in honor of Dmitri I. Mendeleev, the inventor of the periodic table, and was held every five years. It was the most prestigious meeting in General and Applied Chemistry. Located on the banks of the Volga, Kazan is a beautiful city where East meets West and is rich in the oil industry, but it also has a high standard of academic chemistry. At the conference, I gave a lecture titled "Homogeneous Catalysis: Science and Technology," moderated by the academician Valery N. Charushin.

Why did it happen? In fact, Oleg Nefedov, a leading figure in the Russian chemistry community, heard my talk at the OMCOS meeting in Shanghai in 2000 and recognized my recent research achievements. He was originally a specialist in carbene chemistry, and I knew of his productive activities through *Chemical Abstracts* (I could not read Russian. Note that in the era of US-USSR competition, the Chemistry Library of Kyoto University did not purchase journals published in the USSR) when I was interested in carbenes in the 1960s (chapter 2). Of course, I had no personal contact with him at that time, but I was truly grateful for this recognition.



From the left: the author and Oleg Nefedov. At Kazan in 2003.

In addition, in the same year, I was elected as a foreign member of the Russian Academy of Sciences (RAS) on his recommendation. More prestigiously, in 2009, I received the Lomonosov Large Gold Medal, the highest award of the RAS, on the recommendation of Academy of Sciences members Nefedov and Beletskaya. The award is limited to two recipients each year, regardless of their nationality, and was presented by President Yury S. Osipov at the annual meeting in May 2010. I am deeply grateful for the consideration of my research, which was recognized as a contribution to organic chemistry and asymmetric catalysis, although I did not have a direct relationship and feel that I have contributed little to the Russian scientific community.

Author elected to RAS as a foreign member.
With Academicians N. A. Plate and I. Beletskaya (left), 2003.

For some reason, since that time, the reputation of my achievements in Russia seems to have grown. In May 2012, I received a Honorary Degree (Doctor Honoris Causa) from Rector Ilshat Gafurov of the above-mentioned Kazan Federal University. This university, which is now one of the most prestigious universities in Russia, is historically famous for being where Tolstoy studied. My commemorative lecture was titled “Asymmetric Catalysis: Science, Technology, and Innovation,” and this university was once a leader in chemistry. Karl Ernst Klaus discovered ruthenium here, which played a central role in my catalytic chemistry; Alexander M. Butlerov opened modern organic chemistry; Nikolay N. Zinin invented the production of aniline by the reduction of nitrobenzene; Aleksandr E. and Boris A. Arbuzov (father and son), Vladimir V. Markovnikov, and Alexandre M. Zaitsev known in textbooks were all Kazan chemists. Visiting the magnificent University Museum, the Museum of the Kazan School of Chemistry, and the institutes named after famous scientists, I learned about the history of chemistry and renewed my respect for their outstanding achievements.

The author with a portrait of Karl K. Klaus. At Kazan in 2003.

At the time, I was President of RIKEN, and this was an opportunity to promote collaboration in the fields of cryogenic physics and genomic medical chemistry. President Gafurov of Kazan Federal University visited Japan frequently thereafter. On the way back to Japan, I met with President Victor Antonovich Sadovnichy of Lomonosov Moscow State University, a position he has held for 20 years, and met Irina Beletskaya again. I had the impression that the presence of state universities, federal universities, and RAS is still significant. During my stays in Russia, I often met senior researchers, but when I happenned to talk with talented young people, I felt that they were less free than in other European countries or in the US.

My fifth visit to Russia was in May 2013 and was spent in beautiful Saint Petersburg. I was awarded the Honorary Doctor Degree in Petrovsky Hall in the Main Building of the prestigious Saint-Petersburg State University, wearing formal ceremonial attire. After giving a lecture on asymmetric catalytic chemistry, I visited the Mendeleev Museum and the SPSU Museum, both of which commemorate scientific heroes, and again learned about their glorious history. We also discussed the possibility of cooperation between TUFS and RIKEN with Sergey P. Tunik, the Vice-Rector in charge of research, whom we had known for several years. With him as an exception, I felt that this country

was generally reluctant to collaborate with foreign research institutions, probably because they did not want to repeat the brain drain that occurred after the fall of the Berlin Wall in 1989. It is a shame that so much intellectual and cultural assets accumulated over the last century, cannot be put to use.

Mendeleev's statue and, from the left, Masahiko Hara (RIKEN), Kohei Tamao (Kyoto and RIKEN), and the author.

10 Visiting Eastern and Central Europe, and West Asia

With only a few close friends in Eastern European countries, I did not have the opportunity to visit them. However, in 1985, I was unexpectedly invited to attend the Conference on Chemistry and Biotechnology of Biologically Active Natural Products organized by Bogdan J. Kurtev (President of the Bulgarian Academy of Sciences), Günther Snatzke (W. Germany), and Csaba Szántay (Hungary) in Sofia, Bulgaria. Scientific activities in developing countries require strong support from developed countries, and Vladimir Prelog (1975 Nobel laureate in chemistry) was invited to the conference. In addition to Teruaki Mukaiyama and Shoji Shibata from Japan, the meeting was attended by familiar faces such as J. Bryan Jones (Canada), Arnold Brossi (USA), Ian Scott (USA), Nico Speckamp (Netherlands), James P. Kutney (Canada), Koji Nakanishi (USA), Karel Wiesner (Canada), as well as influential people like Wilhelm Bartmann of Hoechst, Germany. To match the purpose of the meeting, I gave a keynote lecture on the synthesis of 2'-5'-linked oligoadenylates, which have a unique structure (chapter 5).

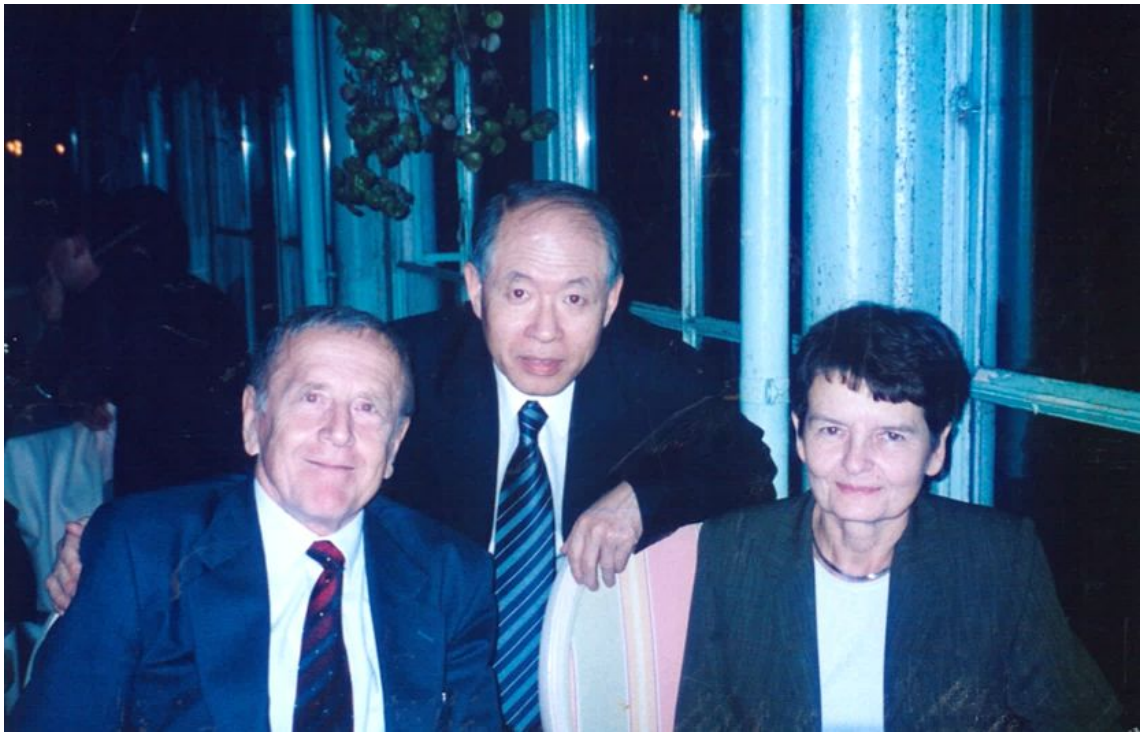
Vladimir Prelog with Nico Speckamp (left) and his wife Kamila, and
Bertram Fraser-Reid (right) at a natural product meeting in Sofia in 1985.

In the same year, I was invited by Csaba Szántay, head of the organic chemistry section of the Hungarian Academy of Sciences, to give a lecture at their academy. In addition, I visited the University of Debrecen and Chinoin, a company active in prostaglandin synthesis, to give lectures. I learned that this country has close connections between academia and pharmaceutical companies.

My relations with Austria are not very deep. Nevertheless, Karl Schlögl of the University of Vienna, who visited Nagoya in 1983, sent his student Michael Widhalm as a postdoctoral researcher to my lab, and he joined our research on Ru-catalyzed asymmetric hydrogenation. In 1989, I was invited by them to visit Vienna.

My relationship with the Polish Academy of Sciences began when I met Mieczysław J. Mąkosza in Japan in 1982. He is a very passionate chemist with excellent leadership skills. I first visited this prestigious institution in 1987 and stayed there for five days. At the request of Jerzy Wicha, a natural products chemist with whom I made a new acquaintance there, I attended the 15th Conference on Isoprenoids in 1993 at the resort Zakopane in the Tatra Mountains. Koji Nakanishi, David R. Williams, William A. Ayer, Hector F. DeLuca, Wittko Francke, Torbjörn Norin, W. Klaus, Steven V. Ley, Charles J. Sih, and other renowned researchers also participated. After arriving from a long trip, Wicha and I took a long walk in the meadow where we had a great deal to talk about, and I gave a keynote lecture on Terpene Synthesis employing Homogeneous Asymmetric Catalysis, which I was asked to do. The next morning, however, I developed severe back pain, probably caused by the long trip from Japan and walking. I managed to get up, get dressed, and leave, enduring the pain, before crawling back to Japan via Paris. It was my first and biggest physical problem abroad.

In July 2000, I was invited to the 13th IUPAC International Conference on Organic Synthesis in Warsaw organized by Mieczysław J. Mąkosza, who was an outstanding figure in chemistry in Poland. He was the founder of phase-transfer catalysis and was very interested in the hydrogen peroxide reaction using the practical phase-transfer catalyst that we had developed at that time. However, in my opening lecture, titled “Asymmetric Hydrogenation via Architectural and Functional Engineering” I presented my most recent results. In the evening, of course, we were treated to a Chopin Piano Concert. Thankfully, in 2005, I was honored with the title of Foreign Member of the Polish Academy of Sciences at the Polish Embassy in Tokyo in the presence of Her Imperial Highness Princess Takamado. This was also made possible by my friend Mąkosza.



Author with M. Mąkosza (left) at the IUPAC
Organic Synthesis Conference in Warsaw in 2000.

Daniel Bellus (Ciba-Geigy/Novartis), a Swiss citizen from Slovakia, had been urging me to visit the Czech Republic and Slovakia for some time. In 2005, at the request of Bellus, Sdenek Halval, a friend of his, and my colleague Kazuyuki Tatsumi from Nagoya (both from Roald Hoffmann's Lab), I accepted an invitation to give an Invited Lecture Series at the Institute of Organic Chemistry and Biochemistry, Academy of Sciences of Czech Republic, Prague. With the help of Irena G. Stará (research scientist), who was the wife of the Department Head Ivo Stary, I managed to go through a packed schedule and delivered a talk titled "Molecular Catalysis: Science and Opportunities." I had the pleasure of meeting and discussing with Antonin Holy, former director and developer of the AIDS drug acyclovir, a national treasure. He was a respectable and splendid researcher. In addition to the sudden appearance on Czech TV Broadcast Evening News, Hiroko and I were able to enjoy the beautiful city of Prague.

In July 2013, I visited Kyiv for the first time at the invitation of Ambassador Toichi Sakata, former Vice Minister of Education, Culture, Sports, Science, and Technology (MEXT) and RIKEN Director. I gave a lecture titled "Science Shapes Our Future" at the prestigious National Academy of Sciences of Ukraine. I also responded to an interview with The Ukrainian Week (weekly magazine), and met with senior officials, including V. V. Goncharuk, Head of the Chemistry Department. and exchanged views with science, innovation, and informatics professionals. I also visited the National Teras Shevchenko University of Kyiv, which was widely covered by newspapers. I learned that during the Soviet era, Ukraine was responsible for the development of the latest military technologies.

In August the following year, I visited Istanbul for the first time to attend the IUPAC 44th World Chemistry Congress at the request of IUPAC President Kazuyuki Tatsumi

(Nagoya), to which Aaron Ciechanover, Ada Yonath, Alan Heeger and others were invited. I gave a keynote speech titled “Chemistry Shapes Our Future.” Although I do not have many friends in the field of chemistry in this country, I have made an effort as a board member to establish a Turkish-Japanese Science and Technology University since 2019 through an agreement between the governments of Turkey and Japan. I look forward to the early realization of the establishment of a high-standard university overcoming the differences in national circumstances.

11 Neighboring Big Dragon

China, with its long history, once had four major technological inventions: the magnetic compass, type printing, black gunpowder, and paper. Nevertheless, China did not lead the world in early modern "science". The same was true for China in our era, the time after World War II, when they promoted the "two bullets, one satellite policy" (development of nuclear weapons, missiles, rockets, and satellites) related to military technology, but did not place much importance on the presence of scientific researchers. The Cultural Revolution that began in 1966 further hindered their development. Under these circumstances, their only famous achievement in the field of chemistry was a huge joint research project in Shanghai in 1964–65 to synthesize bovine insulin. It was only after the end of the Cultural Revolution in 1976 that China made a fresh start in science, and it was only until the Treaty of Peace and Friendship between China and Japan came into effect in 1978 that they became to show a strong interest in Japanese science. Subsequently, in our field of organometallic chemistry, some Chinese began to come to study at Japanese universities. Of course, senior scientists have made unfailing efforts to reform the research environment.

In the early 1980s, I had made many acquaintances in Europe and the US and was conducting my research in the same vein, but in 1982, I visited Shanghai for the first time to participate in the Second China-Japan-USA Joint Symposium on Organometallic and Inorganic Chemistry. Looking back over the past 40 years, it was an extremely important international conference, both for my own research career and from the perspective of building a relationship between China and the Japanese science community. While we were still searching for connections with China, one of the people who became our bridge was Professor Hehu Guo of the Institute of Chemical Physics in Dalian, who was also the eldest son of Moruo Guo, the first President of the Chinese Academy of Sciences (CAS). His father was a graduate of Kyushu University School of Medicine (Japan), a great literary man and a politician, and he himself was also a warm and attentive chemist born and educated in Japan. In China, there is a saying "Yin Shui Si Yuan" (one should never forget the person who first dug the well), and for me, he is the actual person who dug the well. Yaozeng Huang of the Shanghai Institute of Organic Chemistry (SIOC) of CAS, organized the meeting, and I still remember his splendid welcome speech with Chinese poetry hand-written on the blackboard. At the time, I met Lixin Dai (1924–2024) and Xi-yan Lu of the CAS, who were leading OMCOS in China, and Wei-shan Zhou, known for his artemisinin chemistry. Akio Yamamoto and about 20 other participants from Japan came to this symposium. In addition, since many leading American researchers such as Fred Basolo, John E. Bercaw, Larry F. Dahl, Jack Halpern, M. Frederick Hawthorne, Herbert D. Kaesz, Marvin D. Rausch, and Peter Vollhardt, together with NSF's influential program director O. Williams, gathered in full cast to the event, this attracted attention as future developments were foreseen.

(a) Second China–Japan–USA Joint Symposium on Organometallic and Inorganic Chemistry, Shanghai, June 1982. (b) With Hefu Guo (right) of the Institute of Chemical Physics in Dalian.

I was impressed by the enthusiasm of the country's young researchers, who were determined to make up for the "lost decade" by pursuing an active and bold "reform and liberalization economy" policy. Among them were Zhaomin Hou (RIKEN) in the field of rare earth organometallic chemistry, who later came to Japan and succeeded; Kuiling Ding, who studied at a Japanese university and returned to China to serve as Shanghai Institute of Organic Chemistry's (SIOC) President and now as President of Shanghai Jiao Tong University, he has also served as a visiting professor at Nagoya University. It was in 1985 that I accepted my first graduate student Yi Xiao from China through Ying-Yan Jiang (graduate of Osaka University) of the CAS Institute of Chemistry in Beijing. He quickly adjusted to life in Japan and eventually received his degree with me, but later left to pursue his career in the US and eventually returned to his home country: Ying-Yan Jiang was an efficient coordinator, and organized the International Symposium on Organometallic Chemistry and Catalysis at Hohhot in 1994. The chemistry meeting in the beautiful prairie in Inner Mongolia is unforgettable.

In 1985, I again visited the SIOC of CAS. The institute had developed remarkably during the past three years, and I also enjoyed a boat trip to Guilin accompanied by Lixin Dai and further deepened my friendship with him. I have met him at various international conferences and invited him to Nagoya, and have always respected his very sincere and humble behavior as a researcher and his willingness to train future generations as a leader. As a result of his efforts, organic chemistry in China has made steady progress.

From the left: Xi-yan Lu and Lixin Dai in Shanghai, 1985.

The scale of international conferences in China has always been outstanding. I attended the 34th IUPAC Congress in Beijing in 1993, but the most memorable meeting was the 19th IUPAC International Conference on Organometallic Chemistry in 2000 held in Shanghai, co-chaired by my friends Lixin Dai and Changtao Qian (the organizing committee was chaired by B. L. Yang of CAS, where I was a keynote speaker in front of a huge audience. I gave a talk titled “Asymmetric Hydrogenation via Architectural and Functional Molecular Engineering” moderated by Henry N. C. Wong. The talk was a summary of my latest achievements in this field. Other speakers included Brice Bosnich (Chicago), F. Geoffrey N. Cloke (Sussex), Pat N. Confalone (DuPont), Jack Halpern (Chicago), Wolfgang A. Herrmann (TU München), and Tobin J. Marks (Northwestern). The rapid and massive transformation of the country since my first visit in 1982 was astounding, and I was again deeply moved by the dedication of the pioneers as well as the nation’s strong intention towards its development.

At this conference, Jack Halpern, who was the speaker after me and was seated in front of me, had listened to my talk and took the effort to write a letter to me when he returned to Chicago. I was thrilled that I had been so long looked after by a great chemist whom I had admired and respected since my youth in the 1960s (US section). During my career, I have been invited to give many lectures, and I always kept in mind that each of my lectures, which I never know who might be listening, must be handled with sincerity. They should never be presented as self-promotion for the sake of those who take the trouble to come and listen. However, it is also true that over the decades I have always lacked attentiveness and there was not a moment that I regretted for not being prepared as well as I could be. As a matter of fact, the Russian eminent chemist,

Oleg Nefedov (see Russia section), also seemed to have listened to my lecture at this symposium, and I feel as if it had a certain significance. This has been a consistent sentiment of mine as a researcher, and I would like to express my gratitude to all the researchers who had warmly supported me.

The following year, 2001, the Shanghai Institute of Organic Chemistry (SIOC) of the Chinese Academy of Sciences (CAS) celebrated its 50th anniversary, where I was awarded the title of Honorary Professor from Director Biao Jiang who recognized the practicality of my research accomplishments. I was friendly welcomed by Lixin Dai, Xian Lu, the young Kuiling Ding, and other SIOC researchers and treated to a seasonal Shanghai crab feast, just in time for Christmas Eve. The award ceremony was followed by my lecture on "Asymmetric Catalysis: Science and Opportunities," a meeting with the senior management of the Shanghai city government, and a press conference. China had changed; I could not have experienced such passionate discussions with young researchers in any other country. I also met for the first time, Zhu Chen, a medical scientist and Vice President of the CAS, who would later serve as the Minister of Health, with whom I would have frequent encounters.

Author appointed the title of SIOC Honorary Professor in December 2001. From the left: Director Biao Jiang, the author, and Lixin Dai. The hall was packed with numerous enthusiastic students.

The Chinese government strongly believes that science and technology are the source of national strength, and science and engineering students at leading universities are indeed full of enthusiasm and confidence. Compared to Europe and the US, the scientific research community, including universities, seems to have a tendency toward technological inventions with high practical utility rather than the search for truth. I

have no particular intention to do so, but it appears that in such research environment, my hydrogenation catalytic reaction and others are easy to understand because it was seemingly simple and straightforward.

I have been honored with the title of Honorary Professor by many Chinese universities and institutes, including the following: in 2002, I was honored by the South China University of Technology in Guangzhou to commemorate the 50th anniversary of its foundation; in 2007, by Jiangsu University, which was a national key university focused on engineering, and by Xi'an Jiaotong University, which was selected as one of the nine best universities under the direct control of China's Ministry of Education; in 2008, by the prestigious Shanghai Jiao Tong University, the Institute of Chemistry of the Chinese Academy of Sciences, headed by Li-Jun Wan, who has studied in Japan (a graduate of Tohoku University), and the prestigious Peking University; in 2009, by the University of Science and Technology, Beijing, and Dalian University of Technology, where basic experiments and industrialization are directly linked; in 2019, by Harbin Engineering University, which is also an institution that heads mostly towards practical science. Furthermore, in 2007, Nanjing University of Science and Technology granted me the title of Honorary Doctor, which requires permission from the Chinese Ministry of Education. I am extremely grateful for their warm consideration.

Perhaps one of the greatest honors I have received in this country is the selection as a Foreign Member of the Chinese Academy of Sciences (CAS) in 2011. There were nine new Foreign Members that year, including Sumio Iijima (who discovered nanotubes) and myself from Japan, David Gross (US), and Avram Hershko (Israel, 2004 Nobel laureate in chemistry). I am honored by the consideration of many acquaintances with whom I have developed friendships over the years, and the nomination form stated that the recipients had not only made academic achievements, but also "important contributions to China's scientific and technological projects." The award ceremony was held in the Great Hall of the People in June of the following year. In the morning, CAS President Chunli Bai and President Hu Jintao delivered speeches at the opening ceremony of the General Assembly of CAS and CAE, and the academic membership diploma was awarded at the General Assembly of CAS in the afternoon.

