C–C activation achieved by metal-mediated reduction of organic peroxides

Contents come from:

Trends Chem. **2023**, *5*, 174−200.

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Nature https:// doi.org/10.1038/s41586-026-10508-5 (2026)

Xiao Liu

2026/04/30

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- 1991, Seoul National University, B.S.
- 1993, Seoul National University, M.S.
- 1998, Columbia University, Ph.D., advisor: S. J. Danishefsky
- 1998-2001, Harvard University, Postdoctoral Fellow, advisor: S. L. Schreiber
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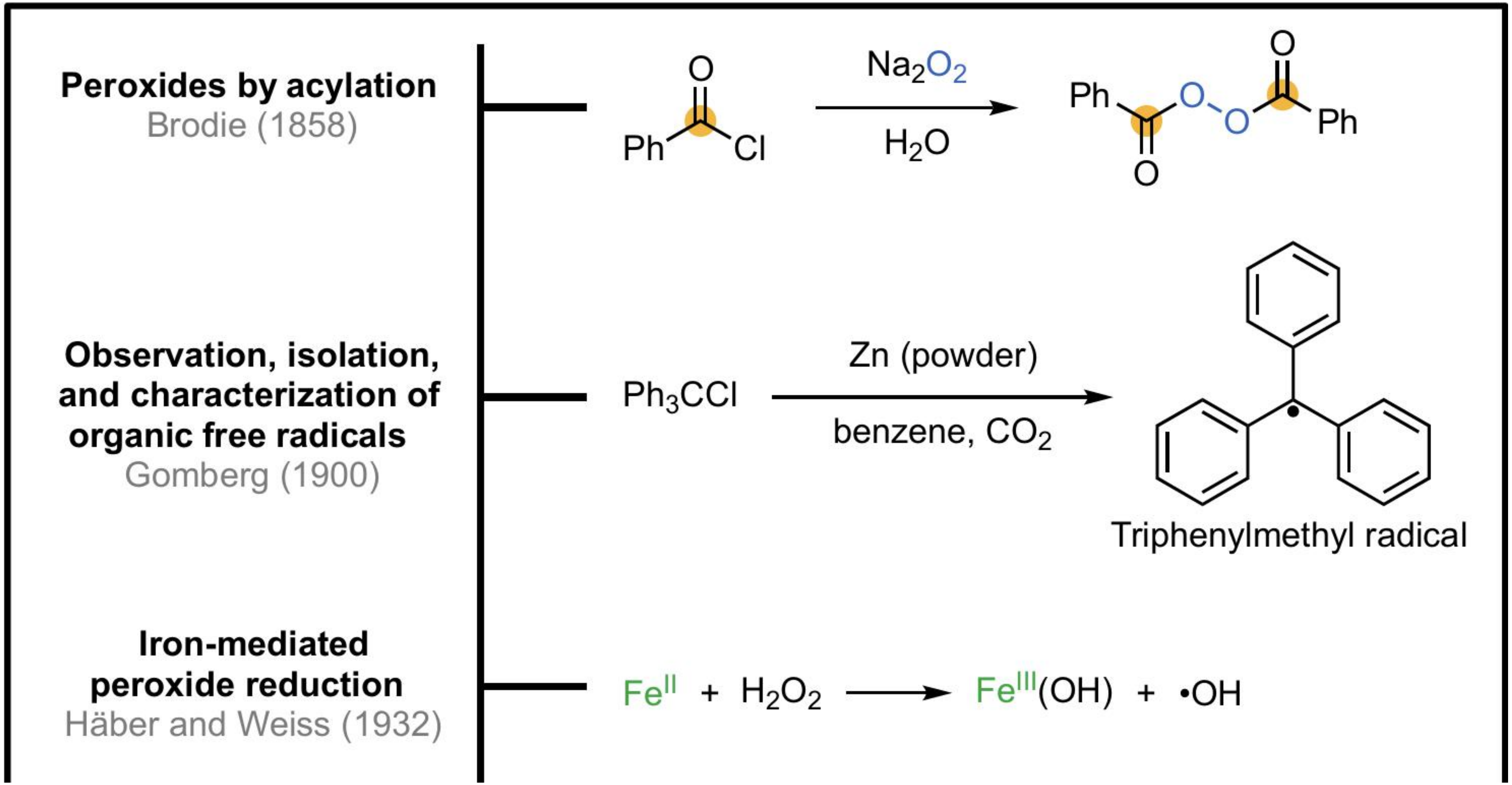
The information is cited from Prof. Kwon's group page:
https://kwonlab.chem.ucla.edu/

