Direct Homo-coupling Reaction of Alcohols Catalyzed by Iron/L-Ascorbic Acid

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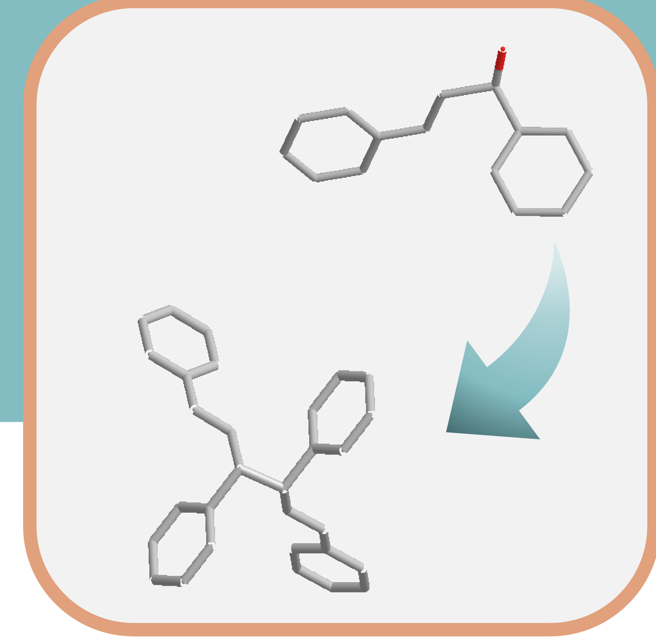
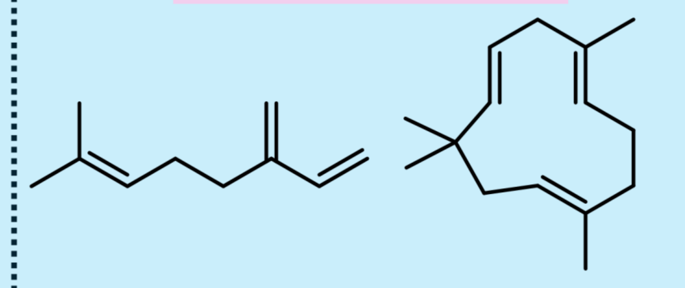
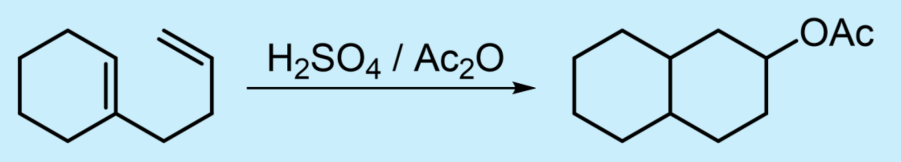