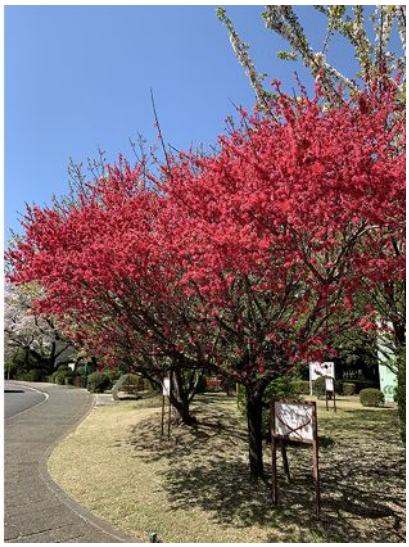
Having established itself as a scientific and technological superpower in recent years, China is confident and noble. In order to promote the construction of a science and technology center with global influence in Shanghai, the World Laureate Association (WLA) was established in 2017. Roger Kornberg was the chairman, assisted by Steven Chu, Michael Levitt, Randy W. Schekman, Venkatraman Ramakrishnan (all Nobel laureates), and others. I also provided help to them. Every year, the World Laureate Forum invites many recipients of the Nobel Prize, Wolf Prize, A. M. Turing Award, Albert Lasker Award, Fields Medal, and other awards to discuss not only science but also various social and global issues. The Forum appears to aim at fostering the next generation in China, following the example of the Lindau Meeting in Germany, but it also involves regional development projects, and I was surprised by its scale.

Scientific ideas are left to individual curiosity, but without the will of the national state, social development cannot be expected. The Chinese government's intention to promote science and technology education and research is also unwavering, and its measures to become a world leader through the fusion of science and education and cooperative

development are strategic. In 2016, I participated in the Japan-China University Fair and Forum and met with Zhongli Ding, Vice President of the CAS and President of the University of CAS, and was impressed by their high ideals and willingness to realize them. On this occasion, I was invited by President Li-Jun Wan to speak at the Forum of Great Minds at the University of Science and Technology in China in Hefei, where I felt the high level of trust that the government has in the CAS. We were taken to the famous Huangshan (Huangshan Mountain) for sightseeing, and the bullet train we used for the trip was extremely fast and comfortable. However, the baggage security checks were as strict as those conducted at international airports.

In 2019, I gave a lecture titled “Where is Science and Technology-Based Innovation Going” at the 21st Annual Meeting of the China Association for Science and Technology, which was held under the leadership of the former Minister of Science and Technology, Wan Gang. I also participated in the Japan-China high level researchers’ dialogue, and here, too, I felt that there seemed to be a system in place to ensure that policies are implemented in an orderly manner. It was clear that the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE), along with selected universities, are playing a central role in research.

Cooperation with China is extremely important for the lasting development of Japanese science and technology. The Chinese Academy of Sciences (CAS) has nurtured a cooperative relationship with RIKEN since 1983, and during my tenure as President, I organized a joint frontier science workshop (2007), opened an office in Beijing (2011), and on the occasion of the 30th anniversary of our collaboration, I made an agreement with Chunli Bai (a materials chemist whom I first met at Hanyang University in South Korea in 2005 when he was vice-president) to strengthen scientific and technological cooperation in 2013. RIKEN also opened a joint research center with Xi’an Jiaotong University in 2012.



Left: In commemoration of the 30th Anniversary of the Partnership between RIKEN and Chinese Academy of Sciences (CAS), the author (right), President of RIKEN, and Chun-li Bai, President of CAS, planted a *kikumomo* tree at RIKEN Wako campus on May 25, 2012. Right: After 13 years, on April 9, 2025, the tree was in full blossom as expected.

I fondly remember the path I have taken with many friends in this country over the past 40 years. However, in recent years, I am very concerned that the younger generation in our country lacks the connections with the Chinese chemistry community in a similar manner as with South Korea.

A "Thin Red Thread" (fate) Connecting Hideki Yukawa, Tsung-Dao Lee, and Ryoji Noyori

At age eleven, I was inspired by Professor Hideki Yukawa's Nobel Prize—Japan's first – and awakened to science. This was just because my parents were acquaintances of him (chapter 1, page 29). At the time of the Prize awarding in 1949, Yukawa at Kyoto was a visiting professor at Columbia University. His research office was succeeded in 1953 by T.-D. Lee (1926–2024), who proposed Parity Violation in 1951 together with Chen Ning Yang (1922–2025) leading to the 1957 Nobel Prize in Physics.

Having worked on molecular chirality, I had felt a scientific kinship with the topic despite the difference in research fields. Although I had never met this treasure of the Chinese scientific community, in 2003 when I became President of RIKEN, I happened to encounter a strange coincidence with T.-D. Lee. We were both members of the Vatican's Pontifical Academy of Sciences and were invited to the 400th anniversary celebration. It was there, in the Sistine Chapel, that we first met personally. This chance encounter profoundly captured my heart as a scientist in many years that followed. I am now firmly convinced that "science is one" and "everything, everybody is connected deeply beyond time and space."

T.-D. Lee was the founder of RIKEN's Brookhaven National Laboratory (BNL). In September 2005, as RIKEN President, I paid a courtesy visit to him at Columbia University in New York, to express my gratitude for his long-standing contributions. I noticed that his office was filled with old furniture inherited from his predecessor Yukawa, whom he continued to respect. At the end of our long, pleasant conversation, he handed me a hand towel *(tenugui)*, saying, "This is a gift from Professor Yukawa to you" Of course, he had no way of knowing about the relationship between Yukawa and me (and my parents), but after hearing my explanation, he said, "I gave it to the most appropriate person."

Yukawa, a person of culture, had obtained this simple hand towel at Ichirki-tei, a 350 year-long famous teahouse in Kyoto, and used it as a centerpiece on his office table at Columbia. And this was given in 1953, some 70 years ago, by the Japanese scientist to the Chinese-born American scientist T.-D. Lee. Then, after more than 50 years, this was handed to a Japanese scientist who had long admired Yukawa since childhood. This Kyoto-made cloth item thus had journeyed twice across the sea for a century. This is an irreplaceable symbol of friendship, and now is carefully preserved at RIKEN, an institution where Yukawa, Lee, and myself had each been involved separately.

T.-D. Lee was certainly among the most important scientists for our nation. In 2007, the Japanese government awarded him the Order of the Rising Sun, Gold and Silver Star, in gratitude for his longstanding contributions to Japan.

A more recent topic is to be added. Shanghai Jiao Tong University stands as one institution honoring the great legacy of T.-D. Lee. In November 2025, at the invitation of President Kuiling Ding, I delivered a Master Distinguished Lecture at the university

and toured the vast Tsun-Dao Lee Library. Learning there more about the life journey of this great physicist who contributed to the beyond-border development of science, I am now convinced that encounters between sincere scientists weave an irreplaceable tapestry of culture and history.

(a)

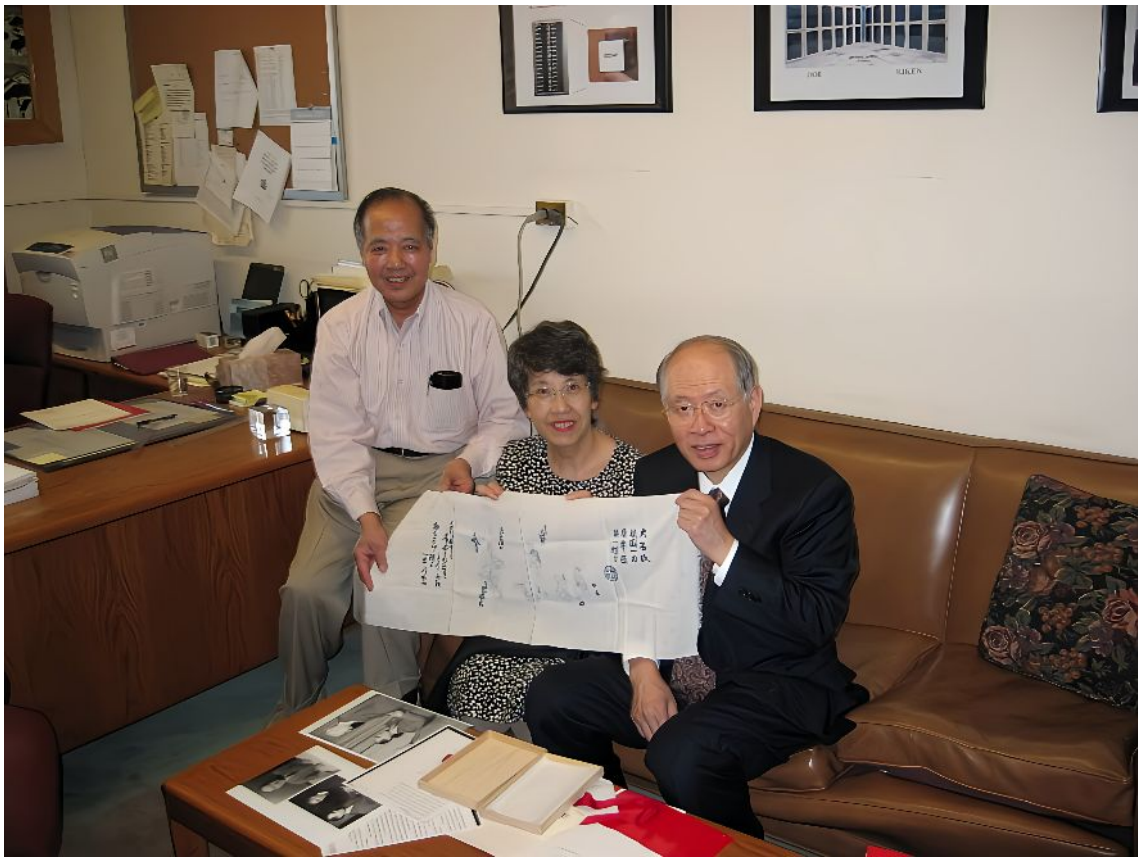
湯川博士にノーベル賞
日本人て最初の栄誉
世界に輝く「中間子論」
現に渡米中 兄弟そろって学者
物理学界の誇り

1949 Nobel Prize in Physics
Asahi Newspaper, November

(b)

(c)

(d)



(e)


the Order of the Rising Sun to Professor Tsung-Dao Lee"

(f)


前言
Introduction

(g)

My tribute to Professors Hideki Yukawa and Tsun-Dao Lee:

(a) Awarding the 1949 Nobel Prize in Physics to Hideki Yukawa was announced by the Asahi Newspaper, November 1949.

(b) Ten years earlier, in September 1939, Professor Hideki Yukawa (second from the left) and my parents (on the right) travelled to Europe and the US on the same ships. Yukawa was scheduled to attend the suddenly canceled Solvay Conference, and my father was traveling to observe the state of Western technology. The photo was taken in Hawaii on the way back to Yokohama from San Francisco.

(c) A hand-cloth used as a table centerpiece at Yukawa's office at Columbia. The motif is from "The Loyal 47 Ronin," a famous historical event occurred in 1703 (*Edo* era) in Kyoto, and holds spiritual and cultural significance for Japanese.

(d) In September 2005, the hand-cloth was given from T.-D. Lee to the author for Yukawa's memory.

(e) T.-D. Lee was conferred the Order of the Rising Sun, Gold and Silver Star from the Japanese government. In Tokyo, January 2007. From the left, the author (President of RIKEN), T.-D. Lee, and Akito Arima (particle physicist, and a former Minister of MEXT, a former President of University of Tokyo and RIKEN).

(f) The author visited the Tsun-Dao Lee Library of Shanghai Jiao Tong University in November 2025.

(g) President Kuiling Ding (right) receives the author's autobiography at the sophisticated university house donated by the T.-D. Lee family. November 2025.

12 Friendly Ties with Taiwan

Taiwan is a place where Japanese chemists felt a strong affinity, as this was where Professor Tetsuo Nozoe, a highly respected Japanese organic chemist, discovered hinokitiol (a seven-membered nonbenzenoid aromatic compound) (chapter 5). However, due to the political situation that implied: "Taiwan has no diplomatic relations with Japan," we had long been advised that caution was required when accepting an invitation from Taiwan. Finally, in April 1988, I was able to visit Taiwan for the first time at the invitation of the young and influential professor Ta-Shue Chou, as the Lecturer at Academia Sinica for the Celebration of the 60th Anniversary. I also visited the National Taiwan University and Tsinghua University, where I gave lectures on asymmetric hydrogenation reactions. Most importantly, I was also invited to the Taipei Conference on Prostaglandin and Leukotriene Research, a major topic in chemistry and bioscience those days. Many world-leading figures in this field including, Bengt Samuelsson, John Vane (both recipients of the Nobel Prize in physiology or medicine in 1982), Osamu Hayaishi (Kyoto), Yasutomi Nishizawa (Kobe), John Pike (Upjohn), and others were also invited to speak at this prosperous conference. I also received an award for presenting my achievements on the three-component prostaglandin synthesis. I will never forget the extremely warm hospitality I received during my stay, including a stay at the historic Grand Hotel, once owned by Madame Chiang Kai-shek. I got the impression that many researchers educated in the US and Japan were also active there.

Author with Ta-Shue Chou (left) at Taipei in 1988.

In 1995, I was invited to give a keynote lecture on the asymmetric synthesis of carbapenem antibiotics at the 15th International Congress on Heterocyclic Chemistry organized by Albert Padwa and Chin-Kang Sha. I also met Chi-Huey Wong, a hero Taiwanese, who was a leading figure in glycochemistry, and we rapidly became close friends. Later, he associated with RIKEN both in research and administration.

In 2002, while I was serving as the President of the Chemical Society of Japan, I was invited to the 70th Anniversary of the Chemical Society Located in Taipei, organized by Tien-Yau Luh, Director of the Chemical Institute, and Shie-Ming Peng, President of the Chemical Society. The invitation was also a recommendation from Yuan-Tseh Lee, the President of Academia Sinica. I attended the commemoration ceremony and gave a lecture reflecting my research. Through the arrangement of Tien-Yau Luh and his wife, my inside story “Living as an Only One” (a Japanese book published by Chuokoronsha in 2002), which Eiji, my elder son, was involved in writing, has been translated into Chinese.

Shie-Ming Peng (second from right) chaired the
70th Anniversary of the Chemical Society, Taipei.

Academia Sinica, the most prestigious institute, and National Taiwan University had a very close relationship. In 2010, I received the Academia Sinica Lectureship, and in 2013, I received the K. T. Wang Bio-Organic Chemistry Lectureship (established in 2000). These were directed by Academia Sinica President Chi-Huey Wong (successor to Y.-T. Lee). I was always asked to deliver public lectures along with talks on chemical research. The city of Taipei, surrounded by old-fashioned Chinese characters and the warm hospitality of Y.-T. Lee and C.-H. Wong and their wives always eased my heart.

In 2014, Taiwan established the Tang Prize, an international academic award founded by Samuel Y.-L. Yin, who has made his fortune in business. The Tang Prize consists of four categories: Sustainable Development, Biopharmaceutical Science, Sinology, and Rule of

Law, and the selection is made by Academia Sinica. I was involved in this successful project as an advisor.

The existence of Yuan-Tseh Lee is extraordinary. He is exceptionally intelligent and a man of integrity. He is the former President of Academia Sinica and recipient of the 1986 Nobel Prize in chemistry, is the most respected existence in the Asian science community and is acting as the indispensable regional leader. He returned to Taiwan from the US in 1994 at the request of President Lee Teng-hui, and has greatly contributed to the reorganization of Taiwan's scientific community and science and technology administration, and to the development of the country to the present day. He has also shown leadership in sustainable development, including on climate change issues, based on his own philosophy. I have felt this person like an elder brother to me. He is closely associated with Nagoya University, where he received an honorary doctorate and, together with me, serves as an honorary dean of the Institute for Advanced Study. I awarded him the title of the RIKEN Fellow, and he gave me useful advice as the Vice Chairman of the RIKEN Advisory Council (RAC). Remarkably, Y.-T. Lee has never forgotten the "orthodox Japanese" that he learned in his youth, and our daily conversations are conducted in Japanese.

Yuan-Tseh Lee (left) is conferred the title of RIKEN Honorary Fellow in March, 2011. Together with Mrs. Lee (middle) and the author.

13 Hong Kong—a Dynamic Science and Technology District

It was Albert S. C. Chan who brought me to Hong Kong many times. Our first encounter dates back in May 1991 during my stay as a Morris S. Kharasch Visiting Professor at the University of Chicago (see the US section). That time I was invited to the Monsanto Symposium on Current Methods for Enantioselective Synthesis in St. Louis. During this symposium, I met William S. Knowles, whom I had not seen since the first IUPAC OMCOS meeting in Fort Collins in 1981, and the meeting was a great success with leading figures in the fields of chemical catalysis and biocatalysis, including K. Barry Sharpless (MIT), Stephen G. Davies (Oxford), David Evans (Harvard), William R. Roush (Indiana), Charles J. Sih (Wisconsin), and Bryant W. Rossiter (Brigham Young). It was here that I first met Albert Chan, who was the key figure in Halpern's famous discovery of the anti-lock-and-key mechanism in Rh-catalyzed asymmetric hydrogenation (chapter 6), and who was working for Monsanto after receiving his degree at Chicago.

After a short stay at the National Taiwan University, he moved to the Hong Kong Polytechnic University in 1994, where he rapidly demonstrated his talented ability. He must have achieved an authoritative position within the university, because in 2000, he granted me the title of Distinguished Visiting Professor, second after Halpern. He was also skilled in the organization of conferences based on industry-academia collaboration as well as research, and he took this opportunity to organize the Chirotechnology Symposium and asked me to give the opening plenary lecture on asymmetric hydrogenation reactions and Michel P. Doyle (University of Arizona) to give the closing plenary lecture on the progress of asymmetric carbene reactions. At this meeting, I realized that over the past 30 years, the field of asymmetric synthesis had come a long way.

Chan was an excellent strategist and was planning to open a joint laboratory with Hong Kong Polytechnic University in Shenzhen, Mainland China. In April 2002, Chan hosted the International Forum on Pharmaceutical Technology to promote this project, and I was invited to this forum. The Chiral Asia Symposium was also held in Hong Kong with the help of Trevor Laird (Science Update), and gathered speakers including John Brown (Oxford), Michael P. Doyle (Arizona), Erick Carreira (ETH), Neresh Nayar (Pfizer), Masakatsu Shibasaki (Tokyo), Mark Burk (Diversa), and Ben L. Feringa (Groningen).

As the Head of the Department of Applied Chemistry and Chemical Technology at Hong Kong Polytechnic University, which was celebrating its 65th anniversary, his activities did not stop there. As a commemorative event, President Poon Chung-Kwong and Council Chairman Sir Gordon Y. S. Wu awarded the Distinguished Honorary Professorships to William S. Knowles, myself, and K. Barry Sharpless, all of whom had just received the Nobel Prize in chemistry in the previous year. The 84-year-old Knowles' talk was shown as a video interview that Chan himself had traveled to the US to meet him directly, and we, who were still young, gave a commemorative lecture on site. In fact, this event was a publicity event to promote the university's project for the Area of Excellence in Molecular Technology in Hong Kong, and this effort was rewarded with a great success. In 2005, at the request of Chan and Chi-Ming Chen, I

was invited to deliver the opening keynote lecture at the Symposium on an Area of Excellence in Molecular Technology in Hong Kong.

Albert Chan studied in Japan and moved to Hong Kong after working in US universities and industry and in Taiwan. He is not only an accomplished researcher in asymmetric synthesis (G.-Q. Lin, Y.-M. Li, A. S. C. Chan, *Principles and Applications of Asymmetric Synthesis*, 2001, John Wiley and Sons), but also a hard worker with outstanding management skills. He later served as the President of Hong Kong Baptist University and Professor of Sun Yat-sen University, Guangzhou. I admire his resilient way of life.

From the right: Albert Chan, Jack Norton, and the author at Nagoya in 1997.

14 Strong Friendship with Korea

From the Japanese perspective, South Korea is a neighboring country and we work today to continue building our long-time friendship. I am sure my Korean colleagues feel the same way. In recent years, the country's science has made great advancements over the past decade. The amount of research investment exceeds 4% of their GDP, ranking second in the world after Israel. Companies such as Samsung, LG, Hyundai, and Posco have made significant investments in R&D. Furthermore, the Korean government is rapidly launching policies to promote science and technology through equipping various national laboratories and, in particular, establishing the Institute of Basic Science (IBS) in 2011, which aimed to become one of the best class institutes in the world. However, the history of modern science in this country is relatively young, and as one of their neighbors in the field of chemistry, I would like to emphasize the efforts of the generation, who were active 40 years ago that laid the foundation for their nation's science.

I remember well the outbreak of the Korean War (1950–1953) when I was in fifth grade of elementary school. I presume that it must have been hard for scientists to recover from the devastation that followed. When I first visited Seoul in 1984, it was still under a quasi-war regime. What is particularly memorable for me was building the road of cooperation between Japanese and Korean organic chemists. The struggle is perhaps unknown in the advanced Europe and the US communities.

The Second Japan-Korea Seminar in Kyoto in 1984. Front row from the left: E. Lee, author, S.-C. Shim, T. Matsuura, Y.-T. Kim, S. Kim, K. Kim, and S. Misumi. Back row from the left: S. Itô, I. Saito, B.-Y. Chung, J. Kang. K. Mori, J.-H. Kim, A. Suzuki, S. Murahashi, and K. Koga.

Japan and Korea ratified a bilateral science and technology agreement in 1985, but our predecessors started the cooperative relationship much earlier, originating from 1980. The photo above is a commemorative one taken at the Second Japan-Korea Seminar on Organic Chemistry held in Kyoto in 1984, which was the first time I was involved with Korea. The Japanese side was led by Teruo Matsuura (Kyoto), Soichi Misumi (Osaka), and Shô Itô (Tohoku), and I was 45 years old at the time. The leader from the South Korean side at that time was Professor Sang-Chul Shim of KAIST, who had studied under George S. Hammond and had also stayed at the Institute for Molecular Science at Okazaki in Japan, with the help of Nung-Min Yoon (Sogan University, H. C. Brown school), who was good-natured and had many Japanese friends. They were leading researchers such as Bong-Yung Chung (Korea University), Eun Lee (SNU, A. I. Scott–K. Nakanishi school), Sunggak Kim (KAIST, Corey school), and others who were younger than me and in their mid-30s to early 40s. I feel that we should try not to forget that these young researchers, who were educated in the US or Canada, returned to their home countries, not only to carry out their own research, but also to create new educational and research systems through their sacrificial efforts. I would like to testify that without their dedication to their country, the standard of Korean chemistry would not be what it is today.