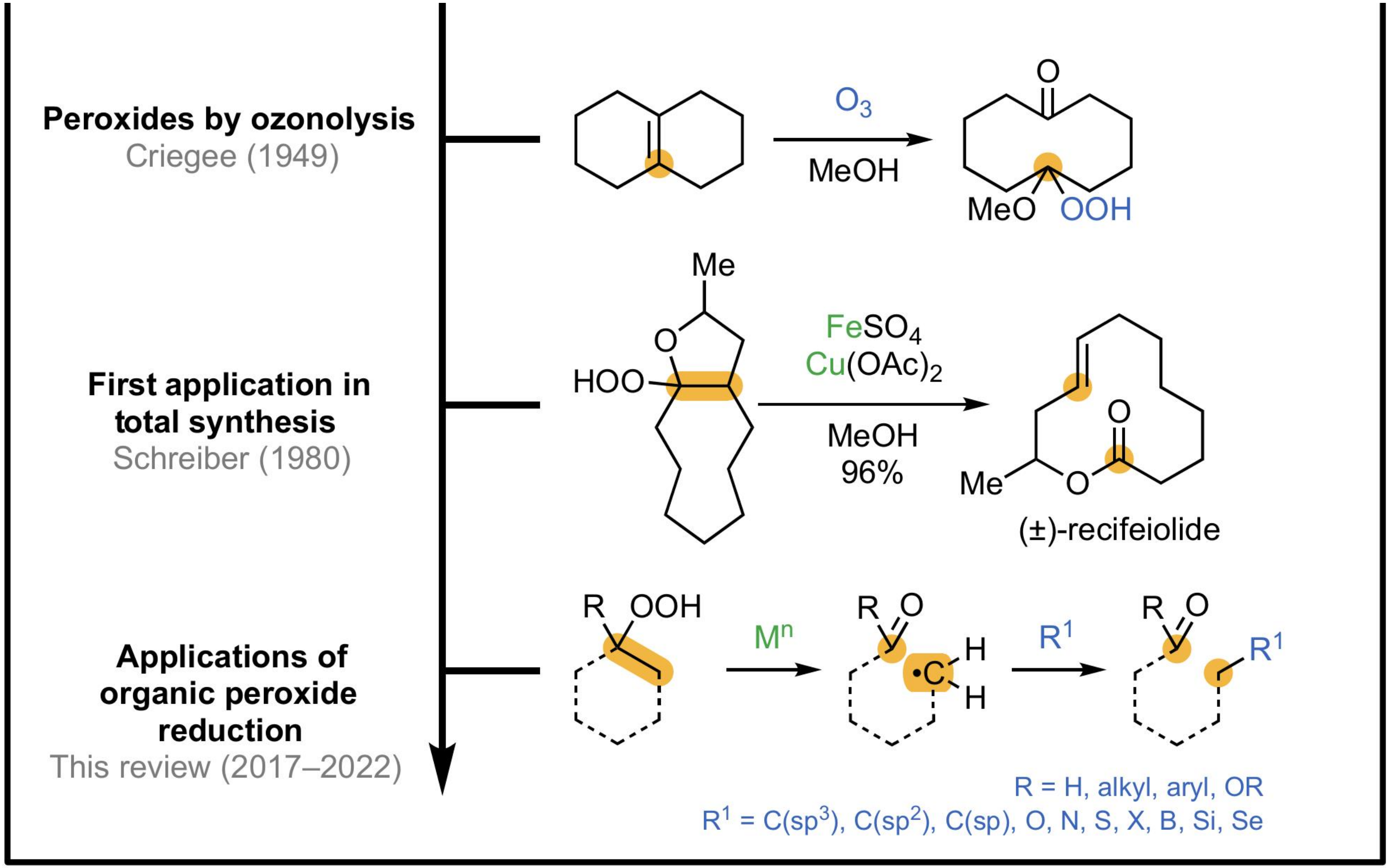
Content

Historical background

