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Total Synthesis of Bioactive Natural Products by Palladium-Catalyzed Domino Cyclization of Allenes and Related Compounds

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Total Synthesis of Bioactive Natural Products by Palladium-Catalyzed Domino Cyclization of Allenes and Related Compounds

Doctoral Thesis accepted by
Kyoto University, Japan

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Author
Dr. Shinsuke Inuki
Graduate School of Pharmaceutical Sciences
Kyoto University
46-29 Yoshida-shimo-adachi-cho
Sakyo-ku, Kyoto 606-8501
Japan
e-mail: shinsuke_inuki@fujifilm.co.jp

Supervisors
Prof. Hiroaki Ohno
Graduate School of Pharmaceutical Sciences
Kyoto University
46-29 Yoshida-shimo-adachi-cho
Sakyo-ku, Kyoto 606-8501
Japan

Prof. Yoshiji Takemoto
Graduate School of Pharmaceutical Sciences
Kyoto University
46-29 Yoshida-shimo-adachi-cho
Sakyo-ku, Kyoto 606-8501
Japan

Prof. Nobutaka Fujii
Graduate School of Pharmaceutical Sciences
Kyoto University
46-29 Yoshida-shimo-adachi-cho
Sakyo-ku, Kyoto 606-8501
Japan

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Shinsuke Inuki, Yuji Yoshimitsu, Shinya Oishi, Nobutaka Fujii, Hiroaki Ohno, "Ring-construction/stereoselective functionalization cascade: total synthesis of pachastrissamine (jaspine B) through palladium-catalyzed bis-cyclization of bromoallenes", Organic Letters, 11 (19), 4478-4481 (2009)

Shinsuke Inuki, Yuji Yoshimitsu, Shinya Oishi, Nobutaka Fujii, Hiroaki Ohno, "Ring-construction/stereoselective functionalization cascade: total synthesis of pachastrissamine (jaspine B) through palladium-catalyzed bis-cyclization of propargyl chlorides and carbonates", The Journal of Organic Chemistry, 75 (11), 3831-3842 (2010)

Shinsuke Inuki, Shinya Oishi, Nobutaka Fujii and Hiroaki Ohno, "Total synthesis of (±)-lysergic acid, lysergol, and isolysergol by palladium-catalyzed domino cyclization of amino allenes bearing a bromoindolyl group", Organic Letters, 13 (8), 2145 (2011)

Shinsuke Inuki, Akira Iwata, Shinya Oishi, Nobutaka Fujii, and Hiroaki Ohno, "Enantioselective total synthesis of (+)-lysergic acid, (+)-lysergol, and (+)-isolysergol by palladium-catalyzed domino cyclization of allenes bearing amino and bromoindolyl groups", The Journal of Organic Chemistry, 76 (7), 2072–2083 (2011)

Supervisor's Foreword

It is a pleasure to introduce Dr. Shinsuke Inuki's thesis work on application to the Springer Thesis Prize, as an outstanding original work in the world's top university. Dr. Inuki joined Prof. Fujii's group, Kyoto University, as an undergraduate student from April of 2005. In April 2006, he entered the Graduate School of Pharmaceutical Sciences, Kyoto University, and started his doctoral study with me at the same laboratory.

In recent years, catalytic cascade reactions have been recognized as an efficient approach to target molecules, by minimizing the number of steps and separation processes as well as the amount of time, labor, and waste involved. Dr. Inuki successfully applied the palladium-catalyzed domino cyclization of bromoallenes as allyl dication equivalents to cascade cyclization–stereoselective functionalization for asymmetric total synthesis of pachastrissamine (jaspine B), an anhydrophytosphingosine exhibiting antitumor activities. A short-step total synthesis of this natural product has been achieved by use of domino cyclization of propargyl carbonates. The thesis also describes his elegant synthetic work on total synthesis of ergot alkaloids based on palladium-catalyzed domino cyclization of amino allenes bearing a bromoindolyl group. The tetracyclic indole, the common synthetic intermediate for his ergot alkaloid synthesis, was directly constructed from the allenic substrates in a stereoselective manner. Using the key intermediate obtained, he achieved asymmetric total synthesis of lysergic acid, lysergol, and isolysergol.

It is noteworthy that all of these works were based on his very original ideas. The four outstanding papers, prepared by himself as the first author, have been published in the top journals in organic synthesis (*Organic Letters and the Journal of Organic Chemistry*). His total synthesis of lysergic acid was highlightened in *Synfact* (2009, 476) and *Organic Chemistry Portal* (2009, May 11).

His thesis study has shown that palladium-catalyzed domino cyclizations are useful for stereoselective construction of the core structures of natural products. These results would contribute to the synthetic and SAR studies of sphingolipids and indole alkaloids. I hope his outstanding thesis will contribute to synthetic research of many readers.

Kyoto, 10 June 2011 Hiroaki Ohno

On behalf of Yoshiji Takemoto
and Nobutaka Fujii

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