I feel that the researchers in this country seek for passionate and enduring friendship, which is likely to arise from the national character they inherit. This conference was aimed to build a stable relationship between the two countries and was held every two years, with the host and venue alternating between Japan and Korea, where Sang-Chul Shim (1986, Daejeon), Kenji Mori (1988, Tokyo), Bong-Young Chung (1990, Daejeon), myself (1992, Nagoya), and Sunggak Kim (1994, Seoul) served as organizing committee chairs. Eventually, Yong-Hae Kim, who had been educated in Japan and is now a Member of the Korean Academy of Sciences, joined this committee, and the understanding between the two countries deepened further. The Korean chemical industry at that time was also very supportive, and Hun-Seung Oh (former Corey group member), who later became the Executive Vice President of LG and Chairman of Korea Research Institute of Chemical Technology (KRICT), also provided strong support towards this conference. The photo below was taken at the Japan-Korea seminar I organized in 1992, which was attended by leading synthetic organic chemists from both countries as well as leaders from China as guests, to promote further advancement of chemistry in Asia. Both the researchers and the symposium developed steadily, and it’s interesting to compare this photo with the photo above, which was taken eight years earlier.

The 6th Japan–Korea Seminar at Nagoya in 1992. Front row, from the left: Wei-shan Zhou, Li-xin Dai, Akira Suzuki, Teruaki Mukaiyama, Xi-yan Lu, author, Bong Young, Mung-min Yoon, Sang-Chul Shim, and Masaaki Suzuki.

In 1993, the Japan-Korea Joint Symposium in Chemistry led by Hiroo Inokuchi (Okazaki, a discoverer of conducting organic substances), was held in Seoul as part of the Japan Society for the Promotion of Science (JSPS) project, and with this relationship as a core, we successfully organized the JSPS-KOSEF (Korea Science and Engineering Foundation) Symposium on Asymmetric Synthesis under the chair of Kenji Koga (UTokyo).

I was invited to visit South Korea not only for Japan-Korea bilateral meetings, but also for more widely open international conferences. Firstly, in 1984, I was invited by the Asian Symposium on Medicinal Plants and Spices organized by B.-H. Han to give a lecture on prostaglandin synthesis. Derek H. R. Barton, Carl Djerassi, Tetsuji Kametani (Tohoku), Teruaki Mukaiyama, and Shoji Shibata (Tokyo) were also invited as keynote speakers for this symposium.

From the left: Carl Djerassi, Derek Barton, Eun Lee, and the author. In Seoul, 1984.

In later years, South Korea provided a platform for science that became open to the world at large. In 2004, Ho-Wang Lee, a renowned virologist and President of the Korean Academy of Sciences, invited me to attend the 4th Science Council of Asia Conference at Seoul. Other leading figures who were invited to attend, included Kiyoshi Kurokawa, President of the Science Council of Japan, Jan Lindsten of the Swedish Academy of Sciences, and Goverdhan Mehta, an organic chemist from the Indian Institute of Science (IISc). I gave a special keynote lecture on the development and application of asymmetric hydrogenation reactions, which was moderated by my old friend, Eun Lee, at the Frontiers in Chemical Research session. In 2005, at the request of Junghun Sue of the Seoul National University (SNU), I participated in the 11th Asian Chemical Congress (founded in 1978 with 27 countries) in Seoul with other Nobel laureates. In 2010, I was invited to the 20th IUPAC Conference on Physical Organic Chemistry organized by Dae-Dong Sung of Busan Dong-A University and talked about the reaction mechanism of asymmetric hydrogenation. Nobel laureates Aaron Ciechanover, Robert Huber, and Rudolph Marcus were also invited to this conference, and I reunited with Weston T. Borden, a theoretical chemist whom I had met 40 years before at Harvard.

In recent years, prosperous Samsung has been supporting not only the economy but also various scientific and technological activities in this country. In 2015, I was invited to participate in the Global Research Symposium (inaugural) organized by the Samsung Science & Technology Foundation. I gave a talk together with Sung-Mo Kang (KAIST, president), Robert Dynes (UC, president emeritus), Efim Zelmanov (UCSD, professor), Mathias Uhlén (KTH (Royal Institute of Technology), professor, former Nobel Prize selection committee member), Andrew Marshall (*Nature Biotechnology*, chief editor), and Seong-Keun Kim (SNU, dean of college of natural science). The title of my talk was "Where Am I From? Where Are You Going?"

I was extremely impressed by the high level of Korean research in the more specialized field of chemistry at the Ho-Am Forum on Engineering 2019. Ho-Am, the title of the Forum, is the pen name of Samsung's founder, Lee Byung-chul. I was asked by Nam-Gyu Park, the famous inventor of the solid-state perovskite solar cell, to give an opening lecture and I gave a public talk titled "From Chemistry to Society: Pathway to Achieving Sustainable Development Goals," although the theme of the forum was Perovskite for Future Photovoltaics and Optoelectronics. Perovskite solar cells was discovered by Tsutomu Miyasaka of Japan, but the work of Nam-Gyu Park, together with that of Michael Grätzel (École Polytechnique Fédérale de Lausanne) and others, made me fully aware that the activities in Korea were leading the world.

As I mentioned earlier, personal relationships are especially important in this country. Sunggak Kim, a junior alumnus of the Corey group and a friend of mine for over 30 years, has grown to become a major force in chemistry at KAIST. In 2000, the Center for Frontiers in Molecular Design and Synthesis (CMDS), which he heads, held the CMDS Symposium 2000 on Frontiers in Molecular Design and Synthesis to which I was invited to. Subsequently, in 2005, from his consideration, I was invited to KAIST as a Distinguished Lecturer, and received a warm welcome, giving a talk titled "Molecular Catalysis: Today and Tomorrow." At that time, KAIST was undergoing major reforms under the leadership of Robert R. Laughlin (1998 Nobel laureate in physics), the newly appointed President who came from Stanford, and many researchers were concerned about the impact on the academic culture that had been cultivated. I wonder how this was settled.

Along with traditional universities such as SNU, new US-model universities have emerged as leaders in Korean higher education. Pohang University of Science and Technology, which was founded with the support of the steel company POSCO, is a prime example. In 1994, when I attended the Fifth CBM International Symposium together with Sunggak Kim, Eiichi Nakamura (Tokyo Institute of Technology), and others at the invitation of Dong-Han Kim, a leader of the Center for Biofunctional Molecules, who had lived in the US for a long time, I was impressed by the extremely favorable environment and observed that they were top class along with their faculty and facilities. With K.-H. Ahn as our guide, we toured Kyung-ju in beautiful autumn. In 2016, I was pleased to receive an Honorary Degree from this Korea's leading university of science and technology on the occasion of its 30th anniversary. Together with President Doh-Yeon Kim (who served as Minister of Education under the Myung-Bak Lee administration), I had a lengthy interview by their local news agency, Joong-Ang Daily News. I was treated to a traditional Korean cuisine by the Dean, Byeyang-Hyean

Kim and his wife, and planted a memorial tree in the university's Nobel Garden. Among the many leading figures I met, I learned about the current state of elite training of North Korean scientists and engineers from Chan-Mo Park, former president of Pohang University of Science and Technology (POSTECH) and honorary president of Pyongyang University of Science and Technology (PUST), who was a US citizen and computer researcher at the University of Maryland. The situation was striking. From talking with him, I wondered if the Japanese scientific community and the administrative agency really understand the actual situation of science in North Korea.

One of the leaders of POSTECH's research was Sung-Kee Chung, an influential scientist who returned from the US. He invited me to the International Medicinal Chemistry Symposium in Seoul in 1997, together with William Lipscomb and A. Ian Scott. The symposium was organized by the Asian Division of the IUPAC Medicinal Chemistry Division, and we discussed the differences in the state of universities in Japan, the US, and South Korea.

This symposium was chaired by Yung-Bog Chae, who studied under Rolf Huisgen (Munich) during his youth. Coincidentally, I later reunited with this great man, who had research experience and served as the Secretary of Science and Technology, in 2005 at Hanyang University, where he was leading. He is a gentle and thoughtful leader. In 2008, I was awarded the prestigious Honorary Degree (Honorary Doctor of Science) from this university. Following President Chong-Yang Kim's opening address, everyone stood to pay homage to the national flag and the national anthem was played. The University Founding Philosophy was explained by the Dean of Academic Affairs, and after that, the reasons for the recommendation of the degree were explained, followed by the conferral of the degree, the presentation of a wreath, my acceptance speech, and a congratulatory recital. Finally, the ceremony ended with Benediction with everyone standing once again, and a closing statement. I was impressed by this solemn ceremony, which had a completely different atmosphere from those held in Europe and the US.

Looking back over the years since the 1980s, the development of private universities and young universities in South Korea during this century has been quite remarkable. In 2005, Yoon-Dae Euh, President of Korean University, a prestigious private university, invited me to give the Nobel Laureate Lecture Series celebrating their 100th anniversary. This university was receiving strong support from Hyundai-Kia Motors. I gave a talk titled "Molecular Catalysis: Today and Tomorrow." Alan J. Heeger (UC Santa Barbara, 2000 Nobel laureate in chemistry), and Yuan-Tseh Lee (Academia Sinica, 1986 Nobel laureate in chemistry) were also invited to this event. Myung-Bak Lee, the mayor of Seoul who later became President, also attended the dinner with the Nobel laureates. In 2007, I was invited to the Yonsei Nobel Forum at Yonsei University, another prestigious private university with a 22-year history. K. Barry Sharpless and I were selected by Kwan-Soo Kim (former Corey lab member) for the field of chemistry, George F. Smoot for physics, H. Robert Horvitz for medicine/physiology, and Vernon L. Smith and James A. Mirrlees were invited for economics. I felt that the international presence of this university is very strong.

Ulsan City is also home to the Ulsan University of Science and Technology (UNIST), which was established in 2009 with MIT as their role model. It is truly gratifying to see the great progress that has been made since then. In fact, prior to its launch, it was

necessary to convince the general public of the importance of the new university. Through my friend Sunggak Kim, the mayor of Ulsan City, Park Maeng-woo asked me to give a lecture at the Nobel Forum on the Chemistry Day of Ulsan City in 2008. I accepted the offer together with my friend Peter J. Stang (University of Utah). This region was highly enthusiastic to thrive as an industrial city, encouraged by the Ulsan Fine Chemical Industry (Director, Do-Hyun Nam). There were many plants of Hyundai Motor and SK in the area, and young people were said to visit the area on industrial tours. As was the case in Japan in the past, industry should more actively and continuously support education in order for the country to become a technological powerhouse.

This country has hosted Nobel Lecture gatherings on various occasions. In 2010, I visited Daejeon's Korean Research Institute of Chemical Technology (KRICT), where my old friend Hun-Seung Oh served as president, and Seoul National University, where Eun Lee was waiting, to give Nobel Lectures. The title of my lecture was "Asymmetric Hydrogenation: Our 30 Years with BINAP." Eun Lee was only 37 years old when I first met him in Kyoto in May 1984, and, later, he became a leading figure as a respected academician. He passed away in 2025. He also studied under Koji Nakanishi, and since his father was a high-ranking official who grew up in Japan, we had endless conversations about the old days.

In recent years, I have been troubled by repeated requests from the government to give lectures beyond my field of chemistry. In 2015, I was invited to the World Science & Technology Forum (Nobel Laureates Lecture) at the OECD Ministerial Meeting in Daejeon. I was selected as the opening speaker for the World Science Summit Forum, and gave a lecture titled "Science, Technology and Innovation for Our Survival," together with Jeremy Rifkin (founder of the Foundation on Economic Trends) and Aaron Ciechanover (2004 Nobel laureate in chemistry), who both delivered insightful talks. Although this was an important gathering of key figures from various fields, I was not used to this type of meeting due to my lack of experience and acquaintances in their fields.

Looking into the future, I feel that the Asia-Pacific region, along with Europe and North America, will be responsible for leading the world's science and technology to a proper direction. The training of the young generation that will bear this responsibility is an urgent issue. Since 1984, I have frequently visited Korea and built trusting relationships with many friends, and as a result, I have received Honorary Degrees from Hanyang University and Postec, and in 2005, I was elected as an Honorary Foreign Member of the National Academy of Sciences, Republic of Korea, the most prestigious honor in Korea. I am deeply grateful for the kindness of my friends. In return, I am obliged to support and encourage the young people of this country. Toray, one of Japan's leading chemical companies, established the Korea Toray Science Foundation, and in 2018, at the request of Toray President Akihiro Nikkaku and Korea Toray President Young-Gwan Lee, I went to Seoul to give a commemorative lecture at the Inaugural Ceremony for the Korea Toray Science Foundation Awards.

While the younger generation in Japan and Korea has been remarkably active in recent years, their main interest is their relationship with the US, and I am concerned that the human connections between the two countries, which once shared the same culture and

were very close, are fading away. Although I myself have trained only a few young associates, I hope that my current female Korean colleague, Jieun Jung, who is an Associate Professor at Nagoya University, will play a role in building a bridge between the two countries.

Academic cooperation between Japan and Korea is of paramount importance for both countries. The Japan Academy, where I now serve as President, has maintained friendly relations with the Korean National Academy of Sciences by holding an annual Forum in Tokyo or Seoul for 18 years.

15 Middle East

Israel

Japan, which is where I grew up, is an island nation in the far east of Asia. On the other hand, Israel is located on the western edge of Asia. Although peace, security, and water are extremely difficult to come by in this country, their scientists have used their precious assets of freedom and pioneering spirit to build a powerful educational, scientific, and technological nation. Their national intention, along with a strong sense of religion and family, is so thorough that I felt a strong tension of pressure. Although Jewish people make up only 0.2% of the world's population, they account for more than 20% of Nobel laureates in science. I respect their hard work, creativity, and global network of contacts. They are also a startup nation that leads the world. In recent years, I have listened to the energetic lectures of Aaron Ciechanover (2004 Nobel laureate in chemistry) and have been impressed by his foresight. Most recently, I had the pleasure of being interviewed by my friend Ehud Keinan (Technion), President of the Israel Chemical Society, about my impoverished childhood (Ehud Keinan, Think Globally, Act Locally, An interview with Prof. Ryoji Noyori, *AsiaChem*, **2021**, *2*, 88. http://www.facs.website/).

I first visited this country in 1995, when I was invited by Agranat Israel of Hebrew University to participate in the 7th International Symposium on Chiral Discrimination. Arriving in Tel Aviv early in the morning on a midnight flight via London, it was a rather exhausting trip, but I was able to further deepen my friendship with Samuel J. Danishefsky, Ben L. Feringa, J. Fraser Stoddart, Chi-Huey Wong, and others. We toured the old and new towns of Jerusalem and learned about the unique culture and history of the city. This is indeed the country that "holds a sword in one hand and an olive tree in the other." I will never forget the extremely strict security checks at Tel Aviv airport when leaving the country. In 2001, upon being awarded the Wolf Prize in Chagall Hall at the Knesset, the parliament (see France episode and chapter 6), President Moshe Katsav said, "There is an unwritten agreement between God and humankind. ... Disease, poverty, ecological disasters, the spread of nuclear weapons must be solved first." It was impressive that his speech referred to the mission of scientists. On this occasion, I was able to learn about the highly original research of David Milstein and Meir Lahav of the Weizmann Institute.

Saudi Arabia

In 1999, I visited Saudi Arabia, where strict religious laws are in place, to receive the King Faisal Science Prize. I was jointly awarded this prize with Dieter Seebach of ETH (Switzerland episode) and experienced an unexpected week with the fellow Laureates in other disciplines and their families. We visited Riyadh for the first time after overcoming the difficulties of scheduling with an Islamic country which has a day of rest on Fridays. From the time we arrived at the airport, we received the best hospitality from the country. I was surprised to see no women in hotels and other public places, but I soon learned about the strict religious rules of the country, which have been kept by the tribes for many years. The national character of the country, of course, gives priority to religion, but this is the largest Arabic award in the name of the great monarch who

earnestly promoted the modernization of the country. The award ceremony was held at 8:30 p.m. in a strictly guarded venue in accordance with the customary ceremony, and I received the prestigious award from Crown Prince Abdullah. The next day, I gave a lecture on Asymmetric Catalysis at the King Abdulaziz City for Science and Technology. HH Prince Bandar bin Saud invited us to his beautifully carpeted, gold-plated mansion and we enjoyed a barbecue dinner. I learned that there were an extremely large number of consanguineous marriages, and family ties are extremely strong. From early in the morning, the sound of people praying facing the direction of Mecca echoed in the air. Together with Dieter and his wife Inge, I was able to experience a very different and beautiful traditional culture of the country. In later years, I met Heinrich Rohrer (1986 Nobel laureate in physics), the recipient of the same prize, who congratulated me, and looking back, visiting this country has brought a series of great surprises and was an invaluable experience. One can expect that completely different scientific ideas will emerge from this place.

Author receiving the 1999 King Faisal Science Prize
from Prince Abdullah bin Abdulaziz in Riyadh.

16 Vibrant Asian Chemistry

Pakistan

The first time I visited Pakistan, also a Muslim country, was for attending the 19th IUPAC Symposium on the Chemistry of Natural Products in Karachi in 1994. At the invitation of Atta-Ur-Rahman, an old acquaintance of mine, I delivered the keynote address along with Herbert C. Brown, Derek H. R. Barton, Richard R. Ernst, and others. The chairman of the organizing committee was a representative of the academic and higher education division in their country, and he put his own position and national prestige on the line by making an impassioned speech about the sufficiency of measurement equipment set up through the international cooperation with Germany and other countries to which he and his country are devoted, rather than about his own or the country's research. This was where I received the prestigious Tetrahedron Prize from Barton himself, as he was the chairman of the selection committee.

Author receiving the Tetrahedron Prize from Derek Barton (left). At the IUPAC Symposium in Karachi in 1994.

India

Neighboring Pakistan, my acquaintances in India had often invited me to visit them, but I was not able to make the trip until October 2006. I was invited by Raghunath Anant Mashelkar, the President of the Indian National Science Academy (founded in 1935 in New Delhi), to give a lecture titled "Asymmetric Hydrogenation as Ideal Green Chemistry" as the Asia Science Lecturer, a lectureship that was established in 2003. On this occasion, I visited the Indian Institute of Science in Bangalore and delivered the

Morris Travers Memorial Lecture. I also visited the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), where Chintamani Nagesa Ramachandra (C. N. R) Rao, a materials scientist. government scientific advisor, known as a "colossus," served as the honorary president. JNCASR is a comprehensive scientific and engineering research institute established in 1989 by the Department of the Ministry of Science and Technology to commemorate the 100th anniversary of the birth of Jawaharlal Nehru, the first Prime Minister of India. I also met its president M. R. Satyanarayana Rao. I was also invited by Goverdhan Mehta, an influential organic chemist, to visit the Indian Institute of Science to give a lecture. Srinivasan Chandrasekaran, a former member of the Corey group was active there. The next day, the newspaper featured my lecture and quoted my statement: "research is for people, not for yourself" in the headline.

In 2013, at the request of the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT), I participated in the India-Japan Bilateral Meeting in Delhi as the President of RIKEN and delivered a public lecture. In addition, at the invitation of M. R. S. Rao and C. N. R. Rao, I visited JNCASR in Bangalore and delivered the Linus Pauling Memorial Lecture titled "Science Shapes Our Future." On this occasion, I took a bus trip to Agra to visit the Accra Castle and the Taj Mahal. In 2015, I attended the 2nd Japan-India Science Seminar at the Indian Institute of Technology, Delhi, and was reassured of the country's recent steady advancements.

Author with M. R S. Rao (left) and C. N. R. Rao (right) and an energetic, large audience at JNCASR in Bangalore in 2013. Credit: RIKEN.

In February 2018, I visited the rapidly progressing major city of Mumbai. This visit was organized by Ganapati Dadasaheb (G. D.) Yadav, an influential chemist and Vice Chancellor of the Institute of Chemical Technology (ICT), with the support of the giant conglomerate Reliance. I was presented the Dhirubhai Ambani Lifetime Achievement Award from ICT and its UDCT Alumni Association. I was also granted the Honorary Degree (Doctor of Science, Honoris Causa) by the world-renowned Chancellor Raghunath Anant (R. A.) Mashelkar in a grand and prestigious ceremony at the ICT convention center. This is the first academic honor I received from an Indian university.

During the break, I enjoyed the English-style high tea and met many fine people, including President Padma Devarajan. Chemistry, which is the colossus of the region, is certainly developing strongly, perhaps with the support of practical collaboration with capable companies. Yadav later recommended me as a Distinguished Adjunct Professor of ICT and an Honorary Fellow of The Indian Chemical Society.

Recent STI research at Indian universities and government research institutes gives the impression of being practical and of an extremely high standard. I have frequently had the opportunity to talk with Chairman VijayRaghavan Krishnaswamy at Okinawa Institute of Science and Technology (OIST) board meetings. His extensive experience and wisdom, gained as the Chief Scientific Advisor to the Government of India, are invaluable, and I am grateful for his contributions to the Japanese academic community.

Author with G. D. Yadav (left) and R. A. Mashelkar at Institute of Chemical Technology in Mumbai, in 2018.

Thailand

Thailand has a strong tradition of natural products chemistry. In fact, in 1987, I attended the splendid Princess Chulabhorn Science Congress organized by Vichai Reutrakul to celebrate the 60th anniversary of the birth of her father, King Bhumibol Adulyadej. Not only natural products chemists such as Alan R. Battersby, Jon Clardy, and Koji Nakanishi, but also synthetic chemists such as Herbert C. Brown, Teruaki Mukaiyama, Barry M. Trost, Martin F. Semmelhack, Jean F. Normant, and Alain Krief were invited to this congress. I spoke about the synthesis of natural and artificial prostaglandins. Princess Chulabhorn herself gave a talk, and I felt that the selection of Jon Clardy (Cornell University) as the Master of Ceremony was very appropriate, as he is intelligent, knowledgeable, and speaks in a dignified manner (which is difficult for a

common researcher). Everybody enjoyed this well-organized exotic conference. Later in 2005, I had the rare opportunity to be invited to give a special lecture to celebrate the 4th Birth Cycle of the Princess herself, as well as to attend the reception at the Royal Palace. Before this, in 1992, I was also invited as a VVIP to the Third Eurasia Conference on Chemical Sciences organized by Ivano Bertini (a leading Italian inorganic chemist whom I met again in Firenze 10 years later), where I gave a keynote lecture on the synthesis of natural products employing asymmetric catalysis.