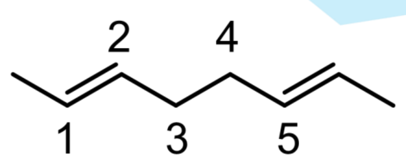
Introduction

Natural product

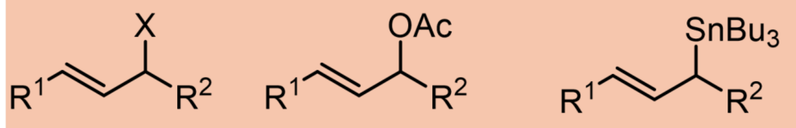


Key intermediate for organic transformation



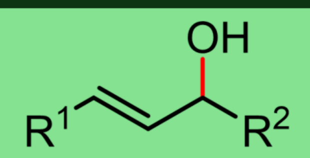


Traditionally



need to prepare in advance
large amount of waste

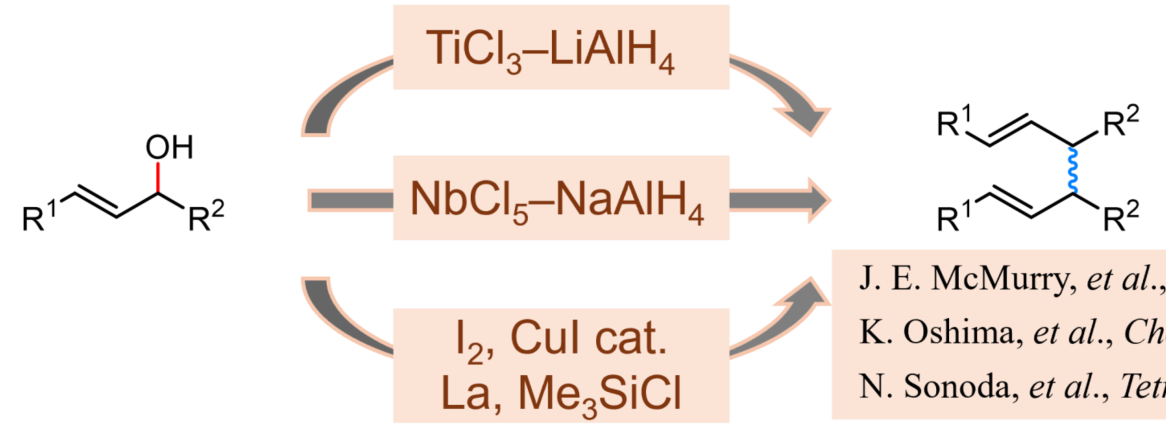
If allyl alcohols can be used,,,



Allyl alcohols

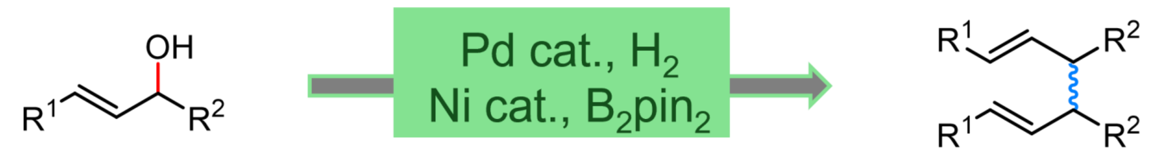
It enables more atom-economically reactions.

More than stoichiometric amount of metal reagent



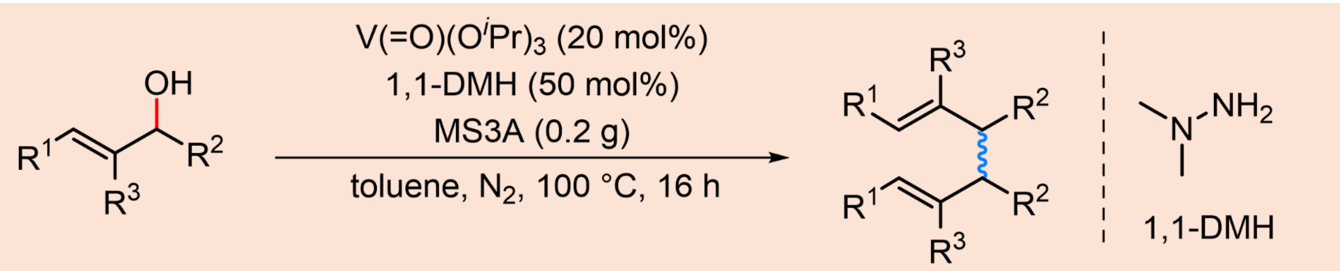
J. E. McMurry, *et al.*, *J. Org. Chem.* **1975**, *40*, 2687.
K. Oshima, *et al.*, *Chem. Lett.* **1982**, 157.
N. Sonoda, *et al.*, *Tetrahedron Lett.* **2002**, *43*, 3689.

