

## Research

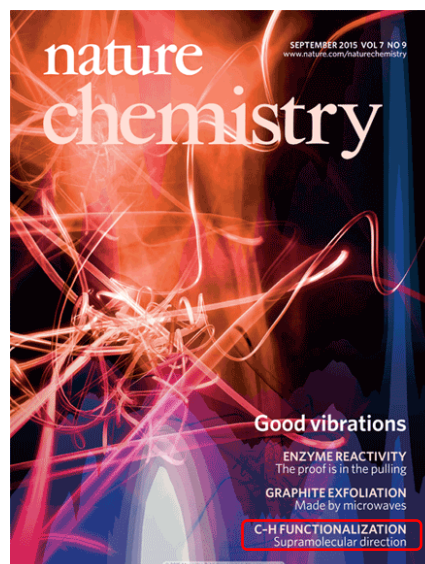
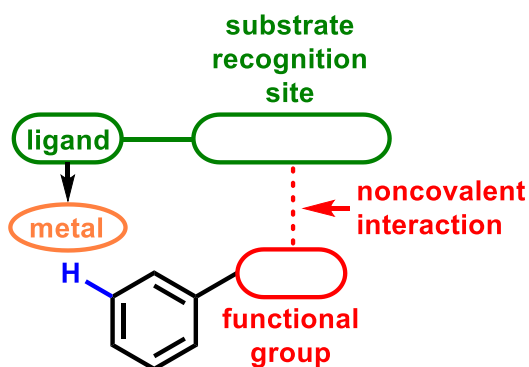
We are trying to resolve energy and environmental problems through creation of high-functioning catalysts, development of practical synthetic organic reactions, and creation of high-performance organic functional materials.

We mainly investigate the following three projects:

1. Creation of High-performance Catalysts
2. Development of Novel Synthetic Organic Reactions
3. Creation of Novel  $\pi$ -Conjugated Molecules with Non-covalent Bonding

### 1. Creation of High-performance Catalysts – Control of Regioselectivity -

Control of regioselectivity is very important for synthetic organic reactions including C-H bond transformations. We are creating new methods to control regioselectivity using noncovalent interactions, such as hydrogen bonding and Lewis acid-base interaction. For example, we succeeded in *meta*-selective C-H transformation using a catalyst with a substrate recognition site, which can recognize a functional group of substrates by hydrogen bonding.



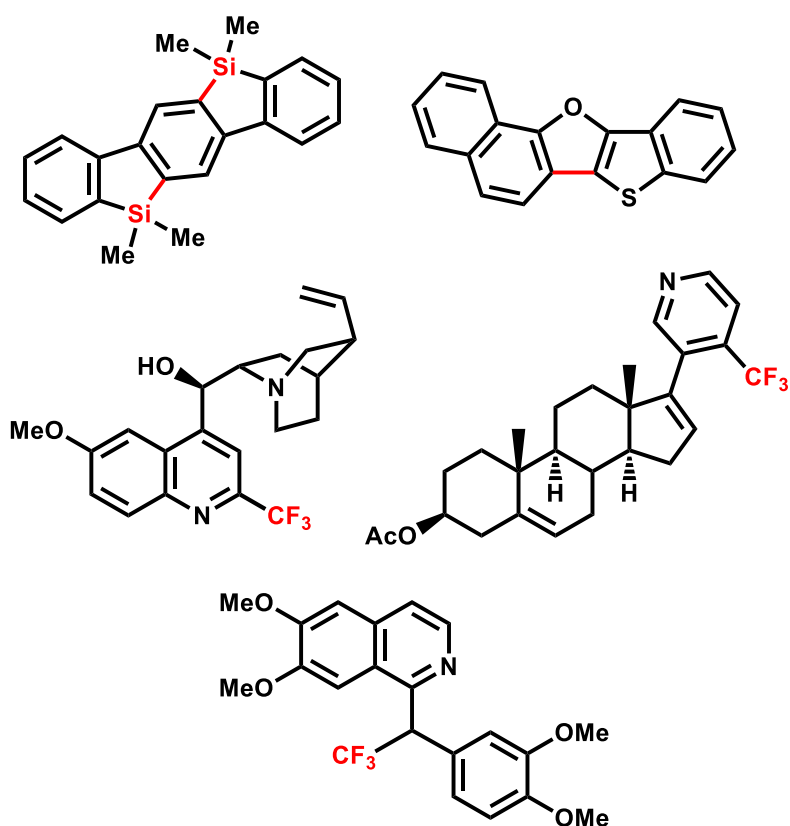
### Reported Papers:

1. *Nature Chem.* **2015**, 7, 712 (DOI: 10.1038/nchem.2322).
2. *Angew. Chem. Int. Ed.* **2017**, 56, 1495 (DOI: 10.1002/anie.201610041).