At the Chulalbhorn Conference in Bangkok, 1987. From the right: Herbert and Sarah Brown, Barry Trost, Princess Chulabhorn, and Alan Battersby.

At the Chulabhorn Conference in 1987. From the right:
Hans Musso, Ekkehard Winterfeldt, and Helmut Vorbrüggen.

I have been involved in promoting education in Thailand. In 2004, at the request of the chairman of Toray Science Foundation, Katsunosuke Maeda (who served as Toray's president and chairman), I participated in the tenth anniversary of the science education promotion project in Southeast Asia. I met with the President of the Privy Council, Prem, who was highly respected by the people, and the Chairman of Chulalongkorn University, Cassim. I gave a commemorative lecture and engaged with professors and students. In this country, the royal family understands the importance of science (which is common with the Japanese imperial family), and they are extremely enthusiastic about scientific education. I saw that Princess Sirindhorn attended the Lindau Nobel Laureate Meeting (German episode), where many young researchers and students gathered from all over the world. Consequently, the morale of young people is very high. In 2013, I participated in the Academic Consortium 21 International Graduate Summer Seminar in Bangkok on the theme of Green Science and Technology for a Sustainable Future hosted by Nagoya University in Bangkok, and gave a special lecture titled "Science Shapes Your Future."

On the trip to Bangkok in 2004, I took this opportunity to attend a similar event in Jakarta, Indonesia, to encourage the students. When I heard from an influential person about the political situation of Indonesia, I learned that, unlike Thailand, it was still not easy for the people and the country to survive under their situation 20 years ago.

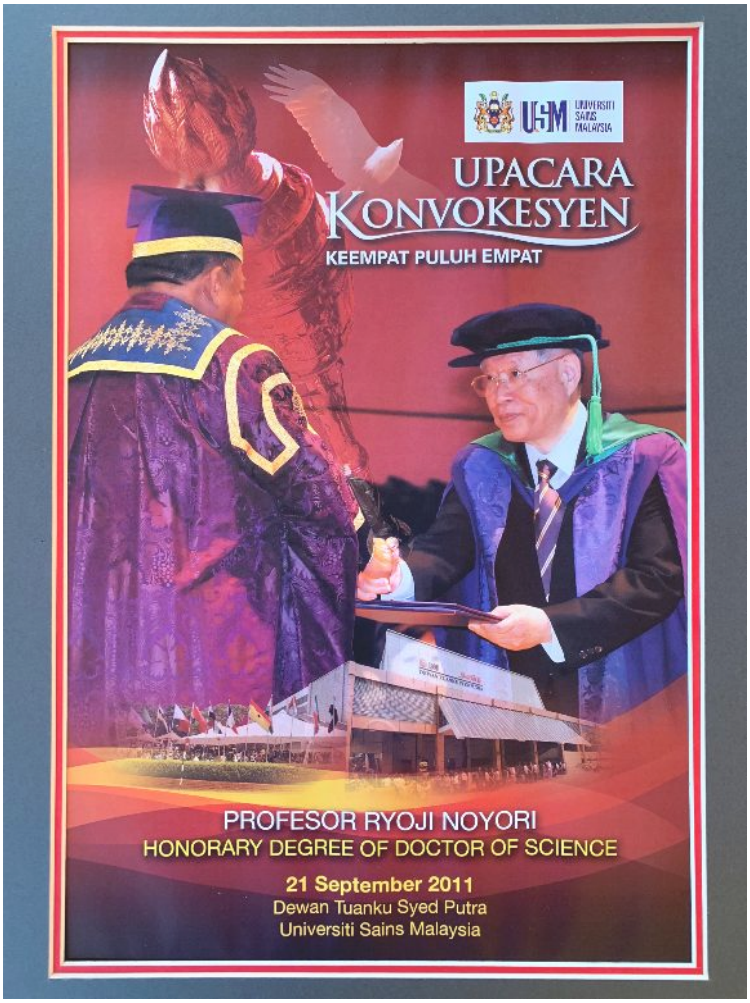
Malaysia

Tun Dr. Mahathir bin Mohamad, former Prime Minister of Malaysia, is a true regional leader of Asia and a man of integrity, principle, and conviction. Ever since we shared a table at the 100th anniversary dinner of the Japan Institute of Invention and Innovation

in Tokyo in 2004, I have strongly agreed with his passion for the promotion of science and technology and his idea of “Stand up on your feet and fight.” In July 2007, I presented him with the title of RIKEN Honorary Fellow. I will never forget his powerful commemorative lecture titled “Future of Asia, Science and Technology,” which he gave upon this appointment. He asserted that Asia's role in the world should be in keeping both its rising economic power and its culture, and warned, “If this world and humanity are not to be destroyed by science then we need to agree on an international scientific code of ethics and morality.” This is very, very true.

Mahathir bin Mohamad, former Prime Minister of Malaysia (left),
is awarded RIKEN Honorary Fellowship. July 2007.

In 2008, I was able to visit Universiti Sains Malaysia in Penang for the first time. This university was developing a research collaboration with Yoshiharu Doi, a RIKEN colleague who pioneered among others the field of poly-hydroxybutyrate, a biodegradable polymer. I also took the opportunity to visit the University of Malaya in Kuala Lumpur to deliver the Nobel Laureate Lecture of the Academy of Sciences Malaysia and was able to pay a visit to Mahathir bin Mohamad. Fortunately, in 2011, I received the Honorary Degree (Doctor of Science) from His Royal Highness The Raja of Perlis at Universiti Sains Malaysia.



At the Science University of Malaysia in 2008.

Singapore

Singapore is a small but extremely flexible science and technology hub in Asia. As a chemist and head of RIKEN, where I had served, I had close working relationships with A*STAR, led by Director General Philip Yeo, and others. In 2007, the A*STAR-Noyori Forum Joint Symposium on Fundamentals and Applications of Organic Chemistry was held, inviting the newly appointed A*STAR Director Lim Chuan Poh, a well-known figure in Japan, as a Guest-of-Honor to increase the overseas presence of Japanese chemical company researchers. The theme of the symposium was Fundamentals and Applications of Organic Chemistry, with speakers including, Shun-ichi Murahashi, Christina Chai, Shinji Murai, Marc Garland, Kuniaki Tatsuta, K. C. Nicolaou, Keiji Maruoka, Loh Teck Peng, Kyoko Nozaki, Andy Hor, Li Lun, and Liu Yen, and I gave a keynote lecture titled “Shaping Chemistry for the 21st Century.” The president of Mitsubishi Chemical Corporation, Yoshimitsu Kobayashi, and many other technical executives from chemical companies also participated in this event. I visited the National University of Singapore, where I met President Choon Fong Shih and other important people in the Department of Chemistry. In 2008, the Molecular Frontiers Symposium and Forum was held at Biopolis. Bengt Norden from Sweden, who was the chair, gave a talk titled “How to win the Nobel prize?” followed by keynote lectures by

K. Barry Sharpless, Richard Schrock, and myself. The success of the conference was widely reported in The Straits Times on the following day.

Later in 2011, I paid a visit to Lim Chuan Poh of A*STAR, visited RIKEN's CREATE (Campus for Research Excellence and Technological Enterprise) Campus, and met with President Tan Chorh Chuan of the National University of Singapore and President Bertil Anderson of Nanyang Technological University (NTU), to learn how the country is responding quickly to changes in the international environment. In 2020, just before the global outbreak of COVID-19 began, at the request of Shunsuke Chiba, I attended the Nanyang Research Conference on Synthetic Chemistry to give the Nobel Laureate Public Lecture along with Ben Feringa. NTU is said to be "the world's best young university," and I am very happy that Yixin Lu, who was my postdoctoral fellow at Nagoya, has a headship in chemistry at NTU.

Vietnam and Philippines (Eurasia Conference on Chemical Sciences)

I was able to participate in many unique international conferences in Asia that differ from those in Europe and the US. In particular, the Eurasia Conference on Chemical Sciences, led by Ivano Bertini (Firenze) and Hitoshi Ohtaki (Tokyo Institute of Technology), brought together the world's leading chemists in various locations to hold unique conferences for the development of chemistry in Asia. In response to their sacrificing effort, I had already attended the Bangkok conference in 1992. In 2003, I was invited to the 8th conference in Hanoi, Vietnam (co-organized with the 10th Asian Chemical Congress). I was worried about the spread of SARS, but I was warmly received by FACS (Federation of Asian Chemical Society) President and NOC (National Organizing Committee) Chairman Ho Sy Thoang and Secretary Huynh Van Trung at the site. In response to their request, I talked about Asymmetric Hydrogenation, although it was an old topic. Y.-T. Lee and J.-M. Lehn, who were enthusiastic about international cooperation in science and technology, were also invited to this conference, and I also had dinner with government officials. As the President of RIKEN, I also visited the Institute for Nuclear Science and Technology (Director, Vo Van Thuan), and also went to Ho Chi Minh City to meet with the leaders of the local chemistry society.

The 10th Eurasia Conference on Chemical Sciences was held in Manila in 2008. It was also held in memory of Hitoshi Ohtaki, who passed away suddenly in 2006. I participated in the Nobel forum on Science and Innovation, which was held immediately after the opening ceremony, together with Aaron Ciechanover, Yuan Tseh Lee, and Hartmut Michel.

Uzbekistan

Uzbekistan, a country I have not been involved in as a scientist, is an important country in the foreign policy of the Shinzo Abe (former prime minister) administration in Japan and in the Asian region policy of Nagoya University. In August 2018, I visited Tashkent with Nagoya University's President Kiyoshi Matsuo and others to participate in the Uzbekistan-Japan Symposium: A Vision for the Future Innovation. I gave a lecture titled "Where am I from? Where are you going?" The conference was successful, attended by Minister Madjidov, Minister Abdurakhmanov, President Yuldashev, Rector Turabjonov,

and others. I had discussions with young people from the Tashkent Technical University, who were interested in Japan. The country was full of youth, with 42% of its population of 32 million people under the age of 24. We then moved on to Samarkand, a strategic point on the Silk Road, to observe academic and cultural facilities. I visited the Go'r Amir maqbarasi, Bibi-Khanum Mosque, Afrasiab Hill and Museum, Shahi Zinder Mausoleum, and especially the Ulugbek Observatory, where I admired its pioneering astronomy and the idea of promoting learning beyond borders. The following year, I was awarded the title of Honorary Academician of the Academy of Sciences, Republic of Uzbekistan, by President Bekzod Yuldashev.

Author and his wife with President Yuldashev (center)
at the Tashkent Technical University in 2018.

Mongolia

Mongolia is also an important country for Japan and academic diplomacy must be actively pursued. In 2019, I was invited by the National University of Mongolia in Ulan Bator to speak at the Nobel Lecture Series. This campus is positioned as the Mongolian satellite of the Nagoya University Asian Satellite Campus Institute. The country is extremely friendly towards Japan, and, surprisingly, many of its leaders speak Japanese. I paid a visit to the Speaker of the National Assembly and the Minister of Education at the Government Palace. In the presence of President Tumurbaatar, Vice Minister of Education, Culture, Science and Sports Ganbayar, and others, I gave a lecture titled “Where am I from? Where are you going?” I participated in a discussion meeting with

young researchers from various universities at the National University of Mongolia. I then visited Shine Mongol School, where I met with Board Chair Janchiv Galbadrakh and others. I was thrilled to receive a warm welcome and to interact with the highly motivated high school students. I was also highly impressed by the passion for education of the former sumo wrestler, *yokozuna* (highest rank in sumo) "Haruma-Fuji Kohei," who was the president of the New Mongolian Fuji Academy. The interest towards Japan in this country was extremely high, but I wondered whether we, as researchers, were really meeting their expectations. Moving to the suburbs far away from Ulan Bator, I observed the natural and cultural environment, visited a nomadic family, and stayed overnight in a ger camp. We enjoyed a star-filled night sky. I believe that the young people who grew up here will generate science different from that of urbanized developed countries.

My experience as a wandering scientist clearly shows that the Asian region is full of diversity and vitality and their uniqueness will certainly contribute to the progress of human society in the years to come.

Author (center of the front) at the National University of Mongolia in 2019.

An Asian Journal of Chemistry

Despite the remarkable contribution of Asian scientists to the progress in chemistry, there existed no internationally reputable journals until the beginning of the 21st century. Considering the necessity of a reliable medium attractive for Asians in particular but also for Americans and Europeans, Peter Gölitz of Wiley-VCH decided to

launch *Chemistry—An Asian Journal* with the assistance of among others Eiichi Nakamura, Kazuyuki Tatsumi (my colleague at Nagoya University and IUPAC President, 2012–2013), and Shinji Murai (then the President of the Chemical Society of Japan). From 2006–2017, as a senior Asian chemist, I served as the first Chairman of the Editorial Board. This new journal, a sister publication of Chemistry—A European Journal, grew steadily and later facilitated the establishment of the Asian Chemistry Editorial Society (ACES), consisting of 12 countries. The need to further foster cooperation in the region prompted Theresa Kueckmann of Wiley-VCH to spearhead the creation of The Ryoji Noyori ACES Award in 2017.

The CAJ inauguration team in Japan. Front row, from the left: Eva E. Wille, the author, and Peter Gölitz. Back row, from the left: Kazuyuki Tatsumi, Shinji Murai, and Eiichi Nakamura in Tokyo, 2005.

17 Australia with a Strong Inorganic and Organometallic Tradition

The chemical community in this country has close ties with the Royal Society of Chemistry in the UK, and I saw the standard of inorganic and organometallic chemistry in particular being extremely high. Since their relationship with the Japanese organic chemistry community was not so intimate, I may have been recognized as an organometallic, not organic, chemist. For the first time in 1979, I was invited to participate in A Seminar/Workshop on Homogeneous Catalysis: Metal Ion Activation of Chemical and Biochemical Processes organized by the three eminent figures, Alan Sargeson, Martin Bennett (who visited Nagoya in 1977), and Hans C. Freeman in Canberra. In this exciting meeting, I compared the regio-selectivity of Ni(0)-catalyzed strained hydrocarbon/olefin cycloaddition (chapter 5) and heterogeneous catalytic hydrogenation of cyclic hydrocarbons.

Subsequently, in 1990, through the organization by Martin A. Bennett, I received the title of the Arthur J. Birch Lecturer at the Australian National University in Canberra and conducted a fruitful lecture tour. Arthur Birch, best known for his practical aromatic hydrocarbon reduction, was one of the founders, along with David Craig, of this prominent university. This famous lectureship inaugurated in 1981 had invited Albert Eschenmoser and eight eminent speakers before me, with five of them being the Nobel laureates in chemistry. At the time, Athelstan L. J. Beckwith, a well-known physical organic chemist, actively served as Dean of the Research School of Chemistry. I spent a pleasant week on this beautiful ANU campus with parrots' colorful tails flying in the air, and gave four lectures, including a major evening talk on "Asymmetric Synthesis". Fortunately, I was able to meet Arthur Birch himself, who was still alive and large-minded, and received many reprints signed by him and his strong encouragement. I then visited the University of Melbourne (Martin Banwell and D. W. Cameron), Monash University (W. R. Jackson), University of New South Wales (David St. C. Black), and the University of Sydney (W. C. Taylor and R. K. Haynes) to give talks on asymmetric synthesis. During my visits, I got the impression that the level of research and education at these universities was very high, but the number of students was too small compared to other countries.

In July 1996, Colin Raston of Monash University chaired the International Conference on Organometallic Chemistry in the scenic Brisbane, first time in the Southern Hemisphere. During the conference I presented the results of my ERATO Project (chapter 7), asymmetric hydrogenation which utilizes the unique activation effect of 1,2-diamines on $RuCl_2$(binap) catalysts for the first time. It was well accepted, I felt.

18 Canada with an Able Scientific Ambassador

The first Canadian chemist I met was Paul de Mayo of the University of Western Ontario, who was an expert of the then flourishing organic photochemistry and visited Nagoya in 1972. Then young Howard Alper of the University of Ottawa is one of my oldest friends in this country. In the early 1970s, I was focusing on prostaglandin synthesis and, in this regard, was accumulating knowledge in organocopper chemistry. Alper, whom I had not yet met at that time, asked me, as editor of the monograph "*Transition Metal Organometallics in Organic Synthesis*" (Academic Press, 1976), to write a chapter on "Coupling Reactions via Transition Metal Complexes." This was the very beginning of a relationship that has lasted more than 40 years between him and his wife Anne, who was active in the Canadian Society for Chemical Engineering. First of all, perhaps because he trusted my competence in organometallic chemistry, he introduced me to the Canadian chemistry community for the first time the following year in 1977. This was at a time when my Fe carbonyl-dibromo ketones chemistry (chapter 5) was attracting a lot of attention worldwide. He arranged for me to travel westward across Canada, starting with the Second Joint Conference of the Chemical Institute of Canada and the American Chemical Society in Montreal. I also met Tak-Hang Chan (McGill), who was well-known in organosilicon chemistry, Stuart McLean (Toronto), Satoru Masamune (Alberta), who was a representative Japanese in North America, and Lawrence S. Weiler (UBC), who was an enthusiastic educator. Meanwhile, Alper, an OMCOS colleague (chapter 5), whom we often met outside of Japan, first visited Nagoya in 1983.

I soon began to receive lectureships from Canadian universities. Raymond Lemieux was the greatest carbohydrates chemist to ever come out of Canada. Moreover, as the University of Ottawa's first chair of the Department of Chemistry (1954–1961), he helped establish the university's presence. The University of Ottawa established a lectureship in his name in 1972 and has invited a number of distinguished organic chemists. Alper invited me to this lectureship in 1988. I gave three lectures on asymmetric catalysis, including asymmetric zinc chemistry, which was progressing successfully at the time, and I also met Tony Durst, a senior alumnus of the Corey group, for the first time. Later, in 1990, I visited the University of Montreal as a Bio-Méga Lecturer at the request of Steve Hanessian, who was residing at the top floor of the building of the Chemistry Department. We enjoyed a lively dinner party at his mansion on the lake. Also, in the following year, at the request of Mark L. Lautens, I visited the University of Toronto as Merck-Frosst Lecturer, where I had discussions with J. Bryan Jones, Adrian G. Brook, Sean McLean, Ian W. J. Still, and Malcolm Bersohn, among others. I had met Peter Yates (1924–1992) in Nagoya in 1982, when we first discussed our previous but well remembered work on the effects of Cu catalysts on carbene reactions (chapter 2).

In 1996, I was able to visit the University of Alberta in Edmonton again. This was upon receiving the Reuben Benjamin Sandin Lectureship. According to Jeffrey M. Stryker, an expert in Cu hydride chemistry who invited me, this is the most prestigious lectureship named after a professor who had contributed to their chemistry department for 60 years. The list of invited lecturers begins with Saul Winstein in 1962 and continues through

1990 with Donald J. Cram, George M. Whitesides, Peter G. Schulz, Barry M. Trost, Kyriacos C. Nicolaou, and Jack Baldwin in the previous year. Although my official schedule was extremely demanding, I could not refuse this kind offer. Looking back, in almost every circumstance, I have spent all of Golden Week (Japanese holiday starting at the end of April), on lecture tours during this season of the year, in which many Japanese people enjoy their holidays. I gave my lectures on asymmetric hydrogenation and nonlinear effects in asymmetric organozinc chemistry, as well as for the first time on asymmetric transfer hydrogenation, an outcome from the ERATO Noyori Project. Since it had been 19 years since my last visit, the faculty had changed a lot, with young Steven Bergens (a student of Brice Bosnich), David R. Bundle, Robert B. Jordan, Dennis D. Tanner, Karl R. Kopecky, and others. I was most fortunate to have lunch with Raymond Lemieux, who was then in his mid-70s. I was glad that I made the long trip.

I visited Montreal three times. In 2001, André Charette, Chair of the Organic Chemistry Section of the Canadian Society of Chemistry, hosted the Symposium on 40 Years of Ruthenium Chemistry at the 84th Conference and Exhibition. It had just been 40 years since Jack Halpern, John F. Harrod, and Brian James reported the first homogeneous Ru-catalyzed hydrogenation reaction in *J. Am. Chem. Soc.*, **1961**, *83*, 753. It was also the year of the retirement of Brian James (UBC), who played a leading role in this work, and they wanted to honor his achievements by holding a symposium to commemorate his retirement. I was invited to give the keynote lecture. Steve Bergens chaired the symposium, and I gave a talk titled “Metal-Ligand Bifunctional Mechanism for Asymmetric Hydrogenation of Ketones.” Brian James himself concluded the symposium as “A Ruby Anniversary of Ruthenium Chemistry.” Delightfully, I was able to finally pay my respects in public to my friend, the initiator of my Ru-catalyzed asymmetric hydrogenation, for his long and faithful career as a researcher.

Honoring Brian James (right) for his Ruby Anniversary of Ru chemistry. From the left, Philip Jessop, the author, and Robert H. Morris. In Montreal, May 2001.

I have since received various honors in Canada, including the title of Honorary Doctorate (Doctor of University of Ottawa) from the Rector and Vice Chancellor, Gilles G. Party in June 2003. I was somewhat surprised to read in the citation written by Acting Dean François Chapleau that the beginning of my research was based on the Japanese philosophy of Zen. In my response, I mentioned my long relationship with the Canadian chemistry community and the great contribution of Raymond Lemieux. I gave a talk on asymmetric hydrogenation in the Department of Chemistry. Here I met again a very active female chemist, Cathleen Crudden, who is not only one of Canada's leading chemists, but has also served as a bridge to Japan. When she was a student of Alper's lab in Ottawa, she spent three months in Osaka in my good friend Shinji Murai's lab and came to visit me in Nagoya. Like Murai, she is open-minded and can speak Japanese with an Osaka accent. She is now an important member of the Institute of Transformative Bio-molecules at Nagoya established by Kenichiro Itami.

