

Functional and Structural analysis of the Terpene Synthase Found from the Genome of Giant Virus

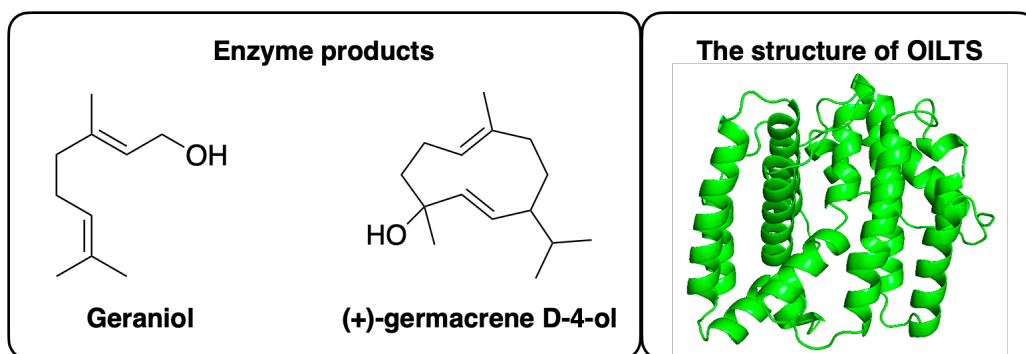
(¹Graduate School of Engineering, The University of Tokyo, ²Institute of Molecular Science, ³High Energy Accelerator Research Organization) ○Youngcheol Jung, ¹Takaaki Mitsuhashi, ²Miki Senda, ³Sota Sato, ¹Toshiya Senda, ³Makoto Fujita^{1,2}

Keywords: Giant Virus; Natural Product; Terpenoid; Protein X-ray Crystallography; Crystalline Sponge Method

A giant virus first reported in 2003¹⁾ is an unusual virus having unique characteristics such as large particle and genome. Thus far, many researchers investigate the genome of a giant virus, genes related to protein translation, immune system and primary metabolism have been reported. However, the research on genes specially related to secondary metabolites has not been investigated yet. In this study, we noticed an existence of a gene encoding a terpene synthase designated as OILTS in a genome data of a giant virus, Orpheovirus IHUMI-LCC2,²⁾ and analyzed its function and structure, using the crystalline sponge method and protein X-ray crystallography, respectively.

As a result, we revealed that OILTS was class I terpene synthase converting farnesyl diphosphate and geranyl diphosphate into (+)-germacrene D-4-ol and geraniol, respectively. Moreover, the X-ray structure of OILTS obtained in this study is the first X-ray structure of the viral terpene synthase.

This work showed that the natural product biosynthetic enzyme OILTS in the giant virus really works and produce the natural products. We thus speculate that giant viruses produce natural products in nature. Even though an actual role of natural products from giant viruses is still unclear, we believe that further analysis of natural products from giant viruses would deepen the understanding of the ecology of giant viruses.



1) B. L. Scola, S. Audic, C. Robert, L. Jungang, X. D. Lamballerie, M. Drancourt, R. Birtles, J. -M. Claverie, D. Raolt, *Science* **2003**, 299, 2033. 2) J. Andreani, J. Y. B. Khalil, E. Bastiste, I. Hasni, C. Michelle, D. Raoult, A. Levasseur, B. La Scola, *Front. Microbiol.* **2018**, 8, 2643.