Catalytic homo-coupling reactions of alcohols



Y. Liu, *et al.*, *Org. Lett.* **2020**, *22*, 4418.
H. Huang, *et al.*, *Org. Lett.* **2021**, *23*, 365.

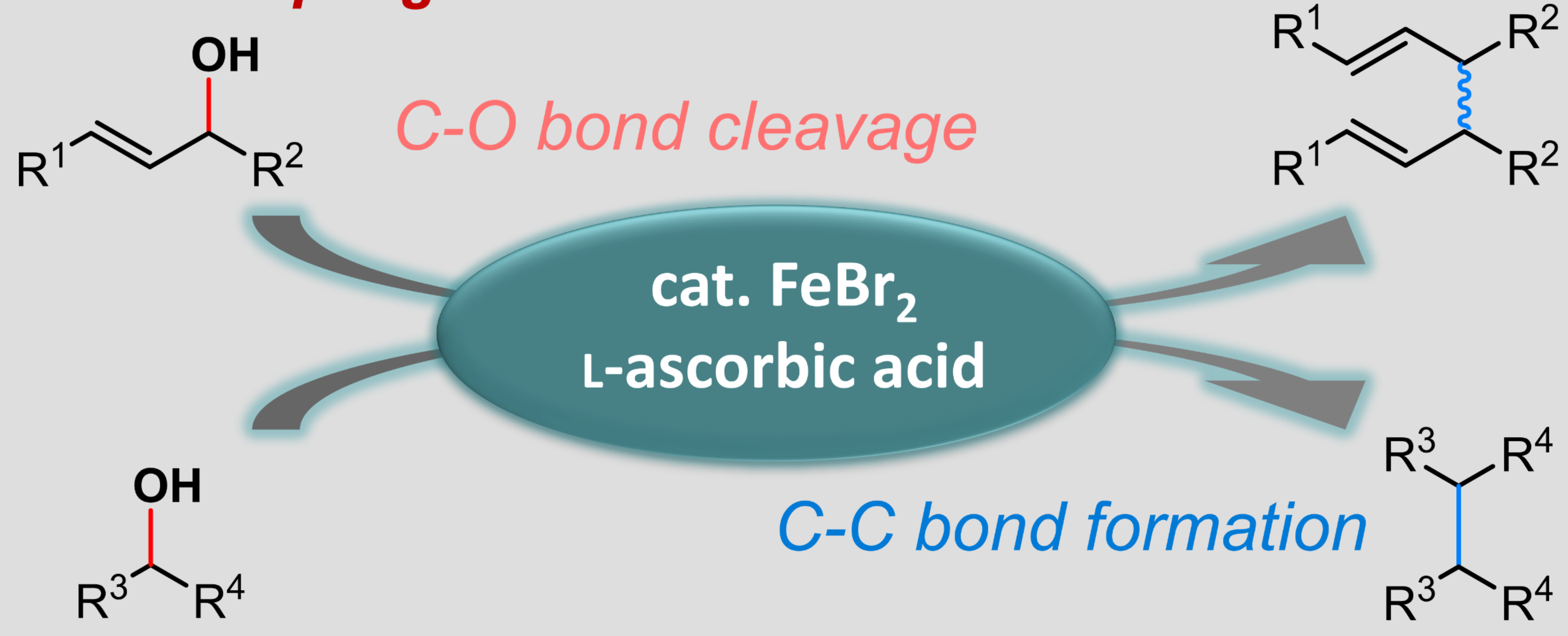
Oxovanadium(V)-catalyzed homo-coupling reaction of alcohols



・Catalytic gram-scale reaction smoothly proceeded to obtain the corresponding homo-coupling product in good yield.

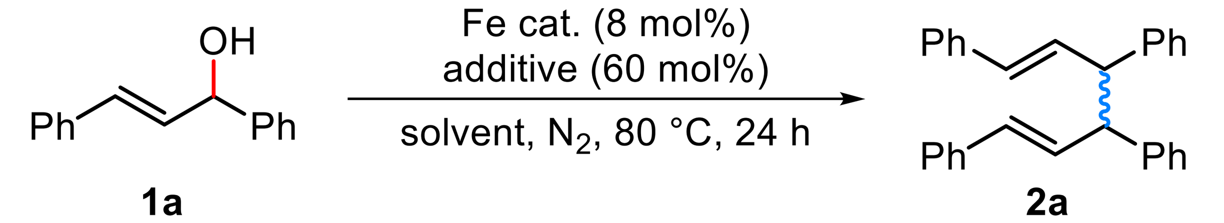
T. Sakuramoto, Y. Donaka, M. Tobisu, T. Moriuchi, *New J. Chem.* **2019**, *43*, 17571.

This Work : Iron-catalyzed dehydroxylative homocoupling reaction of alcohols



✓ Direct transformation of alcohols ✓ Gram-scale
✓ Commercially available catalyst and additive

