An Interview with Prof. Tamio Hayashi

Conducted by Robin Padilla (27.06.2013)

Prof. Tamio Hayashi
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RP: Can you briefly describe your research interests?

TH: Mostly synthetic methodology, especially asymmetric catalysis. Not organocatalysis but transition-metal-catalyzed reactions and the design and preparation of new types of catalysts with higher activity than those already known. Of course, the enantioselectivity is also very important. I hope to use those new types of catalysts for new types of transformations, not just things like hydrogenation or oxidation but in new C—C bond forming reactions. However, substrate functionalization can also be OK too!

RP: What do you think is the biggest scientific challenge of today? Of tomorrow?

TH: Wow, I haven't prepared myself for such big questions! <laughs> I'd say very selective C—H bond activation is a huge area. It's already fashionable but it's still far away from practical use. Usually you need a directing group for good selectivity to be realized but different approaches may be possible. It's a very interesting research area!

Target-oriented chemical synthesis is another very important area. The total synthesis of natural products seems to be slowing down and it's more difficult to publish papers in this area. Many younger researchers prefer to reach for the easier publications in other areas. Maybe people also focus more on methodology. Total synthesis is a very important field but it's difficult to find surprising breakthroughs.

As we move from organic chemistry to somewhere close to other branches, our strong point, as chemists, is that we can understand the natural phenomena in terms of chemical structures and reactions. In that sense, chemists are very strong and we can use our knowledge and perspectives to go to the materials science or biological areas. I can't say what is the next, very surprising project but one way forward would be to move toward materials or biology.

RP: Do you mean branching out from traditional chemistry?

TH: Yes. If we stay in the classical chemistry research fields, then one can of course enjoy sitting there comfortably. But I think chemists should go out and explore new areas.

RP: So we should go out to find and explore new challenges in other fields from a chemical perspective?

TH: That's right!

RP: What is your dream reaction?

TH: I have been working on asymmetric catalysis since some years and I think asymmetric C—H bond activation is a great reaction. It has already been discovered but it is very limited to special systems. Hopefully it will be very useful for the production of things which are very useful. Of course, very high catalytic activity is the most important point in all cases, for example, using 0.0001 mol% of a catalyst.

RP: What sort of hobbies and interests do you have outside of the lab?

TH: I enjoy yacht sailing and have been on sailing teams since I was an undergraduate student. Not really big ships but small ones, like dinghies. We have some regattas for senior people; it's not very serious competition but just for enjoyment. After racing, we then have some drinks together! I also like other sports, like badminton.

Some of Prof. Hayashi's own favorite publications:

Hayashi, T.; Konishi, M.; Kobori, Y.; Kumada, M.; Higuchi, T.; Hirotsu, K. Dichloro[1,1'-bis(diphenylphosphino)ferrocene]palladium(II): An Effective Catalyst for Cross-Coupling of Secondary and Primary Alkyl Grignard and Alkylzinc Reagents with Organic Halides. *J. Am. Chem. Soc.*, (1984) **106**, 158.

Ito, Y.; Sawamura, M.; Hayashi, T., Catalytic Asymmetric Aldol Reaction: Reaction of Aldehydes with Isocyanoacetate Catalyzed by a Chiral Ferrocenylphosphine-Gold(I) Complex. *J. Am. Chem. Soc.*, (1986) **108**, 6405.

Takaya, Y.; Ogasawara, M.; Hayashi, T.; Sakai, M.; Miyaura, N., Rhodium-Catalyzed Asymmetric 1,4-Addition of Aryl- and Alkenylboronic Acids to Enones. *J. Am. Chem. Soc.,* (1998) **120**, 5579.

Hayashi, T.; Takahashi, M.; Takaya, Y.; Ogasawara, M., Catalytic Cycle of Rhodium-Catalyzed Asymmetric 1,4-Addition of Organoboronic Acids. Arylrhodium, Oxa-π-allylrhodium, and Hydroxorhodium Intermediates. *J. Am. Chem. Soc.,* (2002) **124**, 5052.

Hayashi, T.; Ueyama, K.; Tokunaga, N.; Yoshida, K., A Chiral Chelating Diene as a New Type of Chiral Ligand for Transition Metal Catalysts: Its Preparation and Use for the Rhodium-Catalyzed Asymmetric 1,4-Addition., *J. Am. Chem. Soc.*, (2003) **125**, 11508.

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[1] Han, J. W.; Hayashi, T., In *Science of Synthesis: Stereoselective Synthesis*, de Vries, J. G., Ed.; Thieme: Stuttgart, (2011); Vol. 1, p 923.