



Title of Project : Advanced Molecular Transformations by  
Organocatalysts

Masahiro Terada

(Tohoku University, Graduate School of Science, Professor)

**【Purpose of the Research Project】**

Synthetic organic chemistry, which is a fundamental and important research field, has been significantly contributing to the foundation of advanced manufacturing in various fields. Although synthetic methods for numerous useful substances have been realized, it is important for the future of Japan, a country with limited natural resources, not to be satisfied with the current level of science and technology. Japan must develop cutting-edge manufacturing science and technology in accordance with the most critical challenges in the 21<sup>st</sup> century: to avoid using rare and depleted resources, to create a sustainable recycling-oriented society. To these ends, we have organized research groups that focus on a common theme, organocatalysis. We strive to develop methodologies with a superior total efficiency to synthesize useful substances by sharing and integrating valuable intellectual foundations. We intend to create the future vision of manufacturing based on innovative scientific and technological approaches.

**【Content of the Research Project】**

To advance the science of sustainable manufacturing and to develop effective and innovative catalytic systems, we promote three research topics as shown in Figure 1.

**A01 Group: Design of Controlling Systems in Organocatalysis:** To realize the guiding principles in catalyst design, the development of organocatalysis is a major research topic, including development of new functions, elucidation of catalytic phenomena, and scientifically understanding the mechanisms.

**A02 Group: Development of Molecular Transformations by Organocatalysts:** To achieve intelligent construction of catalytic systems, various molecular transformations are pursued by developing new reactions using organocatalysts and molecular transformations via innovative methodologies.

**A03 Group: Practical Synthesis of Useful Substances Using Organocatalysts:** By applying organocatalysts to develop practical synthetic methods for useful substances, biologically active compounds and functional materials, will be synthesized utilizing organocatalysts and the catalytic systems.



Figure 1 Three research topics and purpose

**【Expected Research Achievements and Scientific Significance】**

Through conducting intensive research in this area, it is anticipated that development of organocatalysts with superior characteristics, including enhanced catalytic activities, handling ease, and stereochemical controllability. Moreover, to elucidate the underlying mechanisms of substrate/catalyst interactions, it can be also expected cultivation of molecular transformation systems that cannot be achieved by metal catalysts and novel molecular transformations based on new methodologies. Development of practical synthetic processes based on truly advanced molecular transformations using organocatalysis leads to not only establishing a new academic research field, advanced molecular transformations by organocatalysts, but also significantly contributing to the science of manufacturing.

**【Key Words】**

Organocatalysts: It is a small organic molecule that has the catalytic function and has come to steal the limelight suddenly on the boundary of 2000 as a clean reactive catalyst of the next generation by academia and industry because of excluding metallic element.

**【Term of Project】** FY2011-2015

**【Budget Allocation】** 1,180,200 Thousand Yen

**【Homepage Address and Other Contact Information】**

<http://www.organocatalysis.jp/>  
mterada@m.tohoku.ac.jp