M. Shibasaki

The author presented on this page has recently published his ***25th article*** *since 2000 in Angewandte Chemie*: "Direct Catalytic Asymmetric Mannich-Type Reaction of Thioamides": Y. Suzuki, R. Yazaki, N. Kumagai, M. Shibasaki, *Angew. Chem.* **2009**, *121*, 5126–5129; *Angew. Chem. Int. Ed.* **2009**, *48*, 5026–5029.

Masakatsu Shibasaki

Date of birth: January 25th, 1947

Position: Professor at Graduate School of Pharmaceutical Sciences, the University of Tokyo, (Japan)

Education: 1969 BA degree, the University of Tokyo
1974 PhD with Prof. S. Yamada, "Asymmetric polyene cyclization and its synthetic applications", the University of Tokyo
1974–1977 Postdoc with Prof. E. J. Corey, Harvard University (USA)

Professional associations: The Pharmaceutical Society of Japan, The Chemical Society of Japan, The American Chemical Society, The Society of Synthetic Organic Chemistry (Japan), The Japanese Society for Process Chemistry, and others

Recent awards: **2008** Prelog Medal (Switzerland), Centenary Medal and Lectureship (UK), Creative Work in Synthetic Organic Chemistry (USA), **2005** The Japan Academy Prize (Japan), **2003** The National Prize of Purple Ribbon (Japan), **2002** Arthur C. Cope Senior Scholar Award (USA), **1999** The Pharmaceutical Society of Japan Award (Japan), **1998** Tetrahedron Chair (Belgium), **1996** Fluka Prize: Reagent of the Year (Switzerland)

Current research interests: Asymmetric catalysis: My primary research interests are the development of new bifunctional asymmetric catalysts and their applications to the efficient, short synthesis of pharmaceuticals and natural products. Since our report in 1992 on a rare-earth-metal-catalyzed asymmetric nitroaldol reaction, we have developed series of bifunctional cooperative asymmetric catalysts such as Lewis acid/Brønsted base, Lewis acid/Lewis base, Lewis acid/Lewis acid catalysts, and others. Cooperative functions of two or more metal centers are key in our multimetallic complexes. The concept of bifunctional cooperative catalysis is now used not only in metal catalysis, but also widely in organocatalysis

Hobbies: Watching sport events such as baseball and football

The most significant scientific advances of the last 100 years have been … the discovery of penicillin and the development of vaccines for various infections.

If I could be anyone for a day, I would be … a novelist.

My favorite subject at school was … mathematics.

The biggest challenge facing scientists is … the harmonization of an affluent society with global environment issues.

If I could have dinner with three famous scientists from history, they would be … Albert Einstein, Victor Grignard, and Robert B. Woodward.

I chose chemistry as a career because … I wanted to understand various scientific phenomena on a molecular level.

The most important future applications of my research are … the large-scale synthesis of pharmaceuticals with minimum waste.

My first experiment was … the synthesis of nitrobenzene.

If I wasn't a scientist, I would be … a medical doctor.

My most exciting discovery to date has been … Lewis acid/Brønsted base cooperative asymmetric catalysis.

In my spare time I … read various novels.

The best advice I have ever been given is … "Don't regret past failures so much and keep going".

My ultimate goal is to … contribute to social welfare based on my basic research so far.

If I could be described as an animal it would be … a tiger.

The biggest challenge facing chemists is … the combat against drug-resistant viruses and bacteria.

How is chemistry research different now than it was at the beginning of your career?

When I started chemistry research as a PhD student in the early 1970s, lab equipment and the lab environment in Japan were quite different from now, partly owing to difference in the economic situation at that time. I had to prepare many common reagents by myself, which are currently commercially available. In addition, modern analytical methods such as LCMS and HPLC were not available at that time. I was using a 60 MHz continuous-wave NMR spectrometer, but not FTNMR spectroscopy. Thus, it took a very long time to start any experiments and to analyze the experimental results. The way of conducting literature surveys is also totally different now. Students in my group now check and search synthetic methods through the internet. Of course, internet searching is very useful to accelerate research, but I am afraid that they may lose out on some opportunities of unexpectedly finding new chemistry in different fields, which can occur when reading paper journals in a library.

