PREFACE

Professor Ryoji Noyori

This year the chemical community in Japan is celebrating the 70th birthday ("koki" in Japanese) of Professor Ryoji Noyori, currently University Professor at Nagoya University and the President of RIKEN (multi-site national research institute). Since Professor Noyori is so famous and popular worldwide as a Nobel Laureate in Chemistry (the 10th Nobel laureate in Japan), his career and scientific accomplishments are amply described in a huge number of articles and documents which you can easily find on Internet Web sites. He has also been in the public eye as the chairman of the Cabinet's Education Rebuilding Council. Actually, he is now wearing many kind of caps as a researcher, educator, administrator, science and education advisor for the Government and so on. Perhaps he is the most influential scientist in the general public in Japan; he often appears in TV programs and daily newspapers. Of course, Professor Noyori has been well honored for his great scientific contributions by many prestigious awards including Nobel Prize in Chemistry (2001), Wolf Prize in Chemistry (2001), Roger Adams Award (2001), Order of Culture (2000), Arthur C. Cope Award (1997), Japan Academy Prize (1995), and Chemical Society of Japan Award (1985).

K. Tani, H. Takaya, R. Noyori, S. Ohtsuka, S. Akutagawa, and H. Kumobayashi
1984, at Iwata Factory, Takasago International Co.

Professor Noyori has made a wide range of contributions to organic chemistry, from catalytic asymmetric synthetic methods to green chemistry using supercritical carbon dioxide. Among these, the best known and the most significant is the development of enantioselective catalytic hydrogenations catalyzed by transition metal complexes with BINAP, or 2,2'-bis(diphenylphosphino)-1,1'-binaphthyl. This chiral molecule is one of the most widely used ligands today. In an interview article Noyori says: "The success in producing BINAP took six years ! This molecule is simple and beautiful. In Germany, it is said that function is beautiful. I believe in the close relationship between beauty and functionality." For example, a BINAP-rhodium complex is used as the asymmetric catalyst for the key reaction in the industrial synthesis of (-)-menthol. Each year more than 1,500 tons of menthol are produced by Takasago International Co. for which Noyori is serving on the executive board. Perhaps, this is the largest application of asymmetric catalysis in the world. Furthermore, the asymmetric hydrogenation catalyzed by a BINAP-ruthenium complex is used in the industrial synthesis of a key intermediate of carbapenem antibiotices. Noyori believes in the power of molecular catalysis. In a recent *Chem. Comm.* article he argues for the pursuit of "practical elegance in synthesis" and states that "Our ability to devise straightforward and practical chemical synthesis is indispensable to the survival of our species".

While Professor Noyori always emphasizes the importance of the practical value of synthetic methods, his mechanistic studies on the asymmetric addition of organizincs to aldehydes catalyzed by enantio-enriched amino alcohols are of special interest, since a strong positive nonlinear effect (now called asymmetric amplification) was observed in the asymmetric catalysis. One interesting episode: When the *C&E News* article about Noyori's 1997 Arthur C. Cope Award appeared, stating that "In 1986, Noyori discovered asymmetric amplification," he immediately sent a letter to *C&EN* to correct this statement, saying that "This is not true. H. Kagan was probably the first person who reported the nonlinear effect in asymmetric catalysis. In 1983, N. Oguni discovered a remarkable positive nonlinear effect, termed "asymmetric amplification," in the organozinc reaction catalyzed by a partially resolved amino alcohol." This episode shows his incredible work ethic vividly as it really is.