Author receiving a title of Doctor of the University from University of Ottawa in 2003. With Howard Alper (right).

Alper has followed the same path in molecular catalytic chemistry as I have, and his recent multifaceted leadership is remarkable. From 2007–2015, he chaired Canada's Science, Technology and Innovation Council. As a member of the most important RIKEN Advisory Council, he had provided me as the President with many valuable suggestions. In addition, he often visited me and Hiroko personally in Tokyo to enjoy the Yakitori restaurant. In turn, in June 2009, I visited Ottawa to give a presentation to the Deputy Minister on the state of science and technology in Japan on the topic of "RIKEN: Contribution to Science and Innovation in Japan. Science and Innovation in Japan" and met with National Research Council of Canada's President Pierre Coulombe. This year was the 80th anniversary of the Japan-Canada Friendship, and the Embassy was busy with a lot of events for the Emperor and Empress's visit to Canada the following month, including a large number of science and technology staff.

On this occasion, I was asked to give the Royal Society of Canada 125th Anniversary Science Lecture (Nobel Prize Lecture Series). I first gave a commemorative lecture titled "Asymmetric Catalysts: Architectural and Functional Engineering" at the University of Ottawa. Although Alper was extremely busy with government work, I was able to visit the Center for Catalysis Research, which he founded at the University. We had lunch at the "Atelier," a facility that provides Molecular Gastronomy using liquid nitrogen, from the warm consideration of faculty members, which was a memorable experience. Subsequently, I moved to the University of Montreal, where I met with William D. Lubell (Ph.D. with Henry Rapoport at UC Berkeley), who was my only American postdoctoral fellow at Nagoya. Fortunately, he became a professor at this famous Canadian university. I was assured that he was extremely enthusiastic about

education as well as research. He chaired my talk on asymmetric hydrogenation reactions. In addition, I met Andre Charette whom I have known for a long time, Joelle Pelletier, James Guest, Shawn Collins, and Helene Lebel. Unfortunately, Stephen Hanessian, who reigns on the top floor, was away giving a talk at Gif in France.

I then moved on to McGill University, which I had visited 32 years ago. Here I was hosted by T. H. (Bill) Chan, whom I later invited to Japan, and met with rising star green chemistry researchers Chao-Jun Li and Jim Gleason. I also talked with Heather Munroe-Blum, a prominent female Rector interested in RIKEN, where I worked. I also gave a public lecture as the J. T. Donald Public Lecturer titled “Chemistry: Key to Our Future.” In addition, I was awarded The Centenary Medal by President M. Yvan Guindon of The Royal Society of Canada (RSC). This Medal was established in 1982 and is awarded on an irregular basis to individuals or organizations that have made outstanding achievements in international relations that are consistent with the objectives of the RSC. It was perhaps the first award of its kind in the field of science.

Thus, Howard Alper became an outstanding scientific ambassador traveling beyond borders to encourage the worldwide solidarity for sustaining our civilization. In 2021, he had a wonderful and memorable 80th birthday, which must be a great moment to reflect with greatest satisfaction on his entire life with Anne, past, present and future still to come. I wonder how long would I be able to walk the same path with this respectable friend.

19 United States of America, a Great Scientific Nation

Science nurtures the intellect and humanity of young people. The international chemistry community has enriched my life in many ways, promoting open exchange of knowledge and has been an invaluable forum for friendship. I have endless memories, especially with my overseas friends and their families.

Guidance of E. J. Corey, a Prodigy of Organic Synthesis

Professor E. J. Corey agreed to accept me as a postdoctoral researcher in 1967 when I was an Instructor at Kyoto University. I still wonder why he responded my application, because my scientific knowledge, experimental skills, and English remained insufficient. I was his fifteenth Japanese collaborator, and it was likely the diligent, patient work of my predecessors that had earned his trust in Japanese researchers.

When I first met E. J. Corey at Harvard in January 1969, I was an Associate Professor at Nagoya University. I was merely a 30-year-old, unknown chemist in a remote, still developing country, while Corey was a 40-year-old professor at the prestigious American university and already one of the most famous synthetic organic chemists in the world.

Readers of this book must surely be unable to imagine the enormous economic disparity (probably 10- to even 20-fold) between the US and Japan in the mid 1960s. First of all, I was amazed at the affluence of the American university. Looking back, I recall that Harvard organic chemistry was in its golden age at the time, and the Department had distinguished scholars including R. B. Woodward, Louis Fieser (emeritus), Paul Bartlett, William Doering (just arrived from Yale), Frank Westheimer, and Konrad Bloch, all being senior to Corey. They were all unique and glorious. The regular Department Seminar invited many leading researchers from around the world.

My impression was that Corey was an overwhelmingly knowledgeable, rational practitioner and excellent/efficient scientific writer. He showed us, young associates, his research plans but rarely talked about his scientific philosophy. He might have thought, “Look at the way I live my research life.” He was busy and rarely showed his non-research background. He was an unparalleled hard worker, a man who valued his time, took care of his health, and was a family-oriented American. I don't think he was a socialite.

I did not have the opportunity to get to know Woodward's personality, but he seemed to have a contrasting personality, if one believes the rumors. However, they shared a seriousness about their chemistry research. Later, I was often asked what I learned from Corey and Woodward. Then I can only respond: Both were giants with rare talents who lived in a totally different world and could hardly be role models for me.

In the late 1960s to early 1970s, one of the central issues in synthetic organic chemistry was the synthesis of prostaglandins (PGs), and Corey was undoubtedly a leading figure in this field. At the time of my arrival, the famous “Corey method” was almost complete and various improvements were being made by his postdoctoral fellows (not students) for its industrial production. My role was also there and I was involved in the publication of three papers, one in *Tetrahedron Letters* and two in *J. Am. Chem. Soc.* First, after my arrival, I soon succeeded in synthesizing $PGF_{2\alpha}$ by a different route from

the cyclopentadiene/dichloroketene adduct on my own without the help of other lab mates. After that, I was asked to convert $PGF_{2\alpha}$ to $PGF_{1\alpha}$ by selective hydrogenation. It was a subtle conversion on a few mg-scale sample. Here, I was told from Corey that, with the skills of the Japanese, it would be possible. In the course of this work, I was assisted by John Osborn, Dick Schrock, and K. Barry Sharpless (a postdoc with K. Bloch) (chapter 4). Many old Japanese friends of mine said that I was concept-intensive and was lacking experimental skills (they were probably right), but these accomplishments in a short period of time were proof of my technical skills, not so poor. Later, Corey's PG synthesis was commercialized by Ono Pharmaceutical Co. in Japan. I am happy that my invention of the BINAL-H asymmetric reduction at Nagoya (chapter 5) solved the "15*S* problem" that had been a concern for this process.

Corey's experimental instruction was enthusiastic, very specific, and effective. I could never hope to emulate this supervisor. It was very difficult for us to keep up with this method of instruction; Corey was highly experienced in total synthesis research and had many unique recipes for, for example, protecting and deprotecting functional groups. He had a habit of putting his ideas down on paper, down to the most likely experimental conditions for success and even the details of how to analyze the products on TLC, so that we would not miss any of his instructions. His office was well organized with references and we were quickly given copies as needed. As inexperienced researchers, it was difficult for us to immediately offer him alternatives, and we tended to be passive. At the time, I personally was so concerned about the operation of my own newly founded laboratory at the distant Nagoya University that I may not have been able to contribute fully to Corey's research.

In any case, I have always had a great respect for this creative chemist. He was my mentor and continued to treat me well. For example, in 1994, he recommended me for the prestigious Max Tisher Prize Lecturer at Harvard.

E. J. Corey, aged 60.

In 2001, when I received the Nobel Prize in chemistry, the Centennial Celebration was held and over a hundred past laureates were invited to Stockholm, including E. J. Corey. He after hearing my acceptance lecture, smiled warmly and congratulated me with a firm handshake. He was 73 years old and I was 63. He and his wife Claire brought beautiful flowers to my hotel room as well. Time flies and this year will mark the 33rd anniversary of our first meeting in Cambridge. I can only pray for his physical and mental health.

At the Nobel Prize Centennial Cerebration in 2001, Stockholm.
From the left, Hiroko and Ryoji Noyori and Claire and E. J. Corey.

How I Evolved in My Early to Middle Career (from 1970 to mid-1980s)

My first stay at Harvard from 1969 to 1970 decisively influenced my career. However, the charismatic American leaders whom I encountered could not be my role model due to the enormous economic and cultural gaps between the US and Japan. I wondered how I could survive in the scientific community with a very limited capacity and how I could contribute to the future of Japan's chemistry community and society at large. Nevertheless, I somehow gradually evolved to become a Japan-born international scientist through interactions with many American colleagues. When saying, "American chemists," I do not mean that they are all the same, but rather, they have a diversity of backgrounds. These unique researchers are all dynamic and active in their own sense. It was extremely useful to hear their research achievements at various international conferences in Europe and Japan, but unlike in other countries, I felt that each university in the United States has its own unique characteristics. This is what distinguishes from Japan's national universities, which are very similar. By actually visiting the sites of where they conduct their research activities, it was possible to learn further about their personalities, the roots of their ideas, and the directions in which they were developing.

In addition, I would like to express my respect for the courage and success of Japan-born organic chemists such as Satoru Masamune, Koji Nakanishi, Osamu Shimomura, Yoshito Kishi, and Ei-ichi Negishi, who found their way out of the poor educational and research environment in Japan after World War II and ventured to the new world in the US. I also greatly appreciate their role in acting as a bridge between the US and Japan.

This includes Iwao Ojima of SUNY at Stony Brook, who invited me to the Stony Brook Symposium on New Horizons in Organic Chemistry in 2005 when he had turned 60 years old. I was glad to see him after a long time. Hisashi Yamamoto, who often traveled back and forth between Japan and the US, consistently provided me with useful advice both publicly and privately.

In 1973, I attended the Welch Conference in my earlier years when I was focusing on the [3 + 4] and [3 + 2]-type carbocycle synthesis (chapter 5) by the Fe-carbonyl–polybromoketone reaction. Upon doing so, I traveled through several universities, meeting James P. Collman (Stanford University), Paul G. Gassman (Ohio State University), Robert M. Coates (University of Illinois at Urbana-Champaign), and others through some contacts I had. In the following year, I participated in the memorable Honolulu organometallic seminar on catalysis, where I met many influential senior scholars and future leaders (chapter 5, page 99).

From the left: the author, Rowland W. Pettit, and Iwao Ojima at the Japan-US joint seminar on organo-transition metal chemistry held at Waikiki Beach in Honolulu, 1974.

My research on Fe-carbonyl chemistry quickly attracted international attention, and in 1976, I was invited by the New York Academy of Science to the Conference on the Place of Transition Metals in Organic Synthesis, a conference oriented towards organic synthesis where many industrial researchers gathered. The conference was a great success, with speakers including Paul L. Pauson, who was a co-discoverer of ferrocene, John K. Stille on palladium chemistry, Rowland W. Pettit, who was then a hero of mine, and Günther Wilke, a world- leading figure in the field of catalysis at the time. At this conference, I met Martin F. Semmelhack (Cornell University and former Corey lab member) and Maurice Brookhart (University of North Carolina). I also visited Louis S.

Hegedus (Colorado State University, former Corey lab student) and Jack R. Norton (Princeton University) before the conference, and met Marvin D. Rausch (University of Massachusetts), Dietmar Seyferth (MIT), Paul G. Gassman (Ohio State University), and Manning P. Cooke (Washington State University, Corey lab mate) after the meeting, expanding my network of friends. Stopping over at Harvard, I met E. J. Corey and Yoshito Kishi again. Actually, the most important mission I had at the time was to visit R. B. Woodward in his office, and to recruit his postdoctoral researcher, Masaaki Suzuki (former student of the Hirata Lab), who was working on the synthesis of erythromycin, to come to work with me at Nagoya. He agreed to this offer and made a request to make sure that he would receive proper training with me to become an excellent researcher. Upon Suzuki joining our lab, our prostaglandin synthesis in Nagoya was initiated and completed (chapter 5).

The utilization of Fe-carbonyl was recognized as effective not only in "carbocycle" forming reactions but also in "heterocycle" synthetic chemistry. In 1980, I was invited by the Gordon Research Conference on the Chemistry of Heterocyclic Compounds at New Hampton, chaired by E. Ciganek of DuPont, to speak on the general synthesis of *C*-nucleosides. We gathered at Logan Airport in Boston, took a long bus ride during which I talked with W. Nico Speckamp from the Netherlands, and together with other family members, enjoyed the relaxing culture and rich nature of the American research community at New Hampshire. The Gordon Conference at New Port, Rhode Island, on Organometallic Chemistry, to which I was invited in 1988, was more modernized as far as I remember.

The efficiency of the organometallic methodology of prostaglandin synthesis, to which we devoted ourselves in the late 1970s, was recognized by Barry M. Trost (University of Wisconsin). He invited me to the Third IUPAC Symposium on Organic Synthesis that he organized in Madison in June 1980. I had been interested in transition metal catalysis of highly strained compounds closely related to olefin metathesis and had attended major conferences led by US researchers such as those held in Hawaii (1974) and Athens (1978), but the content tended to be highly specialized in catalysis. This IUPAC meeting was a major conference in the mainstream of synthetic organic chemistry at the time, and the atmosphere was very different, with many presentations on natural products chemistry and pharmaceuticals. I was moved by Trost's enthusiasm as the chairman, as he had invited many prominent speakers from around the world, such as Derek Barton (1969 Nobel laureate in chemistry), James P. Collman, Jeffrey Schwartz, Martin F. Semmelhack, K. Peter C. Vollhardt, Ian Fleming, Philip D. Magnus, W. Clark Still, Léon Ghosez, Edward C. Taylor, Paul A. Grieco, Satoru Masamune, Marc Julia, Hitosi Nozaki, Csaba Szántay, Milan R. Uskokovic, Bertram Fraser-Reid, Leo A. Paquette, and others altogether it was a comprehensive collection of the most active synthetic chemists during those days. Dieter Seebach was also invited, but he cancelled his attendance because his secretary had changed and could not prepare his presentation slides (in Japan, we usually ask our graduate students to produce the slides, so I was rather impressed to know that German born professors are different). In his place, Herbert C. Brown, a big name who had just received the Nobel Prize in chemistry (1979), had been invited on a short notice. Despite his busy schedule, the young leader, Trost, who had just turned 39 years old, took me out for a long drive during the

afternoon break of the symposium. He talked passionately about his research life, the state of academic societies and education, the authoritarianism of prestigious universities, the state of communications and articles published in the *Journal of the American Chemical Society*, in which he served as an Associate Editor at the time, and asked for my consent. This was the beginning of my long-term relationship with him, not only in research but also in publication editorial meetings. I was 41 years old at the time, and my network of friends greatly expanded at this conference.

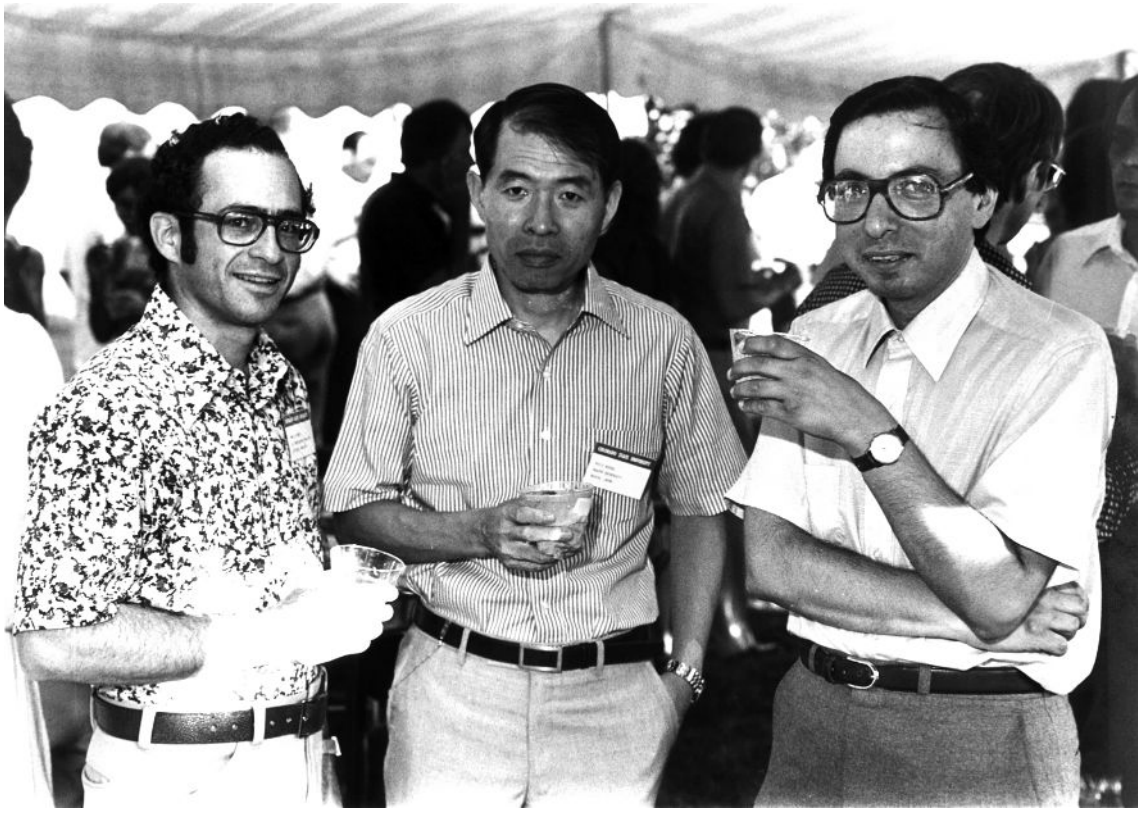
(a) (b)

Author with Barry M. Trost. (a) At the IUPAC Organic Synthesis meeting at Madison, 1980. (b) At Nagoya in 1990.

One of the major events of this era for me was the First IUPAC Symposium on Organometallic Chemistry Directed Toward Organic Synthesis in Fort Collins, Colorado in 1981 (chapter 5). The OMCOS meeting, which I had been unofficially deeply involved in initiating, finally took place. The chair of the meeting was John K. Stille, and the host was Louis S. Hegedus, my friend from Harvard. The keynote speakers were Richard F. Heck, Paul Heimbach, Ei-ichi Negishi, Hubert Mimoun, Gary H. Posner, Martin F. Semmelhack, Michel Pereyre, Barry M. Trost, and Jiro Tsuji, all of whom were well acquainted with each other. I talked about the application of BINAL-H asymmetric reduction to prostaglandin synthesis, which was near completion at that time. Other participants included Albert I. Meyers, a well-known synthetic organic chemist and socialite, William S. Knowles of Monsanto, and Howard Alper of Canada, making the meeting a great success. Japanese participants included senior IUPAC members Shô Itô, Makoto Kumada, and Yoshio Ban, as well as Shinji Murai and Shun-ichi Murahashi, who were prominent figures of our generation. The organizers had invited 24 eminent synthetic/catalytic chemists and gathered 550 participants from more than 10 countries. Four future Nobel laureates gathered there, but more importantly, some 300 participants that came to the meeting were from industry. A representative was W. S. Knowles, who long led a Mosanto research group. It clearly showed the hope of not only academic progress but also development into practical technology. The

open-house garden reception at Stille's huge residence was also impressive. Although this was 40 years ago, it shows the hope for not only academic progress but also development into practical technology. After returning to Japan, I immediately expressed my congratulations to Stille on the success of the conference and told him that we would like to hold an OMCOS conference in Japan at the earliest possible opportunity (which was later hosted by Hitosi Nozaki at Kyoto in 1985).

The inaugural OMCOS meeting at Fort Collins in 1981. From the left: the author, J. Tsuji, J. K. Stille, Sumire Negishi, A. I. Meyers, E. Negishi, and S. Murahashi.



At the first OMCOS meeting at Fort Collins in 1981. From the left:
G. H. Posner, the author, and H. Alper at Stille's residence.

A Story of Launching the IUPAC OMCOS Symposium (in the late 1970s)

Promotion of research and education is not a mission exclusive to senior academics. I have long been engaged in the promotion of organic chemistry nationally (chapter 9) and internationally. The IUPAC symposium on Organometallic Chemistry directed toward Organic Synthesis (OMCOS) is among the most successful ventures and already four decades have passed since its first meeting was held in Fort Collins, Colorado, in 1981. So how was this brought about? I was heavily involved in it by planting a seed in its prehistory.

In the 1970s, IUPAC already had several relatively large-scale, continuously held symposia, for example on natural products chemistry and organic synthesis, held in even-numbered years. It was in the mid-1970s, when Shô Itô (Professor at Tohoku University, a member of Nozoe's school), as the Chair of IUPAC Organic Chemistry Division, was looking for some emerging and promising topics to be promoted by holding a symposium in odd-numbered years. This event was to be a fixed period trial and might or might not have continued based on assessing its performance. In my view, it must be OMCOS. Thus, in response to Itô's inquiry, I suggested a possibility of organizing a symposium on this topic after some discussion with Gary H. Posner (an organocopper chemist and an alumnus of E. J Corey school) of Johns Hopkins University. Itô immediately agreed with me, proposed a reasonable plan to IUPAC, and the idea was accepted without any issues. I was pleased to know of this approval.

However, at the time in the late 1970s, I was yet a young professor under 40 who was inclined to fully focus on carrying out research, and I also felt that my administrative

experience was not sufficient to organize an international conference in Japan. Therefore, in 1977, at the conference held at the lake Biwa in Japan, we asked John K. Stille, a capable organizer, to hold the inaugural meeting at Fort Collins, together with Louis S. Hegedus (Corey's student), and they accepted our proposal. Thus, the OMCOS conference made a good start from both scientific and social perspectives as described above.

The subsequent industrial impact of this chemistry is enormous. Thus, my predication regarding the future potential has been proven entirely correct. As an "unsung" OMCOS meeting initiator, I am very pleased to see the unexpectedly long and glorious existence of the meeting. Moreover, I would like to express my appreciation to many senior Japanese colleagues who led this unique, promising research field in the yet difficult environment during the 1960s. Nothing comes from nothing.

From the left: R. H. Grubbs, Hiroshi Yamazaki, and the author.
At the Lake Biwa Hotel in 1977.