Has your approach to chemistry research changed since the start of your career?

The significant progresses in analytical techniques and calculation methods accelerate research, but my basic approach to chemistry has not changed so much. We discuss daily the experimental results and working hypotheses on a black board with chalk as I did in the 1970s. In my opinion, imagining the behavior of molecules in your mind rather than on a computer is important to get initial inspiration, start new projects, and gain unexpected achievements. Modern analytical techniques and calculations greatly help us to understand the results rationally, but do not always help me to get inspiration about new chemistry.

Has your approach to publishing your results changed since the start of your career?

Not so much. I always select topics that I believe to be the most important in synthetic organic chemistry, and start experiments with a rough working hypothesis. On the basis of experimental results, I change the strategy if necessary, try to improve the results, and publish them in top journals. Currently, we can attach many experimental details as electronic Supporting Information, even for rapid communications. So, I always try to provide as much information as possible at the stage of preliminary communications. Details of mechanistic studies in full articles are, however, still important to deeply understand the novel results and phenomena reported in communications.

What do you think the future holds for your field of research?

I believe that the importance of catalysis will continuously increase, not only in synthetic organic chemistry, but also in other fields of broad chemistry. Catalysis is critically important to minimize waste, to solve energy problems, and to contribute to harmonizing social welfare and global environment issues. For the design of new catalysts and/or functional materials, the concept of "bifunctional" and "cooperative" roles of two or more elements is important. Chemists have accumulated knowledge about elements and have utilized the characteristic properties of each element in 20^{th} century. To improve further the catalysis and create unexpected functions, I believe novel designs, to maximize cooperative functions of two or more elements, are required.

Have you changed the main focus of your research throughout your career and if so why?

Since I started my independent academic career, I have changed the directions of my research a couple of times. I have tried to launch new projects (of course, not always successfully) when I have moved to different positions during my career. I started research on organometallic catalysis in the late 1980s at Sagami Chemical Research Center and Hokkaido University, and expanded them to bifunctional asymmetric catalysis during the 1990s at the University of Tokyo. Personally, I think that starting new additional projects is important to maintain high quality in research when moving to new positions.

What has been your biggest influence/motivation?

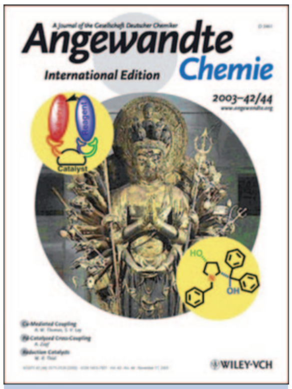
I became a scientist because I wanted to understand various phenomena in detail. The passion to find and understand unknown things has been my basic motivation since my first experiments in the lab. After a long research life, I also strongly feel that I would like to contribute to human welfare based on my basic research.

What advice would you give to up-and-coming scientists?

Believe in yourself, dedicate yourself to chemistry, and try to be the first in the class. But don't forget to respect others in your fields. Human relationships and collaborations are very important for your success in the scientific community. The education and training of your younger colleagues is also your duty for future advances in science.

What is the secret to publishing so many high-quality papers?

The most important thing for me is to attract and encourage excellent co-workers. I think about the basic concept and future directions of my research



M. Shibasaki has featured on the cover of Angewandte Chemie:
"Multicenter Strategy for the Development of Catalytic Enantioselective Nucleophilic Alkylation of Ketones: Me2Zn Addition to α-Ketoesters": K. Funabashi, M. Jachmann, M. Kanai, M. Shibasaki, *Angew. Chem.* **2003**, *115*, 5647–650; *Angew. Chem. Int. Ed.* **2003**, *42*, 5489–5492.

by myself, but I often give my young colleagues a lot of freedom to think and start each project. I believe that it is important to maintain the highest motivation of your colleagues and a good atmosphere so that they enjoy chemistry in the lab. If they don't enjoy chemistry in daily lab life, it is impossible to attract other chemists that have carried out high-quality work. Sometimes, I need to wait patiently for progress without giving too much advice, but that way is still useful for maintaining the high quality and motivation of my lab group for long periods of time.