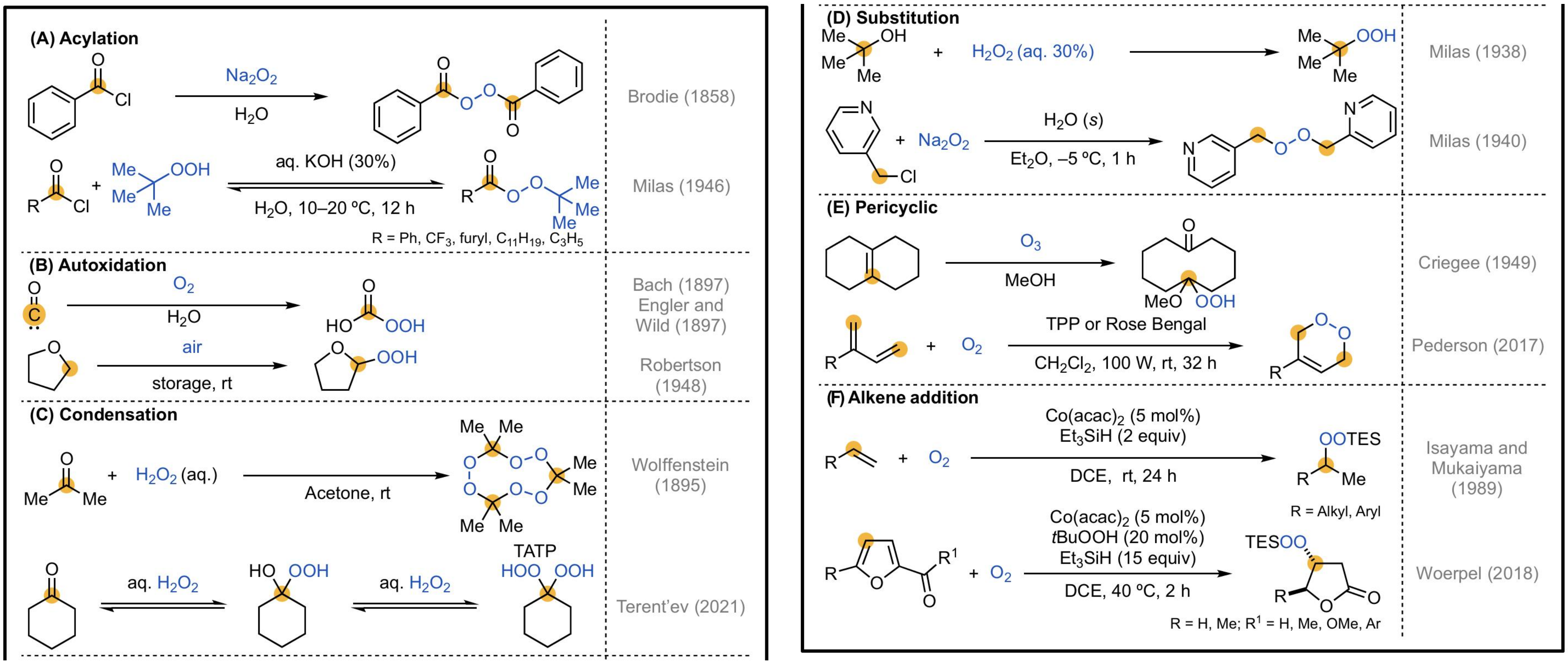


Trends Chem. **2023**, *5*, 174–200.