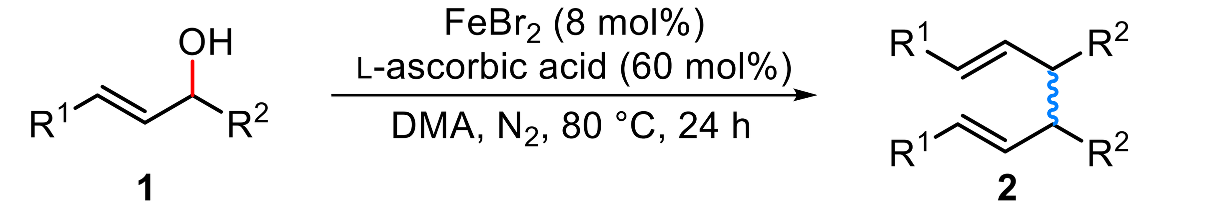
Results and Discussion



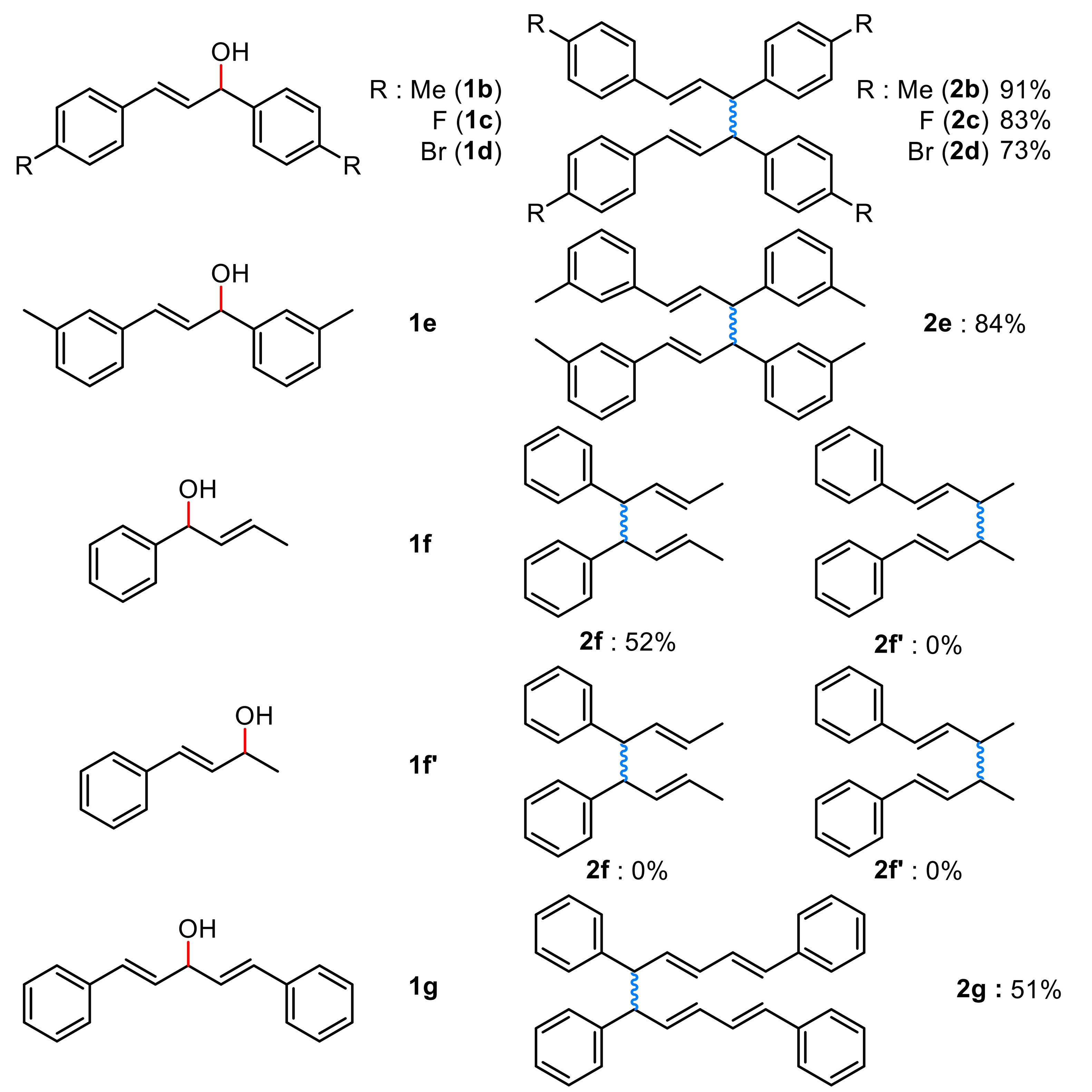
entry	Fe cat.	additive	solvent	NMR yield (%)[a]
1	$FeCl_2$	L-ascorbic acid	1,4-dioxane	82
2	$FeBr_2$	L-ascorbic acid	1,4-dioxane	84
3	$Fe(OAc)_2$	L-ascorbic acid	1,4-dioxane	0
4	$Fe(acac)_2$	L-ascorbic acid	1,4-dioxane	0
5	$FeBr_3$	L-ascorbic acid	1,4-dioxane	17
6	$FeBr_2$	catechol	1,4-dioxane	0
7	$FeBr_2$	hydroquinone	1,4-dioxane	15
8	$FeBr_2$	*o*-phenylenediamine	1,4-dioxane	0
9	$FeBr_2$	1,2-diphenylhydrazine	1,4-dioxane	8
10	$FeBr_2$	1,1-dimethylhydrazine	1,4-dioxane	0
11	**$FeBr_2$**	**L-ascorbic acid**	**DMA**	**93 (90)[b]**
12	$FeBr_2$	L-ascorbic acid	DMSO	89
13	$FeBr_2$	L-ascorbic acid	*t*-amyl alcohol	77
14	$FeBr_2$	L-ascorbic acid	CH_3CN	57
15	$FeBr_2$	L-ascorbic acid	xylene	9
16	$FeBr_2$	L-ascorbic acid	CPME	23
17	$FeBr_2$	—	DMA	0
18	-	L-ascorbic acid	DMA	0

Reaction conditions; 1,3-diphenylprop-2-en-1-ol **1a** (0.25 mmol), Fe cat. (8 mol%), and additive (60 mol%) in solvent (1 mL) for 24 h at 80 °C under N_2
[a] NMR yield was determined by using triphenylmethane as an internal standard.
[b] Isolated yield.