My 5 top papers:

1. "Basic Character of Rare Earth Metal Alkoxides. Utilization in Catalytic Carbon-Carbon Bond-Forming Reactions and Catalytic Asymmetric Nitroaldol Reactions": H. Sasai, T. Suzuki, S. Arai, T. Arai, M. Shibasaki, *J. Am. Chem. Soc.* **1992**, *114*, 4418–4420.
   This was the starting point of Lewis acid/Brønsted base bifunctional asymmetric catalysis. Although we did not know the exact structure and functions of the rare-earth-metal catalyst at the initial stage, further intensive studies revealed the unexpected cooperative functions of the rare-earth/alkali-metal complexes. The heterobimetallic system significantly broadened the scope of asymmetric catalysis, especially in asymmetric C–C bond-forming reactions, and changed the strategy in designing chiral catalysts. Nowadays, the concept of bifunctional catalysis is widely used both in metal and organo catalysts.
2. "Direct Catalytic Asymmetric Aldol Reactions of Aldehydes and Unmodified Ketones": Y. M. A. Yamada, N. Yoshikawa, H. Sasai, M. Shibasaki, *Angew. Chem.* **1997**, *109*, 1942–1944 Angew. Chem. Int. Ed. Engl. **1997**, 36, 1871–1873.
   This was the first intermolecular direct catalytic asymmetric aldol reaction. Although the catalytic activity and selectivity were not satisfactory at the initial stage, I believe that we succeeded in changing the trend in asymmetric C–C bond-forming reactions with this paper. Now, direct catalytic asymmetric C–C bond-forming reactions are widely studied, both with metal catalysts and organocatalysts.
3. "A New Multifunctional Heterobimetallic Asymmetric Catalyst for Michael Additions and Tandem Michael-Aldol Reactions": T. Arai, H. Sasai, K. Aoe, K. Okamura, T. Date, M. Shibasaki, *Angew. Chem.* **1996**, *108*, 103–105; *Angew. Chem. Int. Ed. Engl.* **1996**, *35*, 104–106.
   In this paper, we demonstrated that the concept of Lewis acid/Brønsted base bifunctional catalysis is not restricted to rare-earth-metal complexes, but that it is applicable to other metals such as aluminum. Because an Al–Li–BINOL complex in this paper was readily available from cheap $LiAlH_4$ and BINOL, the complex was widely used by many chemists in the world for the catalytic asymmetric synthesis of biologically active compounds. The heterobimetallic Al–Li complex played a key role in illustrating the synthetic utility of the Lewis acid/Brønsted base bifunctional catalysis.
4. "A New Bifunctional Asymmetric Catalysis: Asymmetric Cyanosilylation of Aldehydes": Y. Hamashima, D. Sawada, M. Kanai, M. Shibasaki, *J. Am. Chem. Soc.* **1999**, *121*, 2641–2642.
   This paper describes Lewis acid/Lewis base bifunctional catalysis. With this paper, we succeeded in expanding the concept of bifunctional cooperative asymmetric catalysis from initial Lewis acid/Brønsted base bifunctional catalysis. Since then, many chemists, including us, have developed various modes of bifunctional catalysts. The reaction in this paper had already been accomplished by simple Lewis acid catalysis, but the proof of concept in this paper led to fruitful successes in developing a broad range of new asymmetric C–C bond-forming reactions.
5. "De Novo Synthesis of Tamiflu via a Catalytic Asymmetric Ring-Opening of *meso*-Aziridines with $TMSN_3$": Y. Fukuta, T. Mita, N. Fukuda, M. Kanai, M. Shibasaki, *J. Am. Chem. Soc.* **2006**, *128*, 6312–6313.
   Since the publication of this paper, I gradually changed my attentions to focus more on contributions to social welfare based on my basic research. Investigations on developing practical asymmetric catalysts for the efficient synthesis of pharmaceuticals are ongoing.

DOI: 10.1002/anie.200904210