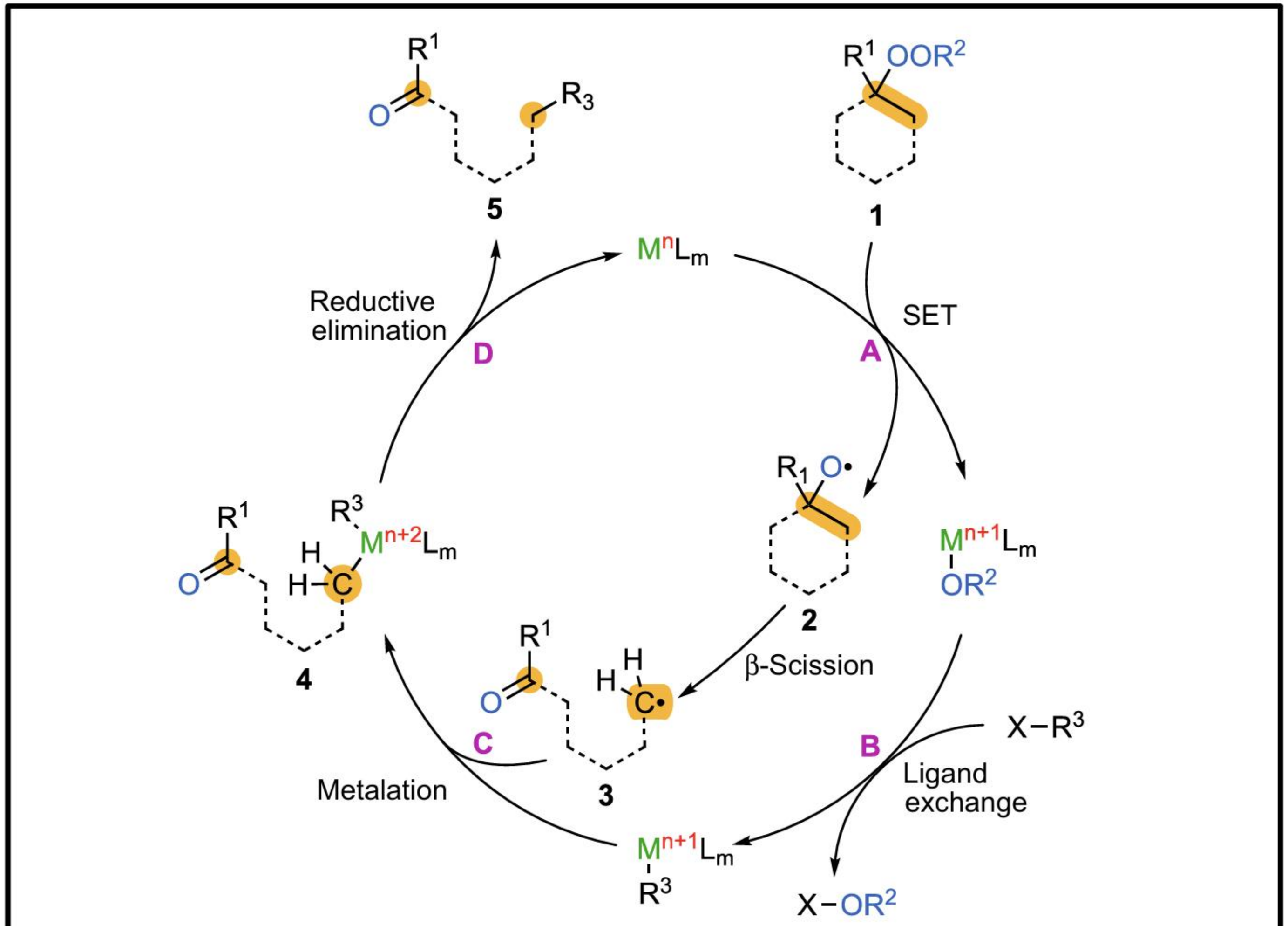
Historical background



Synthesis of organic peroxides



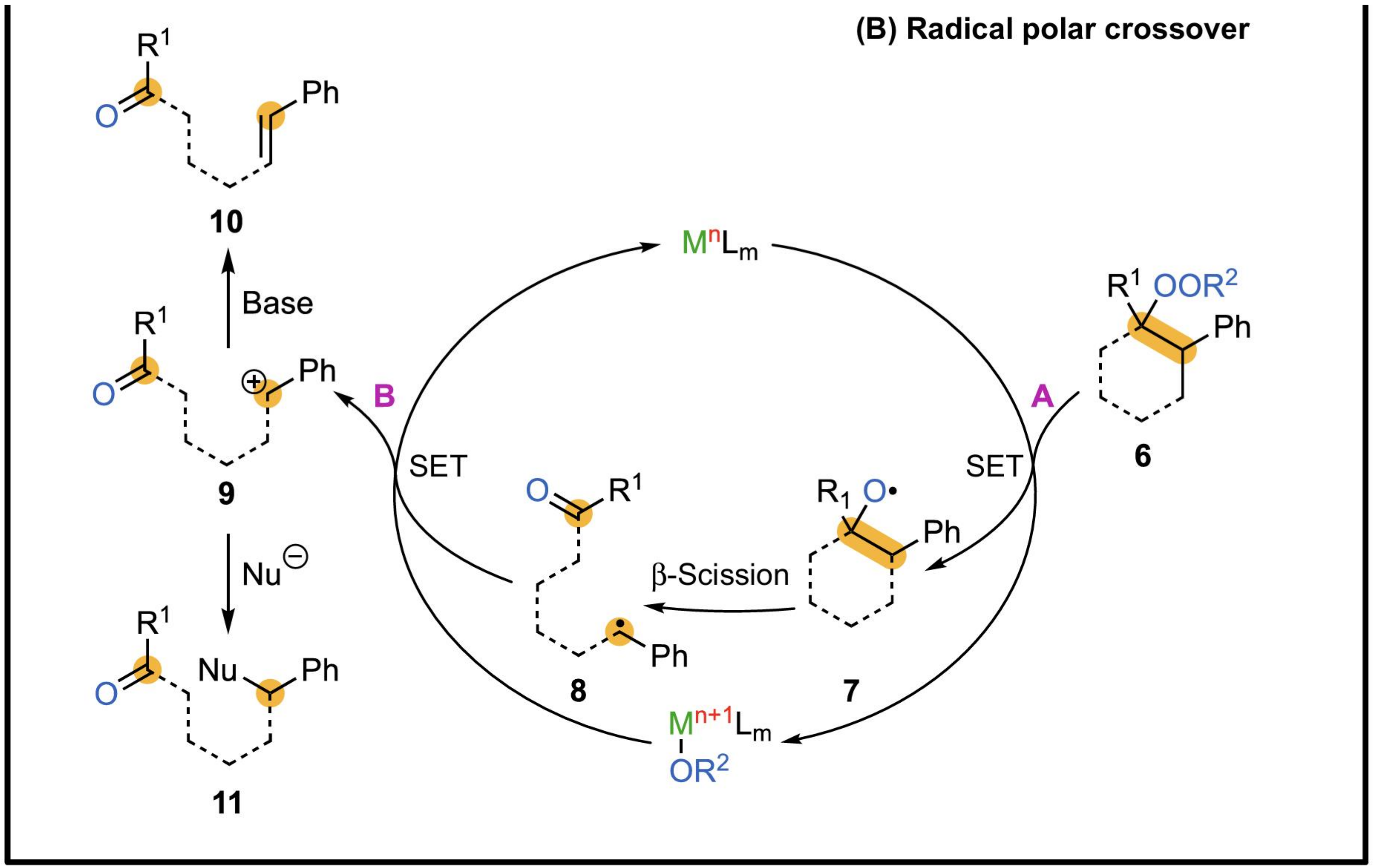