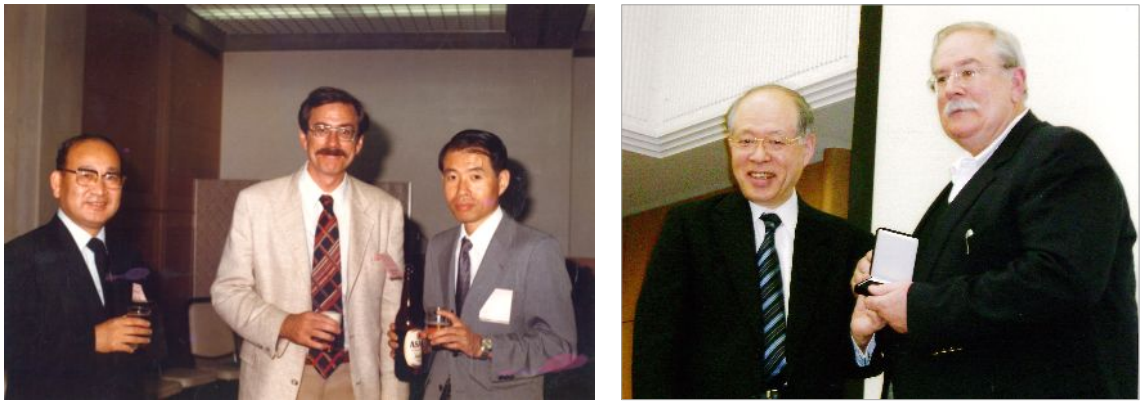
Japan’s organometallic leaders gathered in 2000. Front row, from the left: Akio Yamamoto, Sei Otsuka, Nobue Hagihara, Hideki Sakurai, and author. Back row, from the left: Shigetoshi Takahashi, Shunichi Murahashi, Mitsuo Ishikawa, Akira Nakamura, Hiroshi Yamazaki, Kiitiro Utimoto, and Hideo Kurosawa.

Friends at the West Coast

While international conferences gave me opportunities to obtain diverse friends from all over the world, frequent lecture tours further enhanced a line of personal connection. A memorable event that became the origin of my activities in the US synthetic organic chemistry community, was the Pacific Coast Lectureship that took place in May to June 1982. At the invitation of John Fried, President of Syntex Research, and the planning by John Edward, Vice President, Director of the Institute of Organic Chemistry, I gave lectures at eight universities in the US and Canada located along the Pacific Ocean, as well as at Syntex. From south to north, I went to UC San Diego (hosted by F. Thomas Bond), Caltech (David Evans), UCLA (Donald J. Cram), Syntex, University of Oregon (Richard G. Finke), Oregon State University (James White), University of Washington (Niels Anderson, former Corey lab member), UBC in Vancouver (James P. Kutney), and back to San Francisco to visit UC Berkeley. At the time, the topic of my lecture had shifted from Fe-carbonyl chemistry to practical BINAL-H asymmetric reduction and TAS (tris(dialkylamino)sulfonium) enolate chemistry of ion pairs. My host at Caltech was David Evans, whom I had gotten to know well during his visit to Japan two years earlier, and I was surprised at how the students took the initiative in organizing the program at Pasadena, including transportation for visitors and the dinner party. I also deepened my friendship with John E. Bercaw and Robert H. Grubbs on organometallic chemistry. As enolate chemistry was in full bloom at the time, Clayton Heathcock of UC Berkeley, who was one of the main guests, also jumped in together with Evans to join us for dinner. In fact, it was the next UCLA seminar that I knew that I could not let my guard down on this trip. It was traditionally held after dinner and was known as a "slaughterhouse," where D. J. Cram and Saul Winstein would ask tough questions to the younger speakers. Since both Cram and I were interested in binaphthyl as a key motif for asymmetric recognition, I was concerned about his reaction towards my talk, but I got through the seminar without any issues. I was able to meet with Cram for an hour the next morning, and he invited me to lunch at his home. I got to know that he places particular value on "taste" in research. I also met Frank A. L. Anet, together with Robert V. Stevens and Michael E. Jung, both of whom are specialists in natural products synthesis. My next stop was at UC Berkeley, where I had the opportunity to meet and talk with some of the leading researchers in organic and synthetic chemistry, including Peter Vollhardt, William G. Dauben, Robert Bergman, Wilhelm F. Maier, Paul Bartlett, Clayton Heathcock, and many others, which was a fulfilling experience. After moving north to Oregon State University, I enjoyed a long hike with Jim White (former Assistant Professor at Harvard University), an old acquaintance of mine, and was invited for dinner at his home. I enjoyed the beautiful nature of the West Coast in May when the rhododendrons were in bloom. I was rather puzzled by being served large salmon dishes for dinners at each of the places I visited, being told that it was special. This was because salmons migrate to the north from the south, and I had also travelled a similar route for my trip. It is understandable that foreign friends visiting Japan would often become fed up with being invited to their host's favorite sushi restaurant day after day. But I later learned that, as in France, Italy, China, and other gourmet countries, you cannot fulfill your life as a scientist unless you have a strong stomach (taught by Sir

Derek Barton). I was able to share many dishes with these friends on various occasions, including at international conferences.

(a) (b)



The maturity of the author and David Evans in 25 years. (a) Their first acquaintance in 1980 at Kyoto. From the left: Masaji Ohno (University of Tokyo), Evans (Caltech), and the author. (b) In 2004, Evans (Harvard) receives the Nagoya Gold Medal from the author.

From the left: Paul Bartlett, Cheri Heathcock (Clayton's wife), and the author. In Tokyo in August 1982.

Organic Syntheses, Inc., a Trusted Synthetic Chemists' Club

Another starting point for me in the development of my friendship with US organic chemists was an invitation to join the editorial board of *Organic Syntheses*, a publication project of the American Chemical Society. I served as a Foreign Editor from 1983 to 1988 and later as a member of the Advisory Board. I was very honored to be selected from Japan, second only to Wataru Nagata (Shionogi Inc.), a pioneering synthetic chemist, known for the invention of the cyanoalumination reaction. In fact, I have been repeatedly impressed by the spirit of Roger Adams, the founder of this project, who is known as a "Scientist and Statesman" as well as a mentor of E. J. Corey. In the past, the US had been dependent on Europe, especially on Germany, for obtaining its chemical substances, but in 1914, there was fear that the supply chain would be cut off by World War I. With the help of the Eastman Kodak Research Institute in Rochester, Adams developed and integrated organic synthesis methods to ensure a stable domestic production and supply. This is the basis of their business today. We, the editors, proposed practical synthetic methods, in which its acceptance or rejection is discussed at a meeting. This is followed by review of the accepted manuscript, and then the editors themselves share the responsibility of confirming the reproducibility of the experimental procedure. As a result, the synthetic methods are highly reliable and widely used around the world. Six synthetic methods invented in my research group have also been registered in *Organic Syntheses*. At that time, Orville L. Chapman, Ian Fleming (Cambridge, another Foreign Editor together with me), Clayton H. Heathcock, Andrew S. Kende, Gabriel Saucy (Roche), K. Barry Sharpless, Bruce E. Smart (DuPont), Robert V. Stevens, and Edwin Vedejs were the Editors, with the cooperation of leading companies. The Board of Directors includes the attentive Nelson Leonard (who is also a great singer), Wayland E. Noland, Carl R. Johnson, William G. Dauben, and John D. Roberts, with occasional participation by Albert Eschenmoser and other alumni. It was a truly wonderful gathering. This was an autonomous organization of internationally trusted researchers who met once a year in conjunction with the Spring Meeting of the American Chemical Society at a famous restaurant in the city selected by C. R. Johnson, a culinary expert. The meetings were always held on a Sunday, but special arrangements were made by Johnson to open the restaurant. Through these meetings, we deepened our relationship of trust by understanding not only each other's research expertise but also their personalities. I strongly feel that the warm guidance of these esteemed colleagues has opened the way for me and I grew up as a chemist under such circumstances.

Andrew S. Kende visiting Nagoya in March 1986. From the left: Toshio Goto, Kiyoyuki Yamada, the author, Andrew S. Kende, and Hisashi Yamamoto.

At the *Organic Syntheses* Editorial Meeting in New York City, 1986. (a) Carl R. Johnson. (b) From the left: Al and Mrs. Meyers and Clayton Heathcock. (c) From the left: C. H. Heathcock, Nelson Leonard, Bruce Smart, and Mrs. and J. D. Roberts. (d) Rick L. Danheiser (left) and K. B. Sharpless.

I should not forget to mention the dedication of Jeremiah P. Freeman (University of Notre Dame), long-time Secretary, and the assistance of Theodora Greene (Ph.D. with Corey and well known as the author of *Protective Groups in Organic Synthesis*). In recognition of Freeman's efforts and to spread the activities of *Organic Syntheses* in Japan, I invited him to the Nozaki Conference in Kanazawa (Japan) in 1991 to celebrate the 70th birthday of my mentor, Hitosi Nozaki. Other speakers were K. Barry Sharpless, Günter Helmchen, Eric N. Jacobson, William A. Nugent (DuPont), and Andreas Pfaltz. The speakers' dinner was held at "Tsubajin," a special restaurant that has the longest history in the cultural town Kanazawa, and all seemed to be satisfied with it.

At the 1991 Nozaki Conference at Kanazawa, Japan. (a) From left: the author, Seiji Suga, and K. B. Sharpless. (b) Eric Jacobsen. (c) Hitosi Nozaki and J. Freeman at Tsubajin.

The *Organic Syntheses* publishing project published by John-Wiley is managed by an independent corporation with financially sound operation. We, the editors, have received financial support for organizing lectures at our universities, which has made it possible for us to invite many famous chemists to Nagoya. On the other hand, I traveled to the US by receiving Organic Syntheses Lectureships; I stayed in the office of Henry Gilman at Iowa State University as an Organic Syntheses Lecturer (1987), visited my friend Carl Johnson, the best chef in the world of organic synthesis at Wayne State University (1988) (Actually, I was ashamed as it was highly inappropriate for me to invite him and his family to my home in Nagoya in the previous year to entertain them without knowing his cooking skills. By coincidence, he was in charge of handling my very important short paper on asymmetric hydrogenation of β-keto esters published in

1987 in the *Journal of the American Chemical Society*, and N. L. LeBel, the acting Associate Editor, made the decision to publish the article while Johnson was visiting my laboratory (chapter 6, page 170, and chapter 9, page 263). I also observed Larry Overman's long and responsible leadership at UC Irvine (1992).

Receiving Named Lectureships

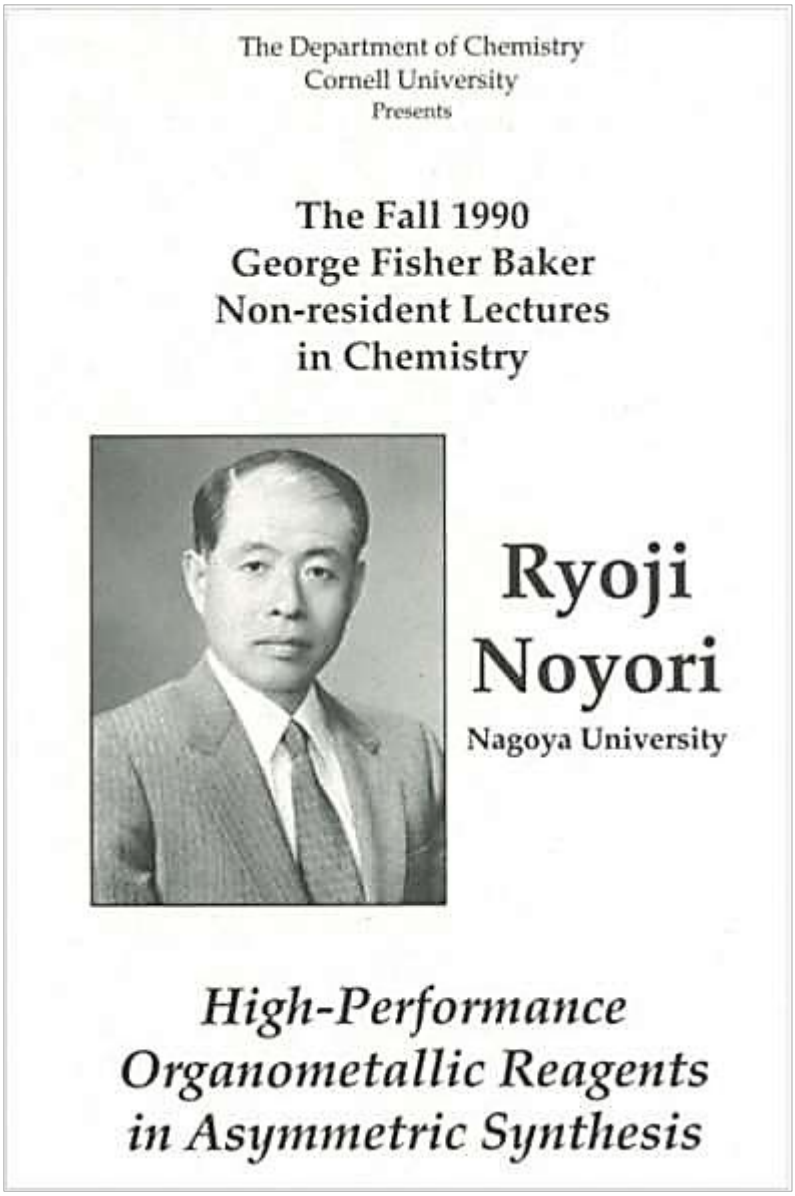
For those of us in academia, there is nothing more valuable and trustworthy than a personal bond. It was through my special relationship with Satoru Masamune that I received the first Karl Pfister visiting professorship at MIT in the US in 1981 (chapter 3, page 63). In 1984, at the invitation of Andrew S. Kende, one of my fellow *Organic Syntheses* editors, I was invited to visit the University of Rochester as the Victor J. Chambers Memorial Lecturer. During my stay, I gave a series of lectures on the topics that I was involved in at the time, such as asymmetric reduction, prostaglandin synthesis, and naked enolates chemistry, and also had the opportunity to make new acquaintances with organic chemists, Robert K. Boeckman and Richard H. Schlessinger, as well as with an inorganic chemist, Richard Eisenberg.

The following spring, in 1985, I was invited by Martin F. Semmelhack, a member of the Corey lab who had just moved to Princeton from Cornell, as the Princeton–SmithKline & French (SKF) Lecturer, in line with the editorial board meeting of *Organic Syntheses* that was held in Miami Beach. I gave lectures on catalytic organosilicon chemistry at SKF, and on prostaglandin synthesis at Princeton. I met the famous Edward C. Taylor, Jeffrey Schwartz, Andreas Mayer, and others, and was invited by my colleagues to Semmelhack's house for a lively dinner party in the garden with many fireflies flying around. I met Kurt Mislow, a great authority on stereochemistry, just before he was going on a trip flying to Paris to meet his friend Jean Jacques and ask him about his new concept. I was impressed by the trust between these chemical philosophers. I wonder whether such scholarly behavior remains in the US and Europe. Unfortunately, this obviously does not exist in Japan. After that, I visited Hoffman-La Roche at Nutley led by Gabriel Saucy, a fellow of *Organic Syntheses*, and then Pfizer's central research institute at Groton led by Hans-Jürgen Hess, a student of Corey at the University of Illinois in his younger days, where I gave a lecture on prostaglandin synthesis. In this way, my circle of contacts was not limited to universities, but also extended to researchers in the pharmaceutical industry in the US and Europe.

I am grateful to have received many prestigious lectureships during my long research career, but the 1990 George Fisher Baker Lecturer at Cornell University is one of the most memorable. In May 1987, I received an unexpected phone call from Jerrold Meinwald, a senior professor at Cornell University whom I had met in 1964 when he visited Kyoto (though he might not remember this event). He asked me if I would be interested in accepting the position of the Baker Lecturer. Although this appointment was still more than three years away, it was one of the most prestigious lectureships in the US, and he wanted to provide enough time for me to prepare for it. I was first asked to stay for eight weeks if possible and to publish proceedings of my lectures. He mentioned that Herbert C. Brown, who was the Baker Lecturer in 1968, had written a fine book and this opened his way to receive the Nobel Prize. Since I would be the first lecturer from the East and it is a highly honorable lectureship, he said that he would

wait for a good response. This was indeed a great honor that I felt I must accept. I thought about it for a while, and then I asked John Wiesenfeld, the chairman of the lectureship, if he would accept me for a six-week period from September to October 1990. Professor Nozaki, my mentor at Kyoto University, had once studied as a postdoctoral fellow under the young Meinwald in the late 1950s, and he told me that the university town of Ithaca was surrounded by such beautiful nature that it had been used as a movie location. I also heard that the autumn leaves are especially beautiful, but the winters are extremely harsh. I have often troubled my colleagues in Nagoya by going away for long periods and since Nagoya University did, and still does, not have a sabbatical system, I felt uneasy for being absent for eight weeks, so this was as long as I could go.

The history of the Baker Lectures began in 1926 and was considered as an invitation to the world's most distinguished scientists and to discover future Nobel laureates. In fact, 19 Laureates, including Otto Hahn, William L. Bragg, Linus C. Pauling, Paul J. Flory, Melvin Calvin, Robert S. Mulliken, Manfred Eigen, Henry Taube, Vladimir Prelog, Gerhard Herzberg, Jean-Marie Lehn, and many others who had been selected as the Baker Lecturers had received the Nobel Prize. Recent speakers were Richard H. Holm (Harvard, inorganic chemistry), Jeremy Knowles (Harvard, enzyme chemistry), and most recently John S. Waugh (MIT, theoretical chemistry). Jean J. M. Fréchet, who was in charge of hosting that year's lectureship, spent a year making all the arrangements, and I was given a room in the S. T. Olin Laboratory Building with a view of the valley and a key to the building, where I was treated like a regular faculty member, and not just a simple visitor. The university was also famous for its hotel department and had an excellent faculty club. During my stay, I became a member of the club and had lunch with faculty members of the chemistry department and learned many things about the university and its surroundings. It was the month after the Iraqi army invaded Kuwait, which triggered the Gulf War.



Author's Baker Lecture at Cornell in September to October in 1990.

As a Baker Visiting Professor, my first lecture was to present overall concepts and achievements to a large audience. Thereafter, I conducted lectures and discussions every Tuesday and Thursday from 11:15 am. Wednesday afternoons were dedicated to discussions with faculty and students from each research group. The title of my lecture on September 18 was "High-Performance Organometallic Reagents in Asymmetric Synthesis," followed by ten lectures on more specific topics such as Asymmetric Catalysis via Chiral Metal Complexes, Prostaglandin Synthesis, An Organometallic Way to Nucleic Acids, and others. During this time, the Executive Director, Earl Peters, along with the head of the department, Jon C. Clardy (natural products chemistry), took care of the details. There was a grand reception, and I made many acquaintances during my six-week stay. I met again my old friend from Harvard Bruce Ganem and Jerrold Meinwald, who opened the field of chemical ecology, but I also met new acquaintances such as Harold A. Scheraga, an authority on protein structures; Barry K. Carpenter, a brilliant theoretical organic chemist, the young David B. Collum; Fred W. McLafferty,

an expert on mass spectrometry; John E. McMurry, a well-known author of organic chemistry textbooks; Peter T. Wolczanski, an inorganic chemist. I recall that Roald Hoffmann thanked me for finding an error in the absolute configuration of *d*-camphor in his paper on molecular chirality (see R. Hoffmann, *The Same and Not the Same*, 1995, Columbia University Press, p. 74). The authoritative *The Merck Index*, which he credited, continued to present the wrong structural formula in its 12th Edition (1996) despite my warning, and it was corrected afterwards.

During this stay, I visited Brandeis University at the invitation of Myron Rosenblum, who had visited Nagoya two years earlier and was the driving force behind Woodward–Wilkinson's ferrocene synthesis research at Harvard, to give a lecture on asymmetric synthesis, and also stayed at a villa in Danbury, New Hampshire to enjoy the coloring of the leaves. While in Ithaca, I received the news that E. J. Corey had "finally" been awarded the Nobel Prize in chemistry, and on my way back from New Hampshire to Ithaca, I stopped by the Anthony Pier Four lobster restaurant in Boston to celebrate and give a toast with Mikiko Sodeoka, Hideo Kigoshi, and other postdoctoral researchers of the Corey lab. I also visited my old friends Andy Kende, Rich Eisenberg, Bob Boeckman, and Joseph P. Dinnocenzo in Rochester, gave a lecture, and enjoyed Niagara Falls for the first time.

My wife Hiroko and my second son Koji (then 12 years old), a sixth grader in elementary school, accompanied me on this long trip. We were provided with housing (Gun Hill Residence) within a 15-minute walk to the university and rented a car for daily use. Hiroko and I had obtained international driver's licenses in Japan for this purpose, but it was difficult to drive on the right-hand side of the road (in Japan, we drive on the left side), which we were not used to. As a custom of this particular lectureship, the professors served as gracious hosts, along with their wives. Many of the professors invited me to their homes for lunch and dinner, and taught me many important things about the American society. Because I was so busy with my personal and professional life, we rarely cooked our own dinner, but often went out to College Town. My son Koji, who went to study at DeWitt middle school, was confused at first, but as he got used to the new environment, the harder it became to say goodbye to his classmates. Clardy and his wife showed me the important intercollegiate football game. There was also a music concert featuring the famous cellist Yo-Yo Ma, and it was impressive to see the children who came with their parents to have a friendly discussion with the great scientists on the campus. We were asked if there was anything we missed or wanted to see, but they could not have been more hospitable. Everyone I met in this university town was well educated, intelligent, and warm. Hiroko, who was in the US for the first time, loved this academic and cultural environment, but I often said to her, "This is not the US. It is Ithaca." These 40 days were like a dream and passed in the blink of an eye. I promised to return, but this has not happened for the next 30 years.

In the summer just before my departure from Japan, Corey, who happened to be in Japan, wished me good luck and congratulated me, and I felt that I was finally approved by my American supervisor and colleagues. I am grateful for the kindness of my many friends. As for the promised publication of the proceedings, I was encouraged by Fréchet and the talented editors Linda Romaine Ross and Shirley Thomas of Wiley-Science. In October 1993, with the help of many colleagues and students at Nagoya

University, I was finally able to publish the book titled "*Asymmetric Catalysis in Organic Synthesis*" in the following year.