W.S. Knowles, R. Noyori, and R. Larock
1981, OMCOS Conference at Fort Collins

R. Noyori, S. Suga, and K.B. Sharpless
1991, Nozaki Conference at Kanazawa

Ryoji Noyori was born in Kobe, Japan, in 1938. His father was a researcher for a chemical company. He became fascinated with chemistry at the age of 12, after hearing that the then-new fiber Nylon was made from air, water, and coal; this episode is so popular to schoolchildren. He recalls, "My appetite for chemistry was further wetted through class work led by enthusiastic teachers in middle/high schools. Together with regular school work, "judo" was his major passion at that time." In 1957 he entered Kyoto University to study chemistry and began his research work in the forth year under the supervision of Professor Hitosi Nozaki. In 1967 he obtained his Ph.D degree there. While working in Nozaki's group as a research associate and instructor, he discovered the enantioselective cyclopropanation of styrene with diazoacetates in the presence of a catalytic amount of a chiral copper complex. This work is a milestone in his career, but attracted little attention at that time. In 1969, he joined the Corey group at Harvard University and worked prostaglandin synthesis for 14 months. Professor Corey describes him in *C&CN*, "While at Harvard, Noyori displayed a keenness of mind and motivation that stood out, even in a collection of very gifted and dedicated individuals." He returned to Nagoya and became full professor in 1972 when he was just 34 years old! Since then, he has been based in Nagoya. Currently he is also based in Tokyo to work as the president of RIKEN in a suburb of Tokyo.

Now let me mention briefly about the Ryoji Noyori Prize, an international award presented by the Society of Synthetic Organic Chemistry, Japan (SSOCJ) and sponsored by Takasago International Co. The prize was established in 2002 to commemorate Noyori's winning distinction of the 2001 Nobel Prize as well as the 60th anniversary of SSOCJ. Its aim is to recognize and encourage outstanding contributions to research in asymmetric synthetic chemistry in its broadest sense. So far six eminent chemists have been awarded: H. Kagan (Paris), G. Stork (Columbia), D. Seebach (ETH), T. Katsuki (Kyushu), D. A. Evans (Harvard), and T. Hayashi (Kyoto). Every year Professor Noyori gives a speech at the award ceremony prior to the winner's award lecture to talk about how the winner had achieved the excellence from his personal points of view. His talks have been quite stimulative, educational, and enjoyable for us. Undoubtedly, his continuing leadership is a key factor in making the Prize so prestigious.

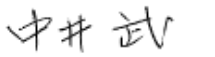
In short, Professor Ryoji Noyori has spent more than 40 years in selfless devotion to science and made substantial technical advances with highly practical implications. His creativity and high standard of excellence have been an inspiration to his coworkers and colleagues as well. He is truly a gifted talent and leader. When Noyori was awarded the Nobel Prize, Professor Teruaki Mukaiyama congratulated him, by saying that "You have jaguar's sharp eyes that actually catch the target through long, patient, laborious work with bold yet carefully planned approach. That is your chemistry. Beautiful ! Bravo !!"

We are always impressed with his strong sense of mission or responsibility as a scholar and scientist. He has said that "Research is for nations and mankind, not for researchers themselves." He often speaks out about science policy and education, particularly higher education including graduate school. Also, he often encourages scientist to be politically active, by saying that "Researchers must spur public

opinions and government policies toward constructing the sustainable society in the 21th century" (the key address for 2005 Internat. Conf. On Green Chemistry). He has been (and continues to be) one of the strongest, the most reliable speakers for science in general and chemistry in particular.

It is a real pleasure for all of us to be able to honor him with this special issue of *Heterocycles*.

We all wish his good health and many more years of enjoyment with his family !



Takeshi Nakai
Tokyo, Japan

Takeshi Nakai, born in 1940 and obtained a B.Eng. from Osaka Prefecture University in 1963 and a Ph.D. from Tokyo Institute of Technology in 1968 in the field of polymer chemistry. He joined the faculty of Tokyo Inst. Tech. in 1968 as research associate and promoted to associate professor in 1975 and full professor in 1984. In 1970-72 he did postdoctoral studies in Prof. Paul Gassman's group at Ohio State University. In March 2001 he retired from Tokyo Inst. Tech. and became an Emeritus Professor there. In August 2001 he moved to Niigata University and retired there in 2006. Currently, he is teaching at Waseda University as a visiting professor and also serving as a Program Officer for Japan Science and Technology Agency (JST). He was the President of the Society of Synthetic Organic Chemistry, Japan, in 2005-2007. He received the Chemical Society of Japan Award in 1994. His research interests include explorations of new synthetic methods, particularly for stereocontrol and asymmetric synthesis, pericyclic reactions, carbanion chemistry, and fluorine chemistry.