Mechanism



(A) General mechanism

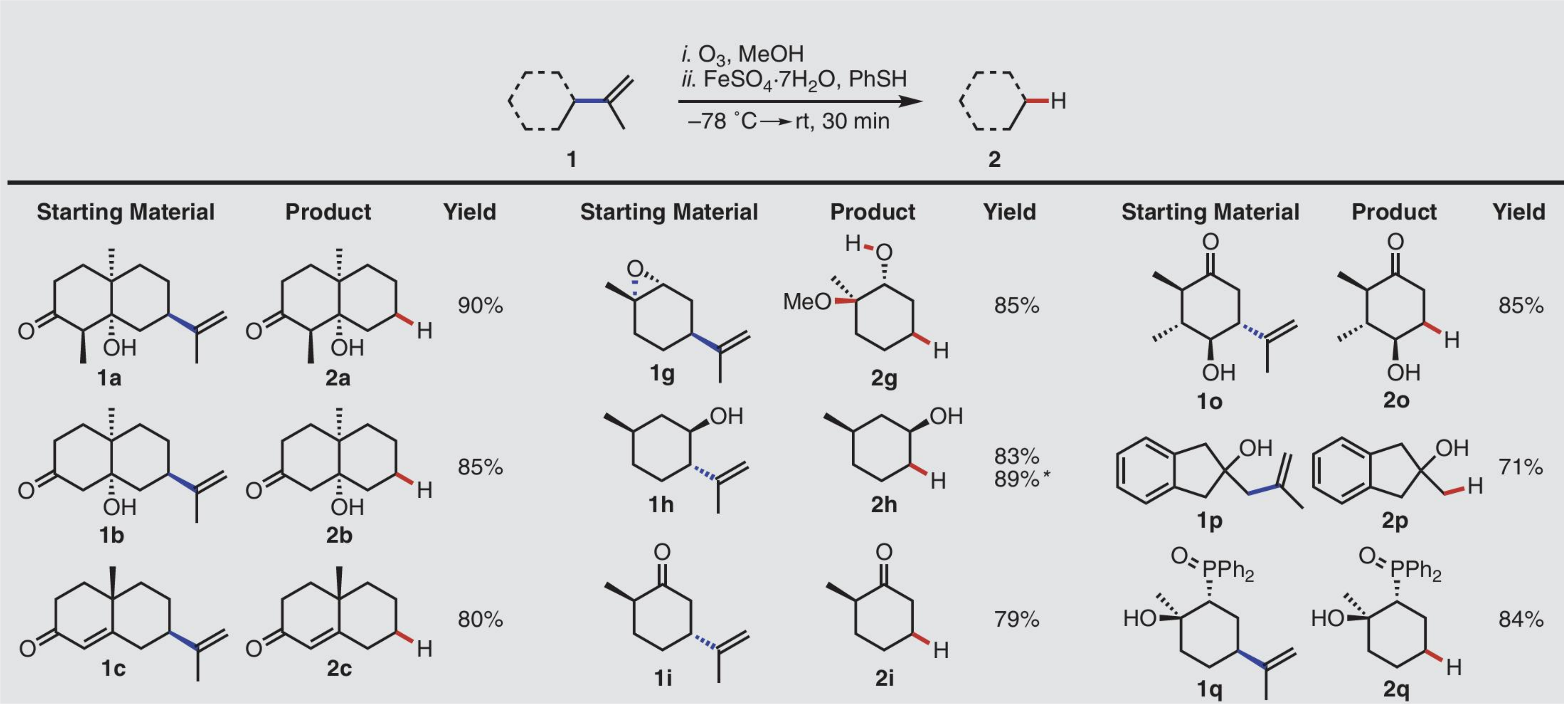
Trends Chem. **2023**, *5*, 174–200.

