Young Career Focus: Dr. Seung Hwan Cho (Pohang University of Science and Technology, Republic of Korea)

Background and Purpose. SYNFORM regularly meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Dr. Seung Hwan Cho (Pohang University of Science and Technology, Republic of Korea).

Biographical Sketch

Dr. S. H. Cho

Seung Hwan Cho obtained his B.Sc. (2006) and Ph.D. (2011) degrees from the Korea Advanced Institute of Science and Technology (KAIST), under the guidance of Professor Sukbok Chang. During his Ph.D. studies, he focused on two different research topics: (1) copper-catalyzed three-component couplings with terminal alkynes, sulfonyl azides, and nucleophiles, and (2) transition-metal-free or transition-metal-catalyzed C–C and C–N bond formation reactions via a C–H activation strategy. After spending one more year at KAIST for his military service, he joined the group of Professor John F. Hartwig at the University of California, Berkeley (USA) as a Cheongam postdoctoral fellow (2012–2014). There, he was engaged in research to develop silane-directed secondary C–H borylation reactions. He began his independent career in July 2014 at Pohang University of Science and Technology (POSTECH), Pohang, Republic of Korea. His research involves chemo- and stereoselective transformations using 1,1-diborylalkanes as coupling reagents. He received the Cheongam Science Fellowship for Young Investigators, the ACP Lectureship Award (Hong Kong and Singapore) and the Thieme Chemistry Journals Award (all in 2017).

INTERVIEW

SYNFORM *What is the focus of your current research activity?*

Dr. S. H. Cho Research in our group aims to discover, develop and understand new organic transformations which will result in a rapid increase in molecular complexity. In particular, we are highly interested in the design and synthesis of new types of organoboron compounds such as 1,1-diborylalkanes and their utilizations in transition-metal-free C–C and C–B bond-formation reactions. Moreover, we are interested in developing transition-metal-catalyzed diastereo- and enantioselective organic transformations of 1,1-diborylalkanes with suitable electrophiles to generate chiral organoboron compounds.

SYNFORM *When did you get interested in synthesis?*

Dr. S. H. Cho During my undergraduate years I majored in chemistry, but I was not interested in studying it. I could not find the motivation to study chemistry, and I had no confidence in myself. But, after I met Professor Sukbok Chang, my life completely changed. He encouraged me to do experiments in his lab, and I started my undergraduate research in his group.

Professor Chang gave me the opportunity to experience independent research and I was able to discover the real research process. There, I luckily had a chance to be involved in a project to develop a copper-catalyzed multicomponent reaction with terminal alkynes, sulfonyl azides and suitable nucleophiles. During the research, I observed that the ketenimine intermediate, which was generated by the reaction between a terminal alkyne and a sulfonyl azide in the presence of a copper catalyst, could react with water to form an amide. This result was an unconventional approach to the synthesis of amides and I was fortunate to publish my undergraduate

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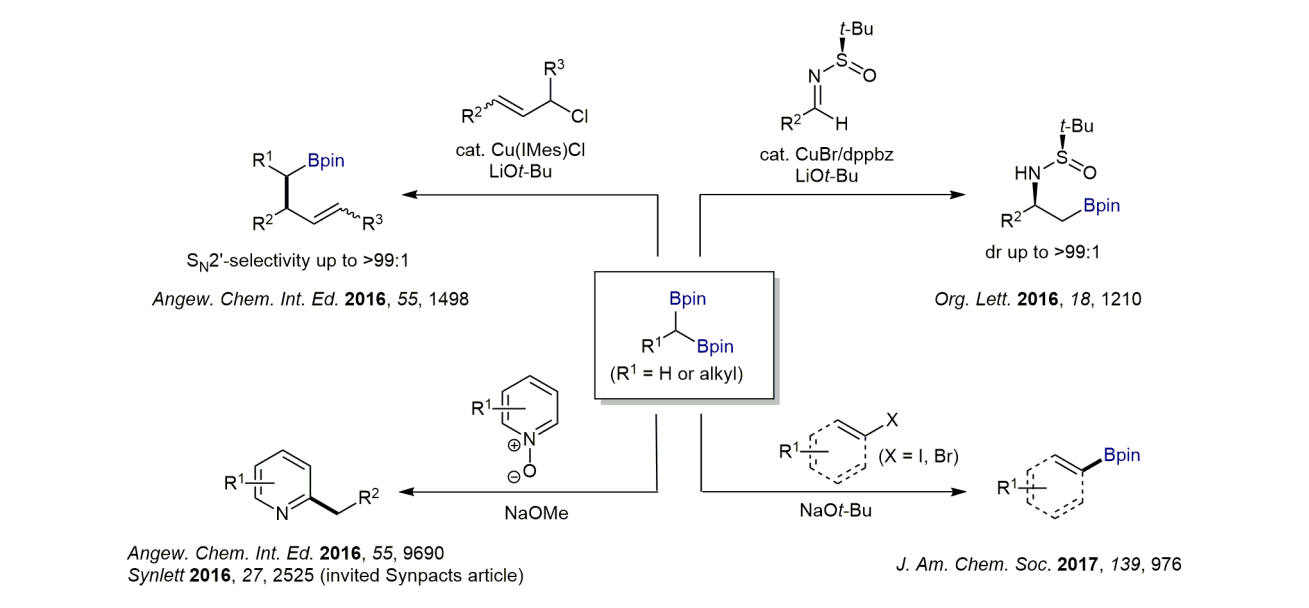
thesis in *J. Am. Chem. Soc.*[1] I felt great pleasure while performing and organizing experiments. After much consultation with Professor Chang, I decided to continue studying organic chemistry.

