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GIST-Caltech international joint research team develops cooperative functional catalyst for innovative organic synthesis

□ GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) Department of Chemistry Professor Sukwon Hong and Professor Brian M. Stoltz of Caltech developed a cooperative catalyst for innovative organic synthesis.

- This research achievement has made it possible to synthesize substances that could not be synthesized with existing catalysts by using the newly developed chirality * ligand **. This is significant because the choice of ligands that can be used for catalytic reactions has been expanded, thereby broadening the horizon for future catalytic reaction development.

* chirality: also called 'hand asymmetry', refers to the property of organic molecules that have the same type of element but do not overlap with each other in any direction, i.e. the property of having a mirror image and a structure that does not overlap

** ligand: an organism with an electron pair that can be combined with a metal

- For this research achievement, the core of the catalytic reaction is the newly developed ligand structure and the synthesis of a chiral ligand having a completely new three-dimensional structure by introducing a rarely used unit chain from the existing nitrogen-based chiral ligand and is used as a synthetic raw material for dihydroisoquinoline (a substance used as a synthetic raw material for medicine, dyes, etc.).

- The newly developed ligand is one of the most active chromones in the natural world that combine with the palladium metal * to produce catalysts, showing excellent catalytic activity (rate 98%) and stereotactic selectivity (99% ee) against the various medicinal and natural products based on it.

* palladium metal: one of the platinum group metal elements

- Composed tetracyclic * chromanon** material is a new substance that has never been reported to the academic world, and in cooperation with Professor Lee Jun-seung of the chemistry department at Chonnam National University, the absolute structure of the material was analyzed through X-ray structure analysis to reveal the exact three-dimensional structure.
- Synthesized chiral tetracyclic * chromanone ** material is a new substance that has not been reported to the academic community. In cooperation with Professor Junseong Lee's team at the Department of Chemistry at Chonnam National University, the absolute structure of a substance was analyzed through an X-ray structure analysis to reveal the exact three-dimensional structure.

* tetracyclic: state in which all four functional carbon groups have been replaced

** chromanone: a type of flavonoid known to have a variety of biological activities

- Professor Sukwon Hong and Professor Brian M. Stoltz said, "This research achievement has the greatest significance in that it has developed a new ligand and made it possible to synthesize substances that could not be synthesized using existing ligands and metal catalysts. It is expected that the developed catalytic reaction can be applied to the synthesis of natural products or new drug candidates in the future."
- This study was carried out with the support of a GIST-Caltech Research Collaboration grant and National Research Foundation of Korea and was published on April 7, 2020, in *Chemical Science*, a world-renowned academic journal in the field of chemistry. It was also included in the "2020 Chemical Science HOT Article Collection" list, where major papers in the journal are collected in recognition of the importance of the research, and was selected as the journal cover paper on May 13.
- Since 2012, the GIST-Caltech joint research project is a program in which professors of GIST and Caltech form a research group to conduct innovative and creative joint research. The team led by GIST Professor Sukwon Hong and Caltech Professor Brian Stoltz announced the results of the joint research

project on the development of a cooperative functional catalyst for innovative organic synthesis.