## 2. Development of Novel Synthetic Organic Reactions – With a Focus on C-H Bond Transformations -

We develop novel synthetic organic reactions with a focus on C-H bond transformations. We focus on the development of both scholastically important and synthetically useful reactions, such as C-H transformations without using directing groups.

For example, C-H/C-H coupling reactions and regioselective introduction reactions of a trifluoromethyl group, which is important in drugs, agrochemicals, and organic functional materials, are developed.



### Reported Papers:

#### Construction of New Bonds via C-H Bond Activation

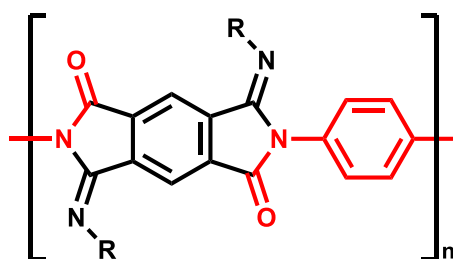
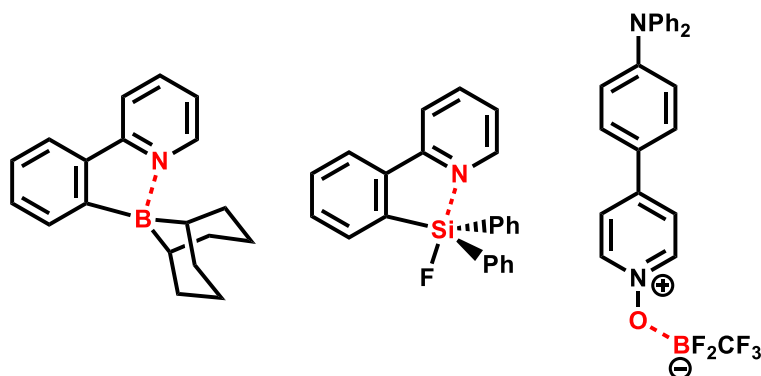
1. *J. Am. Chem. Soc.* **2010**, *132*, 14324 (DOI: 10.1021/ja107698p).
2. *Chem. Eur. J.* **2015**, *21*, 8365 (DOI: 10.1002/chem.201501116).

#### Trifluoromethylation

1. *Nature Commun.* **2014**, *5*, 3387 (DOI: 10.1038/ncomms4387).
2. *Angew. Chem. Int. Ed.* **2015**, *54*, 10263 (DOI: 10.1002/anie.201505335).
3. *J. Am. Chem. Soc.* **2016**, *138*, 6103 (DOI: 10.1021/jacs.6b01753).

### 3. Creation of Novel $\pi$ -Conjugated Molecules with Non-covalent Bonding – Towards the Creation of High-performance Organic Functional Materials -

We synthesize novel  $\pi$ -conjugated molecules with a non-covalent bonding, such as Lewis acid-base interaction. We believe that such  $\pi$ -conjugated molecules must have special properties, which are not expressed in  $\pi$ -conjugated molecules consist of only covalent bonds.



#### Reported Papers:

1. *Angew. Chem. Int. Ed.* **2013**, 52, 4431 (DOI: 10.1002/anie.201210328).
2. *Angew. Chem. Int. Ed.* **2013**, 52, 11879 (DOI: 10.1002/anie.201306360).
3. *Angew. Chem. Int. Ed.* **2014**, 53, 3168 (DOI: 10.1002/anie.201310293).
4. *Org. Lett.* **2015**, 17, 1758 (DOI: 10.1021/acs.orglett.5b00529).
5. *Chem. Asian J.* **2014**, 9, 1026 (DOI: 10.1002/asia.201301688).

#### Account

Development of Novel C-H Bond Transformations Directed Towards Organic Functional Molecules. *J. Synth. Org. Chem. Jpn.* **2016**, 74, 1058-1068.