In 1994, at an international conference in the UK, I was publicly congratulated by H. C. Brown, who had also published his Baker book (UK edition). I have heard this giant speak with clarity and integrity at various conferences. In 1991, I was invited as a Herbert C. Brown Lecturer at Purdue University in West Lafayette, along with Peter A. Kollman, Sidney M. Hecht, and Peter B. Dervan, in his honor. The moderator was Ei-ichi Negishi (2010 Nobel laureate in chemistry), who had studied under Brown.

The Corey School in Japan has strong ties and has held a reunion each time Corey had visited Japan. In August 1988, we celebrated his 60th birthday in Kyoto, and in November of the same year, the Corey Symposium was held at Harvard, organized by David Evans and Yoshito Kishi, with myself as an invited speaker along with fellow students, Dieter Seebach, Al Meyers, and Rick Danheiser. Corey was very pleased with the participation of 90 of his students and many other interested parties. Considered by many to be one of the most productive researchers, Corey was also an educator, having trained 160 university professors at this time. Returning to this campus brings back many emotions.

(a) (b)

Corey's 60th birthday celebration in 1988. (a) In Kyoto. (b) At Harvard with the 1969 group members. From the left: E. J. Corey, David Cane, Herb Kirst, author, Ned Weinshenker, and Manning Cooke. Front on the right: Ted MacDonald.

In 1994, I was awarded the prestigious Max Tishler Prize Lectureship at Harvard. I felt that my many friends brought me back to the place where I had studied as a young man 25 years earlier. The Prize Lectureship was established in 1951 as a donation from Max Tishler, who had greatly contributed towards the development of Merck Sharp & Dohme. According to Corey, this was the most prestigious lectureship organized by the Organic/Bioorganic Group of the University, first awarded to Vladimir Prelog, and I was the 26th recipient and the first to receive it from Japan. I gave lectures titled "Asymmetric Hydrogenation" (main lecture) and "A Mechanistic Study on Asymmetric Catalysis" (seminar). Gregory L. Verdine, who was still young, made various arrangements for me, and I was able to have discussions with excellent young students and postdoctoral researchers from Japan, including Masaya Sawamura (now at

Hokkaido University) and Yujiro Hayashi (now at Tohoku University). I met with many leading researchers such as Yoshito Kishi, Stuart Schreiber, Eric Jacobson, David Evans, William Doering, George Whitesides, and others. Among them, I had the opportunity to meet with Frank Westheimer, the founder of bioorganic chemistry, and I was particularly impressed by his earnest inquisitiveness. He is a big proponent of hydrogenase, and he told me that his impression after hearing me talk about hydrogenation reactions was that certain enzymes produce hydrogen, but he also believes that molecular hydrogen may actually be used in the reaction as well. He gave me a beautifully typed note during my stay. A scientist, of course, must be humble. I have always believed that metal-catalyzed hydrogenation is the ideal reaction from the standpoint of general practicality, but I wonder if biotechnology will ever surpass it. I enjoyed dinner with the faculty members of the Department of Chemistry at the Faculty Club, where I frequently passed by then during my postdoctoral period, and also had dinner with Yoshito Kishi and Satoru Masamune (MIT), speaking in Japanese with them after a long time.

There are many lectureships named after great scientists in the US. I am always impressed by the achievements of our predecessors, but Melvin Calvin, who received the Nobel Prize in chemistry in 1961 for his work in photosynthesis, especially stands out. In 1977, I heard his keynote lecture at the Congress of Pure and Applied Chemistry, Tokyo, organized by Michinori Oki (University of Tokyo). I was fortunate enough to receive the Melvin Calvin Lectureship, established in 1984, from the University of California, Berkeley. I received a lengthy invitation in advance from my esteemed friend Robert G. Bergman. He is a very meticulous man, but he wanted to be sure that I could speak on Tuesday at 11:10 a.m. at a large enough lecture hall and there was time for lunch with the students and faculty. He asked me to give him several possible dates for this. Both he and I had various appointments, and it was very difficult to coordinate our dates, but I cancelled my other commitments and managed to secure Tuesday, September 29, 1998. Jean Fréchet greeted me with a big smile. He had been an excellent host for my Baker Lectureship in Cornell in 1990, and he had since moved to Berkeley, where the climate is more favorable. He was originally of French descent and stored several thousand bottles of vintage wine, which required strict temperature control (within $\pm$1 °C) to transport them across the continent in a U-Haul vehicle. We reflected on our families' memories and enjoyed our conversation on sumo wrestling, which was one of his favorite hobbies. He hosted a reception at Jean/Janet's mansion and generously served his great wines to the attendees. The presence of a guest like me creates an opportunity to strengthen the bonds between colleagues. I spoke to a large audience simply on the topic of asymmetric hydrogenation. The university, which I visited in 1982 as a Pacific Coast Lecturer, remains extremely diverse and full of energy. I met and discussed with friends new and old, including Kenneth N. Raymond, Graham Fleming (physical chemistry), Andrew Streitwieser, Don Tilley, the young David MacMillan, as well as Paul Bartlett, Peter Vollhardt, Doug Gin, Alex Pine, Clayton Heathcock, Jon Ellman, and many others. It was an intense but very satisfying stay.

The world was unstable and full of uncertainty. On September 11, 2001, multiple terrorist attacks happened in the US and the World Trade Center in New York, a symbol

of prosperity, burned to the ground. This was followed by the disruption of the world's flight network, but I had to be in Los Angeles on October 2 after attending a conference in Europe, which I had been planning for some time. On the next day, I was scheduled to present the George A. Olah Lecture at the University of Southern California, organized by G. K. Surya Prakash. This lectureship to honor the 1994 Nobel Prize Laureate in chemistry was established in 1996, and has been awarded to Istvan Hargittai (Budapest; Olah was also from Hungary), Gabor Somorjai (Hungarian, UC Berkeley), Ivar Ugi (Estonia-born German, TU Munich), and others. In the immediate aftermath of the terrorist attacks, airports across the US were closed, safety regulations were imposed on baggage, and FedEx and other cargo flights were put on standby. The flights were in chaos, and the administrative procedures for obtaining a visa were so confusing that it was impossible to get a visa in time by e-mail alone, but with the help of many people, I was able to travel and arrived safely in Los Angeles on a packed flight from London.

The title of my talk was "Asymmetric Hydrogenation," and to honor Olah's great work, I began with the similarity between the six-electron carbocation and our d^6-electron Ru(II) structure. It was a large-scale lecture, and Fred Hawthorn of UCLA was there to hear it, and I also had the opportunity to meet for the first time, Mark Thompson, Andrey Vilesov, Golam Rasul, Curt Wittig (Chairman), Charles McKenna, Philip Stephens, Arieh Warshel (2013 Nobel laureate in chemistry, enzyme computational science), Robert Bau, and others.

Although Olah himself probably did not remember it, I had once visited him in his laboratory at Case Western Reserve University in Cleveland on my way home from Harvard in 1970. Later, I was so impressed by his great research achievements that I wrote a book in Japanese, "Super-strong Acids and Super-strong Bases" (Kodansha Scientific, co-authored with Kozo Tanabe) in 1980, together with an explanation of the book. Olah, of course, had a special place in the heart of this wealthy West Coast university, where he worked tirelessly in the magnificent Loker Hydrocarbon Research Institute, which displays Nobel Prize-related memorial goods. I should not forget to also mention the longtime efforts of his wife Judith. G. K. Surya Prakash has understood and practices the ideas of this great chemist under the title of George A. & Judith A. Olah Nobel Laureate Chair. Olah was an openhearted man with a very strong personality, and a scientist with a broad social perspective and faith. Olah took the opportunity to share many anecdotes with us, both from himself and from his colleagues. According to my wife Hiroko, who shared this fulfilling stay with me, when we parted on the evening of October 3, Olah told her to be careful because I would be busy when I returned home. Subsequently, a week later, I received a phone call from Stockholm that I was selected as a Laureate of the Nobel Prize and became really busy. I suppose he must have been a prophet of my destiny.

Author and Hiroko with George and Judith Olah (middle) at Southern California University in October 2001.

The California Institute of Technology had the prestigious Arnold O. Beckman Lectureship, established in 1985. In the past, E. J. Corey, J. Meinwald, R. Breslow, D. J. Cram, and many other distinguished researchers had served as lecturers. I was also invited by Peter Dervan in 2002 to visit the beautiful campus in Pasadena, where David Baltimore (1975 Nobel laureate in Physiology or Medicine) was president at that time. In addition to giving lectures on Asymmetric Hydrogenation, I also had the opportunity to meet with young Brian Stoltz, Linda Hsieh-Wilson, and old acquaintances, such as Nelson Leonard (formerly at the University of Illinois), Jonas Peters, Dennis Dougherty, and others. Although they were a small university with about 300 faculties and 1,000 graduate students, it was of extremely high quality and already had 26 Nobel laureates, including Linus Pauling, William N. Lipscomb, Rudolph Marcus, Ahmed Zewail, and others (in 2005, R. H. Grubbs was added to the list). I wonder why this place is so wonderful. The atmosphere in their chemistry department was cheerful and the relationships were open. Perhaps this was partly because the Honor code is “never take unfair advantage of any other member of the Caltech community.” The openness of faculty, staff, and students to this code allows individuals to freely exchange ideas and information, fosters mutual trust and respect, and produces creativity. Through having dinner with faculty members after going to Dervan’s home, I got the impression that John (Jack) D. Roberts (1918–2016) had a great personality and educational role in his affection for young people and students. His experience, which many chemists admire, is outstanding.

There are, of course, many professors in the US who wish to see the development of their chemistry departments at their universities. At the University of Nebraska in

Lincoln, which has a considerable history, the family of Hamilton, a prominent organic chemist who served as head of the department in 1939–1955, founded the Cliff S. Hamilton Award program. This award had been granted to E. J. Corey, A. Eschenmoser, H. C. Brown, V. Prelog, and more recently K. B. Sharpless, D. Seebach, K. C. Nicolaou, and I received the award in 1999 and visited this characteristic university. I remember discussing organometallic chemistry with Reuben Rieke, who also founded Rieke Metals Inc. and was invited to his home for a chat.

The University of Michigan has a prominent lectureship named after Werner Bachmann, a student of Moses Gomberg who solved various problems in organic chemistry, including radical chemistry, and contributed to the development of the chemistry department at the university. The first lectureship was established in 1957, and its lecturers included many US researchers, such as William S. Johnson, Paul D. Bartlett, John D. Roberts, Robert B. Woodward, as well as Karl Ziegler, Georg Wittig, Derek H. R. Barton, with a total of 38 prominent lecturers being selected. I was also honored to be invited for this lectureship by my friend William R. Roush in 2000. I gave two lectures on asymmetric hydrogenation, and I met old acquaintances, such as Edwin Vedejs, Masato Koreeda, and André S. Dreiding from Switzerland again after 17 years since the unforgettable Bürgenstock conference (Switzerland section). Chemical research gives people good health, and none of them had changed at all.

Lectureships Supported by Industry

In the US, there are many organic chemistry-related lectureships supported by pharmaceutical companies. In addition to catalyzing various research and educational activities, they also contribute greatly to enhancing the credibility of the companies concerned. In my case, I received the Pacific Coast Lectureship in 1982, which was supported by Syntex, and also received the Syntex Distinguished Lectureship twice. In 1986, I revisited Colorado State University to tell Robert Williams, Al Meyers, Louis Hegedus, John K. Stille, and others about the progress of our new asymmetric hydrogenation reactions. In 1992, I visited the University of Colorado to meet Gary A. Molander, David Walba, Josef Michl, and Charles DePuy, as well as Marvin H. Caruthers, who is well known in nucleic acid chemistry.

I felt that the company that has most strongly supported the synthetic organic chemistry activities of academia was Merck. In 1986, I was invited by Burton G. Christensen (antibiotics authority) and Ichiro Shinkai, who were in charge of basic chemistry, to visit the Merck Sharp & Dohme Research Lab, Rahway, where I met Tom Verhoeven, Paul Reider, and others, who were also very interested in my basic research at the time. In 1992, I visited the University of Minnesota as a Merck Lecturer at the invitation of Paul G. Gassman, where I got acquainted with excellent young researchers such as Thomas R. Hoye and Scott Rychnovsky. In the same year, I was invited by Edwin Vedejs of the University of Wisconsin to receive the Karl Folkers Lectureship, the university's most prestigious award, again with Merck's support. My lecture title was "Asymmetric Catalysis: Science and Opportunities", and I gave three talks on isomerization of allylamines, hydrogenation, and zinc chemistry. I was also able to speak with Howard E. Zimmerman, a senior figure in physical organic chemistry; Robert C. West, an expert in organosilicon chemistry who is also a Japanese expert that

can enjoy a sushi restaurant alone in Japan and calls himself “Professor Nishi (West)” in Japanese; Charles J. Sih, Howard W. Whitlock, Stephen F. Nelsen, Daniel H. Rich in microbial chemistry, Charles P. Casey in olefin metathesis, Hans J. Reich in structural chemistry, the young Steven D. Burke, and others. Vedejs invited me to a Turkish restaurant, where we had a great discussion about the unsuccessful “Genko” (Mongolian invasion) in the 13th century. In the same year 1992, at the request of Eric Jacobsen, I became the Merck Centennial Lecturer at University of Illinois at Urbana-Champaign, where I had the opportunity to meet with fellow *Organic Syntheses* members, Robert M. Coates and Nelson Leonard, John A. Katzenellenbogen, a top student at the Corey lab around 1970, Scott Denmark, who was proud of his German car, Garry Schuster, Kenneth Rinehart, William Pirkle, Peter Beak, and others. I was reassured that there is a strong tradition of organic chemistry from the Roger Adams era, and that there are many researchers in this significant field.

Later, in 2003, I was invited by my friend K. C. Nicolaou to the Scripps Research Institute, La Jolla, as a Merck-Scripps Lecturer. I was the second to receive this lectureship after E. J. Corey, who was also his mentor, and spoke on asymmetric hydrogenation. Nicolaou was an extremely energetic and productive researcher with a large research team including 10 Japanese researchers, and I presume that it must be very difficult to secure research funding to maintain his group. His lab has a strong supportive system, and in addition to a secretary who handles routine tasks, there are specialists in the preparation of papers and drawings. Their chemistry department was well staffed, and I met with Phil Baran, M. G. Finn, Floyd Romesberg, Kim Janda, Dale Boger, Jeff Kelly, Julius Rebek, Richard Lerner, Erick Sorensen, and other prominent members. Nicolaou had invited me many times to visit his beloved birthplace, Cyprus, but I am afraid that I have missed the opportunity to do so.

Author with K. C. Nicolaou (right) at Scripps Research Institute in 2003.

In addition to Merck, there are a variety of sponsors. In 1992, I was invited to be the Rhone-Poulenc Rorer Lecturer at Ohio State University, Columbus, where I met young Viresh H. Rawal (now at the University of Chicago), Harold Hart's son, David Hart, Andrew Wojcicki, and others. I was also a Kraft Distinguished Lecturer at Indiana University, which had a beautiful campus in the woods of Bloomington, where I met William R. Roush, Paul Grieco, Malcolm Chisholm, Joseph J. Gajewski, Jack Crandall, Dave Williams, and Kenneth Caulton. In 1998, I received an Amgen-UCLA Lectureship at the invitation of my friend Michael E. Jung. I was selected as a chemist involved in both academic and industrial applications, and was able to meet with UCLA's leading figures such as Fraser Stoddart (Winstein Chair, later 2016 Nobel laureate), Fred Wudl, and Kendall N. Houk, as well as visit the nature-rich laboratories of Amgen, then a rapidly growing pharmaceutical venture company. In 2005, I was invited by Justin Du Bois of Stanford University to talk on green chemistry as a Bristol-Myers Squibb Lecturer. I enjoyed meeting Barry Trost, Robert Waymouth, John Brauman, Paul Wender, and others and making new acquaintances.

International Conferences in the US

The International Conference of Organic Synthesis (ICOS) in Madison in 1980 and the OMCOS meeting in Fort Collins in 1981 were international conferences authorized by IUPAC, but the success of the meetings depended strongly on the enthusiasm of the organizing committee chairs as well as the unity and strength of the host universities. The William S. Johnson Symposium in Organic Chemistry at Stanford University was one of the most fruitful symposia I ever attended in the US. W. S. Johnson who moved from Wisconsin to Stanford in 1960, contributed greatly to the rapid development of the Department of Chemistry, not only through his research but also by recruiting many outstanding faculty members as a department chair. The symposium was established in 1986 to honor his achievements. In October 1989, Barry Trost, who had followed a similar career path as Johnson, organized a symposium with Carl Djerassi and Paul A. Wender, and I was invited together with J. Baldwin, A. R. Battersby, D. A. Evans, R. H. Grubbs, C. H. Heathcock, K. Nakanishi (dinner speaker), and C. H. Sih. The event was a great success. During my trip, I was caught in big trouble at the check-in desk of the SF Hilton, my accommodation site, because the Giants-Dodgers Subway World Series was held at the same time. Immediately after the conference, I took off for Japan on the noon flight on October 15th, but a major earthquake occurred in San Francisco immediately afterwards. I was surprised by the news when I heard about it later.

The Johnson Symposium, which specially commemorated the 10th meeting in 1995, was even more successful. Paul A. Wender chaired this year's symposium with the assistance of Carl Djerassi and Barry Trost. I was honored to have the opportunity to be invited together with Derek Barton (Oxygen and I), Ronald Breslow (A Rapid Interest in Hydrophobia), George Olah (The Search for Carbocations), Robert Grubbs, Albert Eschenmoser (Chemistry of p-RNA, the Pyranosyl Isomer of RNA), Ralph F. Hirschmann, Clayton Heathcock, K. Barry Sharpless, Gilbert Stork, and the dinner speaker John D. Roberts (Yesterday, Today and Tomorrow). This lineup reminded me of the spectacular meeting in London in 1991 to celebrate the 150th anniversary of the

Royal Society of Chemistry (UK section). I spoke on Asymmetric Hydrogenation, chaired by Paul Bartlett, and was again impressed by the above ingenious presentations by the senior members. W. S. Johnson had passed away 2 months earlier and we all paid our respects and gratitude to him for his contributions over the past 50 years. Furthermore, it was truly regrettable that, on the morning of my departure for this trip, I received the news of the death of Hidemasa Takaya, my long-term colleague at Nagoya (chapter 3, page 64), while he was attending a conference in Germany. I was in deep sadness as I headed towards Stanford, where Takaya had studied under James P. Collman in his earlier years.

At the William S. Johnson Symposium at Stanford in 1989. From the left: Clayton Heathcock, Paul Wender, Charlie Sih, W. S. Johnson, Koji Nakanishi, author, and Alan Battersby. Front row: Jack Baldwin, B. M. Trost, and Carl Djerassi.

Princeton University has also hosted impressive international conferences. In August 1996, the 10th International Symposium on Homogeneous Catalysis was held under the organization by Istvan T. Horvath of Exxon (who returned to Budapest a few years later and later went to Hong Kong) and John T. Groves of Princeton. The topics ranged from organometallic catalysis to polymer chemistry and industrial technology, and I had the pleasure of meeting with Maurice S. Brookhart (North Carolina), Henry E. Bryndza (DuPont), Henri B. Kagan (Paris-Sud), Alexander M. Klibanov (MIT), George A. Olah (Southern California), Manfred T. Reetz (Max-Planck), Barry M. Trost (Stanford), and Robert M. Waymouth (Stanford). Other invited keynote speakers were Irina P. Beletskaya (Moscow), Matthias Beller (Hoechst), Michael J. Burk (Duke), M. Catellani (Parma), J. Bryan Jones (Toronto, enzyme chemistry) Walter Kaminsky (Hamburg, molecular polymerization catalysis), Shun-Ichi Murahashi (Osaka), and Peter T.

Wolczanski (Cornell) were also invited. I was asked to present the latest results on asymmetric catalysis, and I presented the C=O-selective hydrogenation reaction by a ternary catalytic system using $RuCl_2$(diphosphine), 1,2-diamine, and KOH, which had novel selectivity, rate, and productivity at that time. Susumu Akutagawa, a collaborator of Takasago Co., also spoke at the Industrial Technology Outlook forum, and Kyoko Nozaki (daughter of Hitosi Nozaki), a collaborator at Kyoto University, gave a special lecture in memory of Hidemasa Takaya, who had suddenly passed away the previous year. I also met again with John Osborn (Strasbourg) and M. F. Semmelhack, my friends from Harvard, and Jan-E. Bäckvall, Donna Blackmond, Steven Bergens, William Nugent (DuPont), Jun Okuda, and many others also attended the conference. During the excursion from New York Harbor to the Hudson River, I spent a lot of time talking with Barry M. Trost, without paying much attention to the scenery.

John Groves visited Nagoya in March 1997. From the left,
Hiroko Noyori, Mrs. and John Groves, and the author.

From the left: Shunichi Murahashi, Henri Kagan, Gerard van Koten, and the author.
At Princeton in 1996.

Times have changed. In 2010, I was invited to the Merck Catalysis Symposium at Princeton, where I got the impression that the Princeton chemistry department had undergone a considerable generational turnover, with the young David MacMillan (2021 Nobel laureate in chemistry) taking the lead to expand the department. He and Merck's Skip Volante (formerly of the Corey group) organized a symposium that included presentations by Frances Hamilton Arnold (who later became a Nobel laureate in chemistry in 2018, Caltech; How Enzymes Adapt: Catalysis by Evolution), Justin Du Bois (Stanford, Catalytic C-H Oxidation: Recent Insights and Advances), and others. I gave a classic keynote speech titled "Asymmetric Hydrogenation: Our 30 years with BINAP". Old friends, including John Groves, Martin and Christina Semmelhack, and Richard Tillyer (Merck's next leader after Ichiro Shinkai and Paul Reider) joined us for dinner. I also met with Merck researchers who were closely related to Takasago International, and was invited to stay at the Palmer House, a guesthouse on the campus where I had stayed 35 years ago, which reminded me of my younger years.