Mechanism



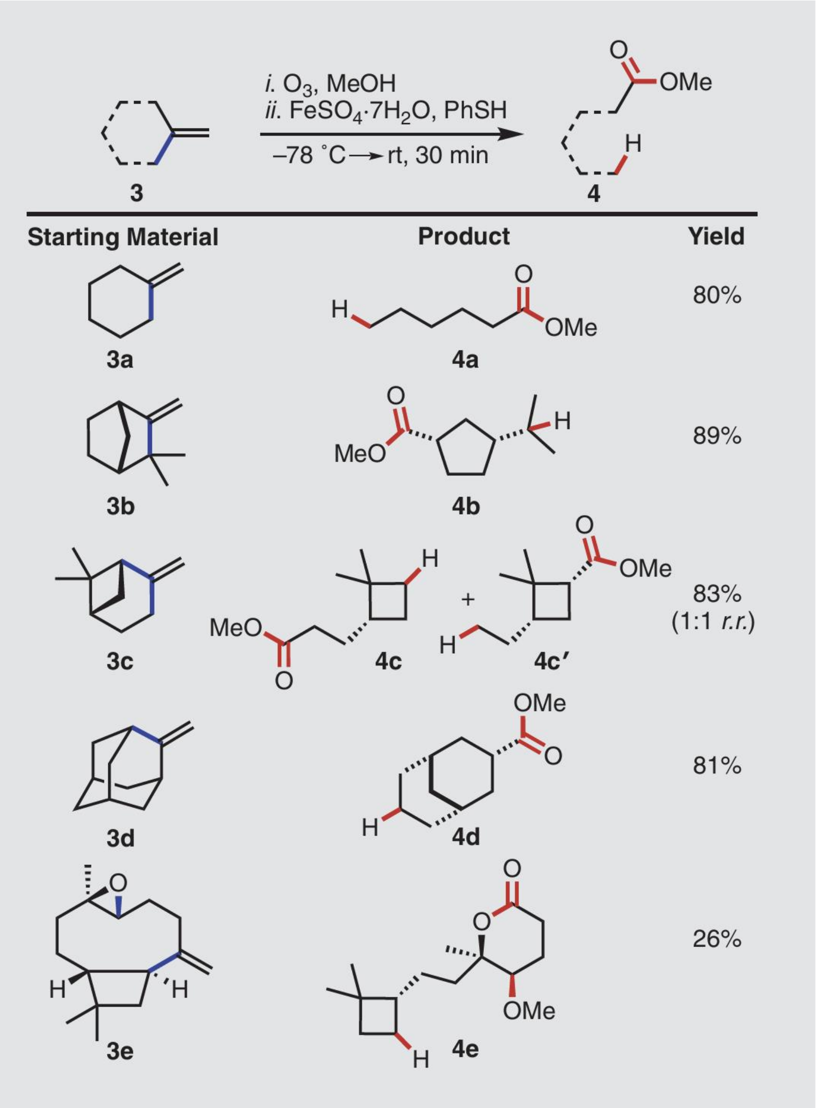
Trends Chem. **2023**, *5*, 174–200.

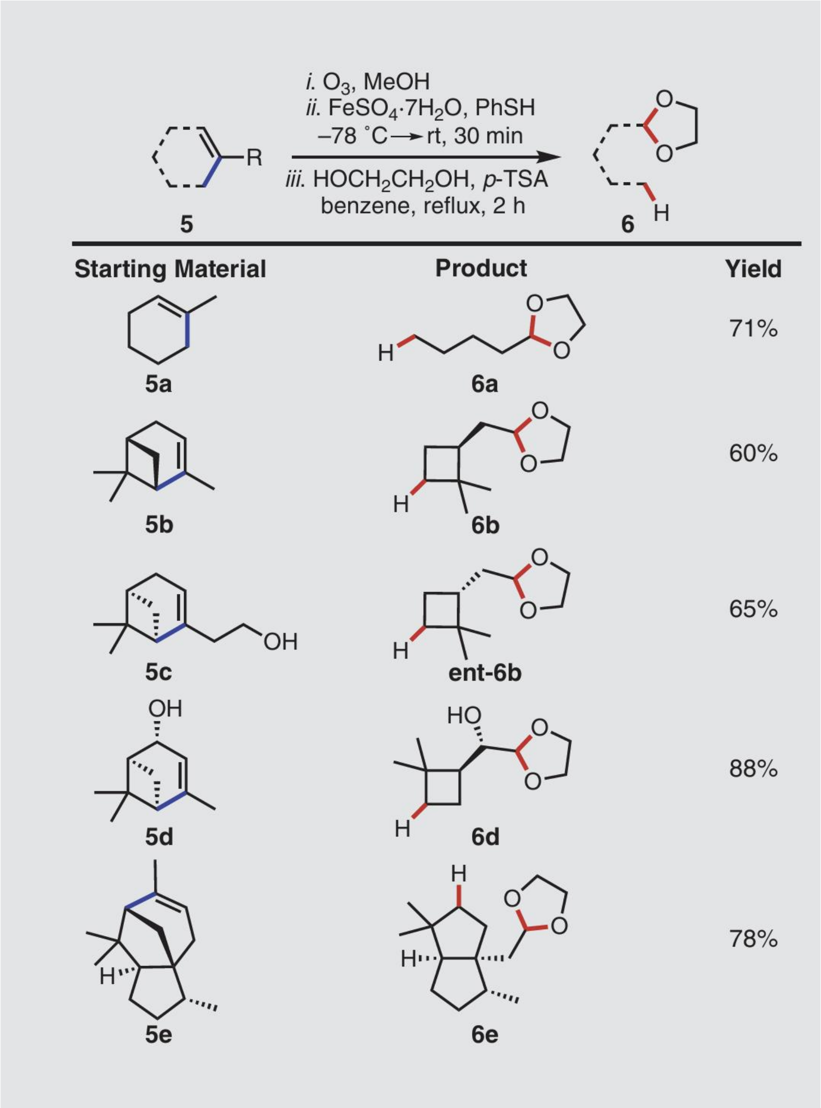
Hydrogenation



Science **2019**, *364*, 681–685.