SYNFORM *What do you think about the modern role and prospects of organic synthesis?*

Dr. S. H. Cho Organic synthesis is a vast area in science because there are an infinite number of molecules that can be synthesized. I think this intriguing point drives chemists to devote themselves to creating new molecules and to understanding Nature in terms of reactivity and mechanism. These efforts ultimately lead to breakthroughs in related fields such as medicinal chemistry, chemical biology, and materials science. Over the past decades, impressive advances have been made in the area of synthetic methodology. There have been many breakthroughs in organic synthesis over the last few decades, but there are still many unsolved problems that are affecting the development of other research areas (materials, biomedicine, environment, etc). I believe it is our job to use our endless creativity to find new molecules and reactions and to increase our mechanistic understanding. These efforts will definitely expand the area of organic synthesis explosively and constantly, thus supporting the overall development of society.

SYNFORM *Your research group is active in the area of organic catalysis and new synthetic methodology. Could you tell us more about your research and its aims?*

Dr. S. H. Cho Since the start of my independent research in 2014, my group has been interested in two main topics using 1,1-diborylalkanes as coupling reagents (Scheme 1). Specifically, we developed the transition-metal-free alkylation of N-heteroaromatic N-oxides using 1,1-diborylalkanes as methylation or alkylation sources. In this reaction, we have shown that the α-boryl carbanion generated in situ from the reaction between a 1,1-diborylalkane and an alkoxide base can attack the electrophilic C2 position of an N-heteroaromatic N-oxide; subsequent elimination and re-aromatization delivers C2-alkylated N-heteroaromatic compounds. We also developed the transition-metal-free borylation of aryl and vinyl halides using 1,1-diborylalkanes as boron sources. While 1,1-diborylalkanes are typically used for the formation of C–C bonds, our example offered unique reactivity and selectivity. Moreover, we also developed the copper-catalyzed chemo- and stereoselective reaction of 1,1-diborylalkanes with suitable electrophiles. In particular, we developed copper-catalyzed allylic substitution and 1,2-addition reactions to form synthetically useful organoboron compounds. We are still continuing this research and aim to design new types of 1,1-diboron compounds that can be used in regio-, diastereo- and enantioselective organic transformations.[2–6]



Scheme 1

SYNFORM *What is your most important scientific achievement to date and why?*

Dr. S. H. Cho Personally, the copper-catalyzed three-component coupling reaction of a terminal alkyne, a sulfonyl azide and water, which provides unconventional amide synthesis, is one of the most meaningful papers in my career. As I mentioned above, I was able to continue studying organic chemistry because of this research experience. Since I have only spent three years in academia, it is hard to choose my most important scientific achievement. Of course, I hope that it still lies ahead of me. However, if I were to choose some contributions to the field during my independent career, I would pick the transition-metal-free methylation of N-heteroaromatic N-oxides. Because the introduction of a methyl group into N-heteroarenes is challenging and their separation from the starting material is quite difficult, our developed protocol offers a convenient method for the methylation of N-heteroarenes with a simple purification process.

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