Symposia of the American Chemical Society

I frequently attended conferences sponsored by the American Chemical Society, one of the largest academic organization based in the US. In 1986, I attended the Ernest Guenther Award Symposium in New York with T. S. Kelly and Larry Overman to celebrate our friend Clayton H. Heathcock's receiving his award. At the National American Chemical Society Meeting in Washington, D.C. in 2000, Harry H. Wasserman organized a Tetrahedron Symposium to celebrate Henri Kagan's receiving the Tetrahedron Prize, for which K. Barry Sharpless, Eric Jacobsen, and myself were invited. In 2003, a joint commemorative symposium to celebrate the 125th anniversary of the *Journal of the American Chemical Society* (editor-in-chief, Peter Stang) and the 80th anniversary of *Chem. Eng. News* (editor-in-chief, Madeleine Jacobs) was held in

New York. This symposium was organized by Peter Stang and Steven Lippard to celebrate the best in basic science research, to which Allen J. Bard, Jacqueline K. Barton, F. Albert Cotton, Larry Overman, Ahmed Zewail and I were invited. I was asked to speak on behalf of the field of organic chemistry, and I gave the opening talk titled “Molecular Catalysis: Today and Tomorrow” and enjoyed a black-tie dinner in the evening.

The Commemorative ACS Meeting in New York, 2003. Standing left to right: Author, Judith Lippard, Steve Lippard, Allen Bard, Scott Anderson, and Cynthia Burrows. Sitting left to right: Jack Norton, Peter Stang, wife of Eric Anslyn, and Eric Anslyn.

In 2005, I attended the Joint Meeting of the 2nd International Conference on Green and Sustainable Chemistry and the 9th Annual Green and Sustainable Chemistry Conference in Washington, D. C. The program chair was Robin D. Rogers (University of Alabama, Director of the Center for Green Manufacturing) and the conference chair was Paul T. Anastas (ACS, Director of Green Chemistry Institute), and unlike ordinary academic conferences, this large-scale and serious meeting involving private and public organizations illustrates the magnitude of this social issue on green and sustainable chemistry. I was the keynote speaker, along with George M. Whitesides. Anastas was extremely practical and dynamic, taking to the streets during lunch breaks to give speeches to test the public’s reaction and his own persuasive ability. He was satisfied by the positive response.

Gratitude to the American Chemical Society

With 102,000 members (global community of 208,000 associates), the American Chemical Society is the world's largest chemical scientific society, and its activities are wide-ranging, including holding conferences, publishing scientific journals, and presenting awards among many others. As a foreign scientist, I have been involved in this society in various ways over half a century. I am grateful that many of my friends have understood my research achievements, and I have received various commendations.

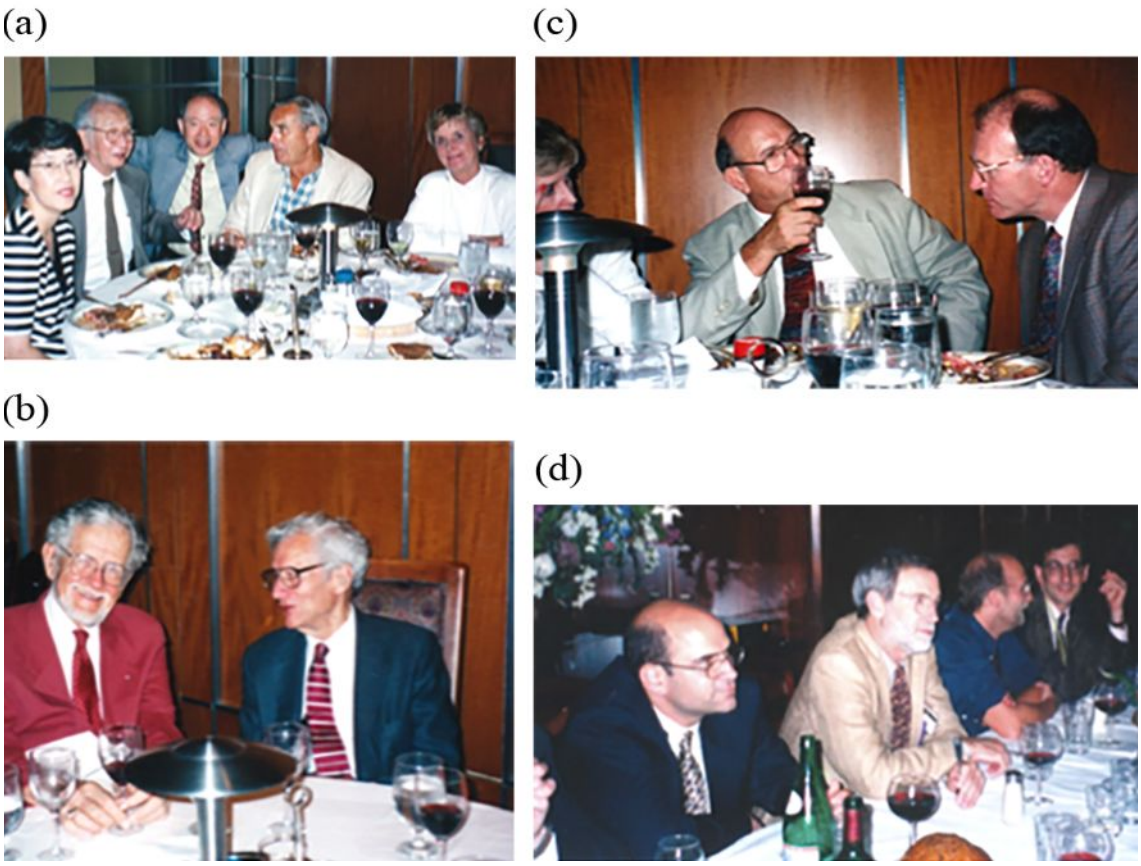
Back to more than 30 years ago, on June 11, 1990, I clearly remember receiving a fax from Frederick E. Ziegler of Yale University. This was at a time when letters were still commonly sent via airmail, and the round trip took two weeks. It was the first academic award I received from the US, and it was completely unexpected. The letter stated that the American Chemical Society, New Haven Section, and Yale University had jointly established the J. G. Kirkwood Award, which they would like to present to me in 1991. The award was named in honor of Professor James Kirkwood, who has made significant contributions to the development of Yale's Department of Chemistry. Since its establishment in 1962, the award has been presented to Nobel laureates such as Lars Onsager, Manfred Eigen, Robert S. Mulliken, Robert B. Woodward, and Henry Taube. I was congratulated by my friends James P. Collman, Bruce H. Lipshutz, Koji Nakanishi, and others upon the announcement of this award in *Chem. Eng. News*. This award was probably granted to me through the recognition by F. E. Ziegler, Jack W. Faller, Robert H. Crabtree and their colleagues on my recent achievements on catalysis research. In October 1991 I visited Yale, New Haven to give a lecture on my recent achievements in asymmetric synthesis and thanked them for their recognition. It was a very intensive visit where I had the opportunity to meet with the famous chemists, William Jorgensen, Harry H. Wasserman, Kenneth B. Wiberg, Samuel J. Danishefsky, and others.

In August 1996 I received the Arthur C. Cope Scholar Award at the National American Chemical Society Meeting in Orlando. This prestigious ACS award was established with an endowment from Arthur C. Cope, who once led organic chemistry at MIT. Each year, the Arthur C. Cope Award is given to one outstanding organic chemist, and the Arthur C. Cope Scholar Award is given to a significant number of researchers in consideration of their age groups. That year, the Arthur C. Cope Scholar Award was given to myself and ten others, including Daniel K. Kahne, Stefan Hecht, Bruce Ganem, John H. Griffin, Stephen F. Martin, Stephen Hanessian, T. Ross Kelly, Barbara Imperiali, and Jeffrey S. Moore. I was then 57 years old, so I guess I was classified as a senior. Nationality was not taken into consideration for the selection, but most of the recipients were US researchers.

(a) (b)

At the ACS National Meeting in Orlando, 1996. (a) From the left: C. R. Johnson, the author, and A. B. Smith III. (b) Our *Organic Syntheses* editorial colleagues, R. M. Coates (left) and J. Freeman.

In fact, the selection process for the following year's award was already underway at that time. To my surprise, I was informed immediately the following month that I had been selected as the recipient of the prestigious Arthur C. Cope Award. Robert G. Bergman, the recipient of that year's award, whom I had just met at Orlando, was the first to inform me of the award and extended his heartwarming congratulations. The following September, I received the award at the ACS Meeting in Las Vegas, where I presented my award lecture titled "Homogeneous Catalysis: Selectivity, Reactivity, and Productivity" in front of an audience of over 1,000 people. The 10 "scholar" awardees that year were Philip Eaton (Chicago), Jon Clardy, Barry K. Carpenter, and David B. Collum (all of Cornell), as well as Steven C. Zimmerman, Samuel H. Gellman, Daniel S. Kemp, and the great Jack D. Dunitz (ETH), and young OMCOS members Bruce H. Lipshutz and Erick M. Carreira. The annual meeting of the American Chemical Society can only be held in a city where a number of huge hotels are located. Since Las Vegas was a special place for my wife and me, we toured the glamorous casinos and saw the rare white tiger.



At the ACS National Meeting at Las Vegas in 1997. (a) From the left: Hiroko Noyori, Koji Nakanishi, author, and Nelson Leonard. (b) J. D. Roberts and F. Westheimer. (c) C. R. Johnson and Andy Holmes. (d) From the left: Erick Carreira and Jon Clardy.

Two years later, in June 2001, I was awarded the Roger Adams Award at the 37th National Organic Chemistry at Bozeman, Montana. This award is considered the highest honor in organic chemistry in the US and is intended to recognize and encourage outstanding contributions to research in organic chemistry as defined in its broadest sense. The sponsors are *Organic Reactions, Inc.* and *Organic Syntheses, Inc.* and the award is given to one person every other year. Nationality was not considered but I was the first Asian to receive this award. Since 1959, six of the 21 recipients had been foreign nationals, and eight Nobel laureates in chemistry: Derek H. R. Barton, Robert B. Woodward, Vladimir Prelog, Herbert C. Brown, Georg Wittig, Donald J. Cram, George A. Olah, and Elias J. Corey, had received the award (now eleven if K. Barry Sharpless, myself, and Carolyn R. Bertozzi are included). I do not know the names of the people who nominated me, but the many researchers whom I have been with must have supported me and I was again grateful for the honor. The respectable Jerrold Meinwald, the first American chemist I met in 1964, was also present to congratulate me, as was Gary Molander (University of Pennsylvania), who organized the meeting, with Cynthia A. McClure serving as the local facilitator. The conference was a great success, with an attendance of 1,200 people. Peter Stang, Josef Michl, Carolyn Bertozzi, Jeff Kelly, Gary Sulikowski, Alois Fürstner, Bruce Lipshutz, Andrew Evans, John Hartwig, Jerrold Meinwald, Manfred Reetz, Ei-ichi Negishi, and others were also invited, but the younger generation on our behalf had come to play a leading role. I gave an evening

lecture titled “Asymmetric Hydrogenation via Architectural and Functional Molecular Engineering”, moderated by Robert Boeckman, the section chair. In addition, I did a long, difficult interview with *Chemical & Engineering News* (Author’s Family, page 297).

Author with Jerrold Meinwald (center) and A. B. Smith, III (right). On the occasion of receiving the Roger Adams Award from the ACS at the National Organic Chemistry Symposium. Bozeman, Montana in 2001.

On the way back to Japan, we stopped by Salt Lake City at the invitation of Peter Stang, and departed after talking about various matters in science and our life. I had first met Peter Stang in Nagoya in 1985, and we had deepened our friendship. I would like to express my respects to him not only for his research achievements in self-assembly chemistry but also for his contributions as an editor-in-chief of the *Journal of the American Chemical Society* for nearly 20 years.

It is nice to know that I still have friends in the American Chemical Society who remember my old work, even though it has been almost 20 years since I left the research field. The Division of the History of Chemistry, in recognition of my work on Ru-BINAP catalyzed asymmetric hydrogenation of β-keto esters in 1987, granted me on behalf of my organization, the Citation for Chemical Breakthrough Award. This is totally different from other honors including the Nobel Prize; we are among a very few who are informed of such recognition while we are still alive.

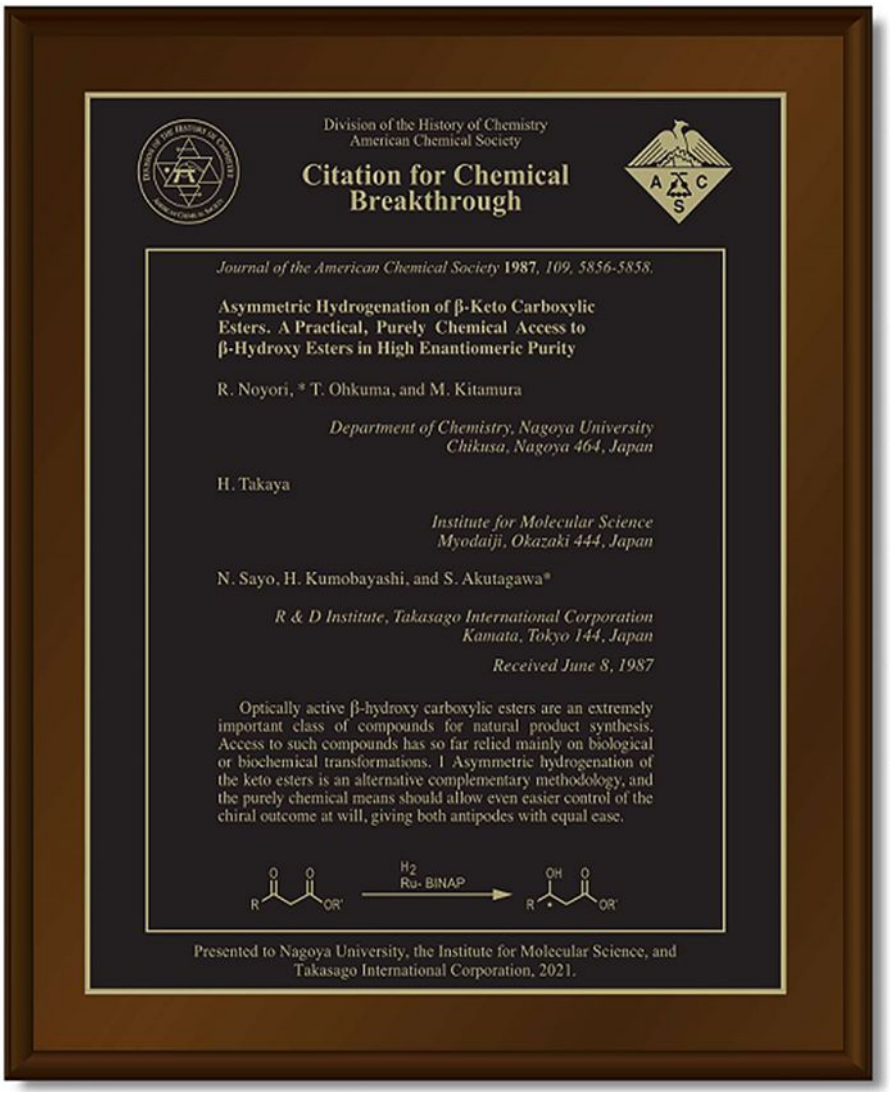


Plate for the 2021 Citation for Chemical Breakthrough Award of the American Chemical Society. Recognition of Nagoya's organic chemistry.

Sympathy with Jack Halpern, an Uncompromising Organometallic Chemist

In my youth, I studied physical organic chemistry in Kyoto and organic synthesis at Harvard, and then focused on OMCOS in Nagoya. Readers may be surprised to learn that I was greatly influenced by Jack Halpern (1925–2018), whatever this organometallic chemist might have thought about my science and academic behavior. He was extremely critical minded (this is very different from myself) and valued clear conclusions in the Occam's razor style. In the 1960s, I was amazed by his bold comparative concepts of carbene vs. Rh(I), carbocation vs. Ru(II), and carbon radical *vs*. Co(II) (chapter 2). Later on, his Rh(I) chemistry and my Ni(0) chemistry resonated with each other, while the intervention of transition metal effects into the Woodward-Hoffmann Rule was being discussed (chapter 5). Furthermore, the limitations of Rh-diphosphine-catalyzed asymmetric synthesis were overcome by my Ru-diphosphine catalysis (chapter 6). He probably first recognized me in 1974, when I was 35, at the US-Japan Organometallic Chemistry Conference in Honolulu. Since then, we have met frequently at international organometallic conferences, and I invited him twice to

Nagoya University. I feel he came to understand my chemistry as he looked through my papers as an Associate Editor of *Journal of the American Chemical Society*. He continued to guide me appropriately through his sincere response towards my submission of manuscripts of various kinds of research.

The University of Chicago was his workplace, and he was my host during my stay as the Morris S. Kharasch Visiting Professor in 1991, which I strongly remember. According to the invitation letter from Graham Fleming, the chief of the department, this famous lectureship was established in 1960 in honor of Kharasch, who was a pioneer in free radical addition and polymerization reactions, a mentor of H. C. Brown, a founder of the *Journal of Organic Chemistry*, and was instrumental in the development of the Department of Chemistry at the University of Chicago. Starting with Woodward as the first Lecturer, eminent researchers who have built the history of organic chemistry have been selected. I was honored to receive this prestigious lectureship and gave a talk on asymmetric organozinc catalysis and nucleic acid synthesis, in addition to my achievements in asymmetric hydrogenation reactions. There was a unique intellectual atmosphere in their chemistry department. Every day at lunch time, the main and unique professors of the Department of Chemistry would gather at a fixed place in the Faculty Club to exchange information. The main leaders were Stuart Rice and Jack Halpern, both of whom are well-spoken physical or mechanistic chemists, and they discussed various topics including politics and economics, and most of the decisions on the department's management were made there. I was able to meet and discuss with prominent researchers such as Gerhard L. Closs, David Lynn, William Wulff, Nien-chu Yang, and others, and was treated to dinner and excellent hospitality by the principal investigators. Takeshi Oka, a quiet and sincere scientist (and structural advocate of H_3^+), invited me to his home and treated me to a–sashimi dish home-prepared by his wife who had obtained fresh fish at the market. Among the most unique chemists I knew in the US was Philip Eaton, who became famous at a young age with his synthesis of cubane, and whom I first met at the Welch Conference in Houston in 1973. He was as sharp as ever. I was treated to a meal served at the highest restaurant in the world. In addition, Brice Bosnich, the inventor of CHIRAPHOS, the chemist with whom I have the most rapport, likes to joke and camouflages himself, but in fact he is an uncompromising perfectionist, and his laboratory is the cleanest in the world. He loves absolute perfection.

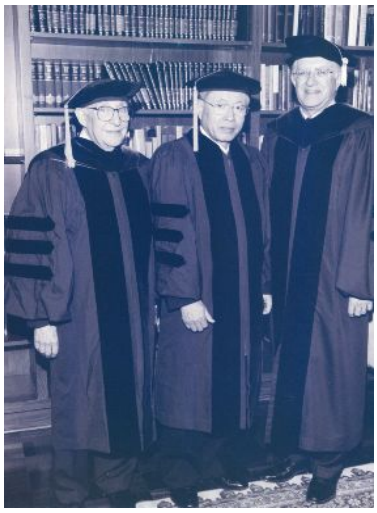
During my stay, Richard Smalley, who had worked on laser spectroscopy with Donald Levy and others, visited their school and gave a very enthusiastic talk on C_{60} Buckminster Fullerene. The classroom was packed, with students sitting and occupying the space from the podium to the front rows, satisfied with listening to his passionate talk. This was the first time I had attended such a hot seminar.

Jack and Helen Halpern who hosted me had a profound knowledge of culture, and their home was full of artistic crafts largely from China. They loved classic music as well and invited me to the performance of the Chicago Symphony Orchestra directed by Daniel Barenboim. I was guided by the colleagues to the Court Theater, the Institute of Chicago, the university's beautiful Prairie style house designed by Frank Lloyd Wright together with the famous Science Museum. Thus, I learned that the University of Chicago's Chemistry Department is a highly intellectual and culture-rich institution.

However, this city can never be too careful. We always locked our offices whenever we go outside, and of course we do the same when we left in the evening. However, one morning, when I came to the office, I found that my personal computer that I was borrowing was missing. I felt that this city was a scary place even within the university block.

Jack Halpern was more inclined towards inorganic chemistry, structure and reaction studies, and less interested in synthetic organic chemistry. However, he was closely associated with William S. Knowles of Monsanto, and fully valued the practicalities of catalytic chemistry. He was rigorous and uncompromising in his research. He was always in the front row at lectures, and when the speaker finishes his talk, he always says, “I have a comment and some questions.” Many peoples suffered from his tough comments. But he is a man with a sense of fairness who has long served as an Associate Editor of the *Journal of the American Chemical Society*, was a conscious member of the Chemistry Division of the National Academy of Sciences, and has contributed to the development of *Proceedings of the National Academy of Sciences, USA* (PNAS) and the promotion of chemistry in the US.

As such, I was extremely grateful for his invitation to the Kharasch Lectureship mentioned above. At the 2000 IUPAC Conference of Organometallic Chemistry in Shanghai, Halpern happened to listen to my plenary lecture on asymmetric hydrogenation. After I returned to Japan, I received a letter from him with the following words of encouragement: “Your recent works, demonstrating broadly applicable and highly practical applications of stereoselective catalysis, truly raises this field to a new level.” Later in 2003, when I was awarded a Doctor of Science (honorary degree) from the University of Chicago, he wrote me a very nice citation. On this occasion, I was deeply moved by the congratulatory visit of Professor Kazuo Nakamoto of Marquette University, who was my first chemistry teacher at the Nada Junior Higher School 50 years ago (chapter 1). In the same year, I was elected as a Foreign Associate of the National Academy of Sciences, which I believe that he must have been involved in this nomination. He passed away in 2018. I offer my heartfelt thanks and condolences. In addition, I was also nominated as a Foreign Honorary Member in 2001 by the American Academy of Arts and Sciences, and am grateful towards the undisclosed academy members who recommended me.



Author receiving a Doctor of Science Degree at University of Chicago in 2003. (a) With Jack Halpern (left) and President Don M. Randel (right). (b) Congratulated by author's first chemistry teacher at junior high school in 1951 (chapter 1), Kazuo Nakamoto (second from the left, Professor of Illinois Institute of Technology and Marquette University).

With gratitude
for every encounter