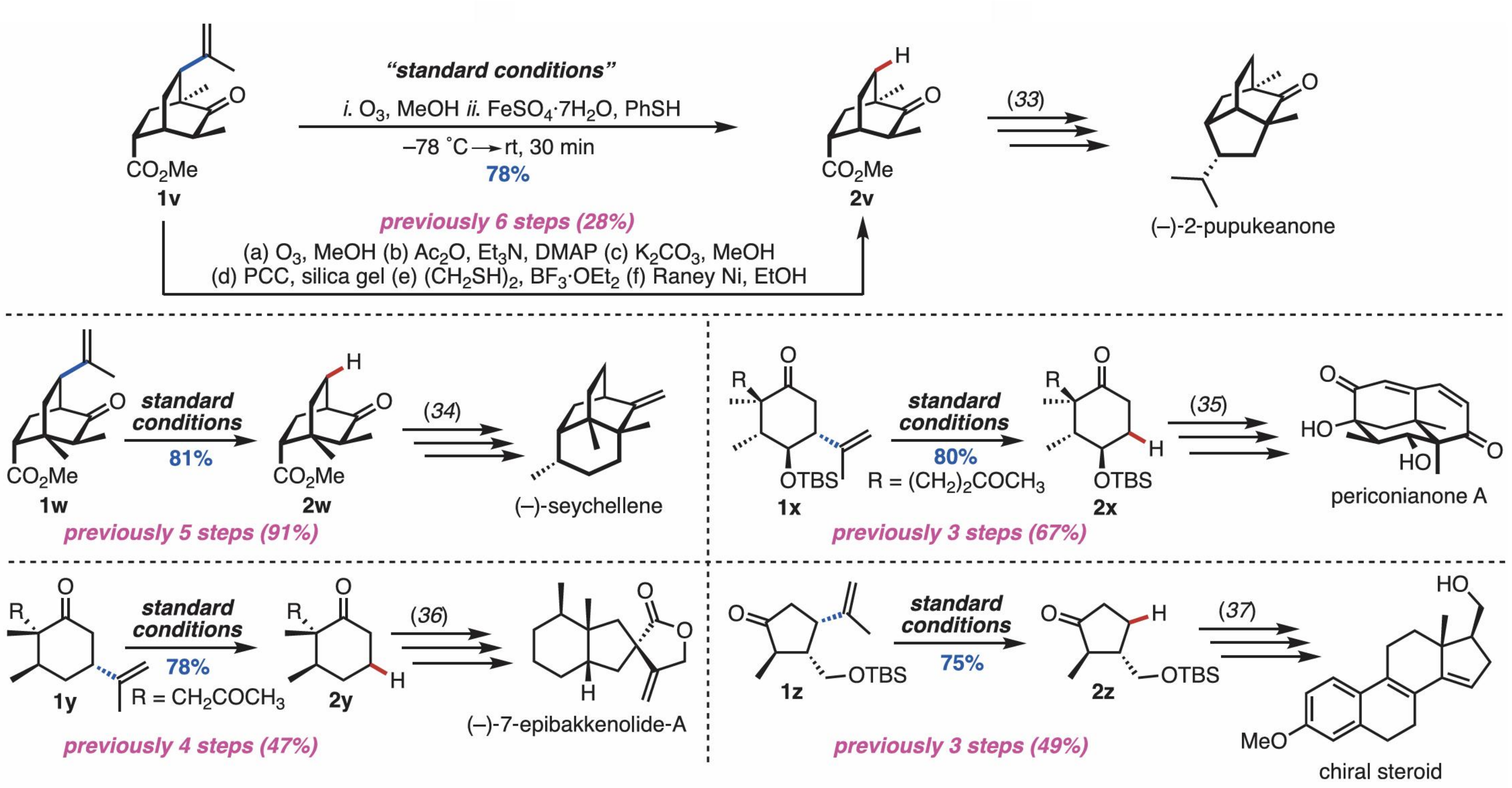
Hydrogenation





Science **2019**, *364*, 681–685.

Hydrogenation



Science **2019**, *364*, 681–685.