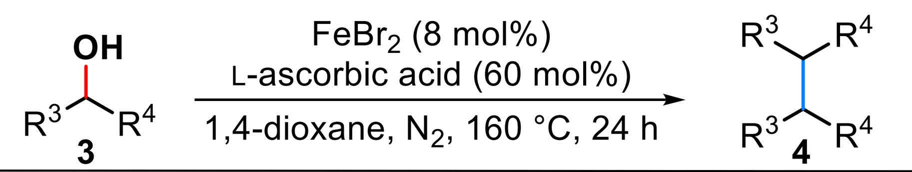
Substrate scope of allyl alcohols



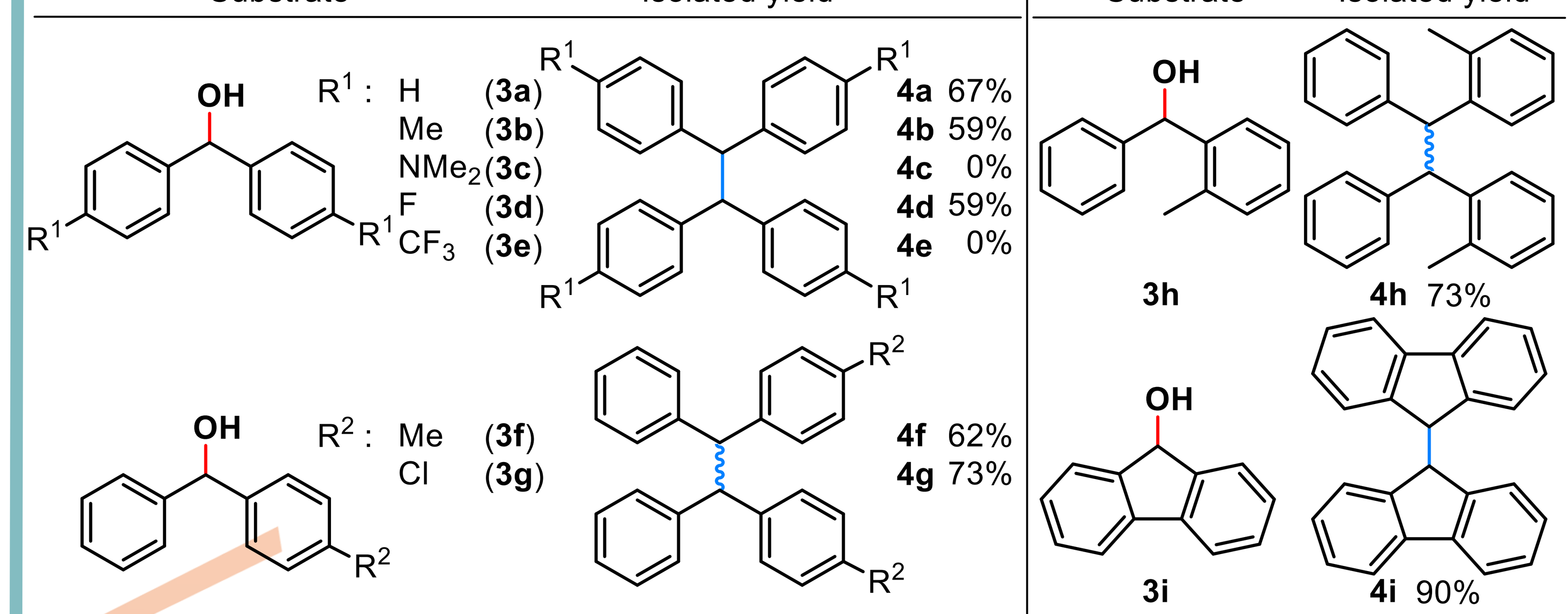
Substrate	Isolated yield



Substrate scope of benzyl alcohols



Substrate	Isolated yield	Substrate	Isolated yield



You can see this work from *New J. Chem.*

Kento Okabayashi, Masumi Itazaki, Toshiyuki Moriuchi, *New J. Chem.* **2025**, in press. (DOI: 10.1039/d5nj03299g)