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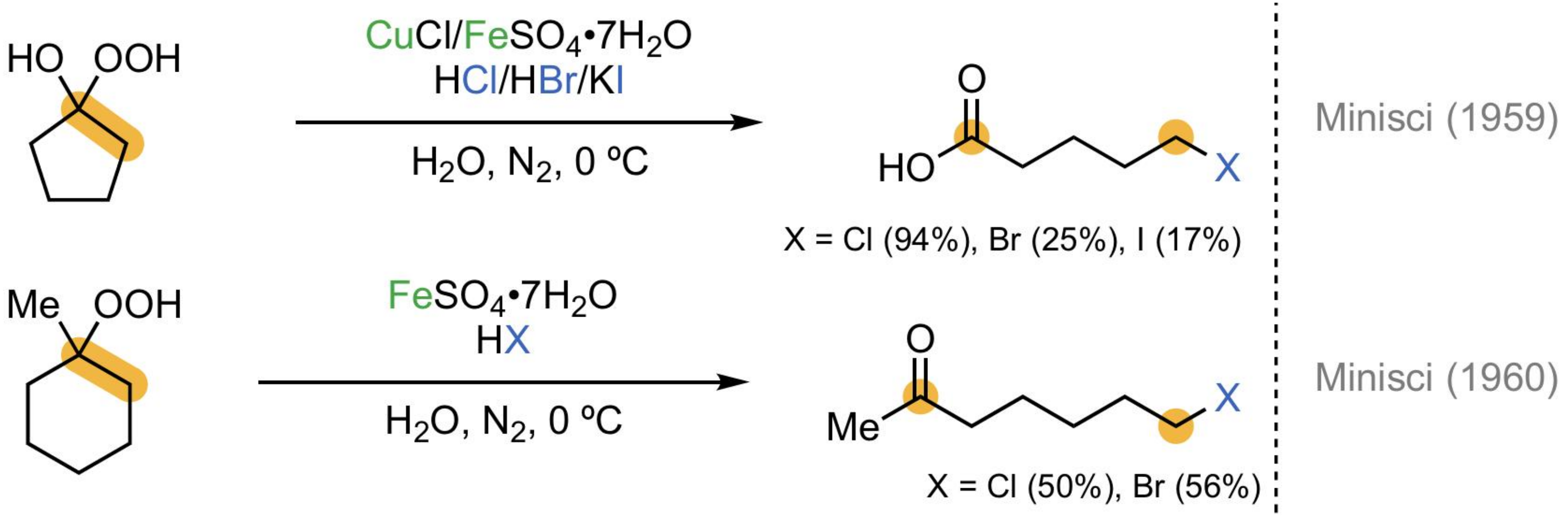

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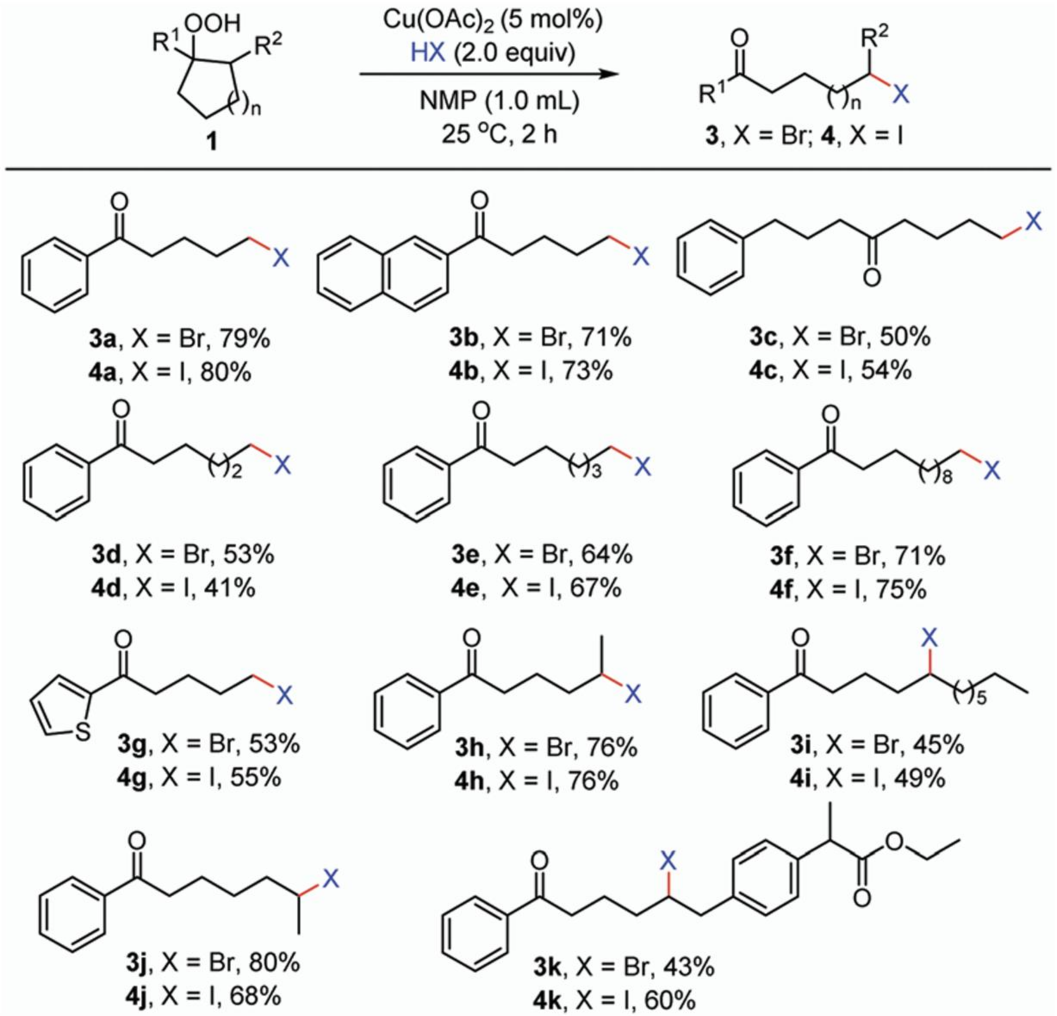
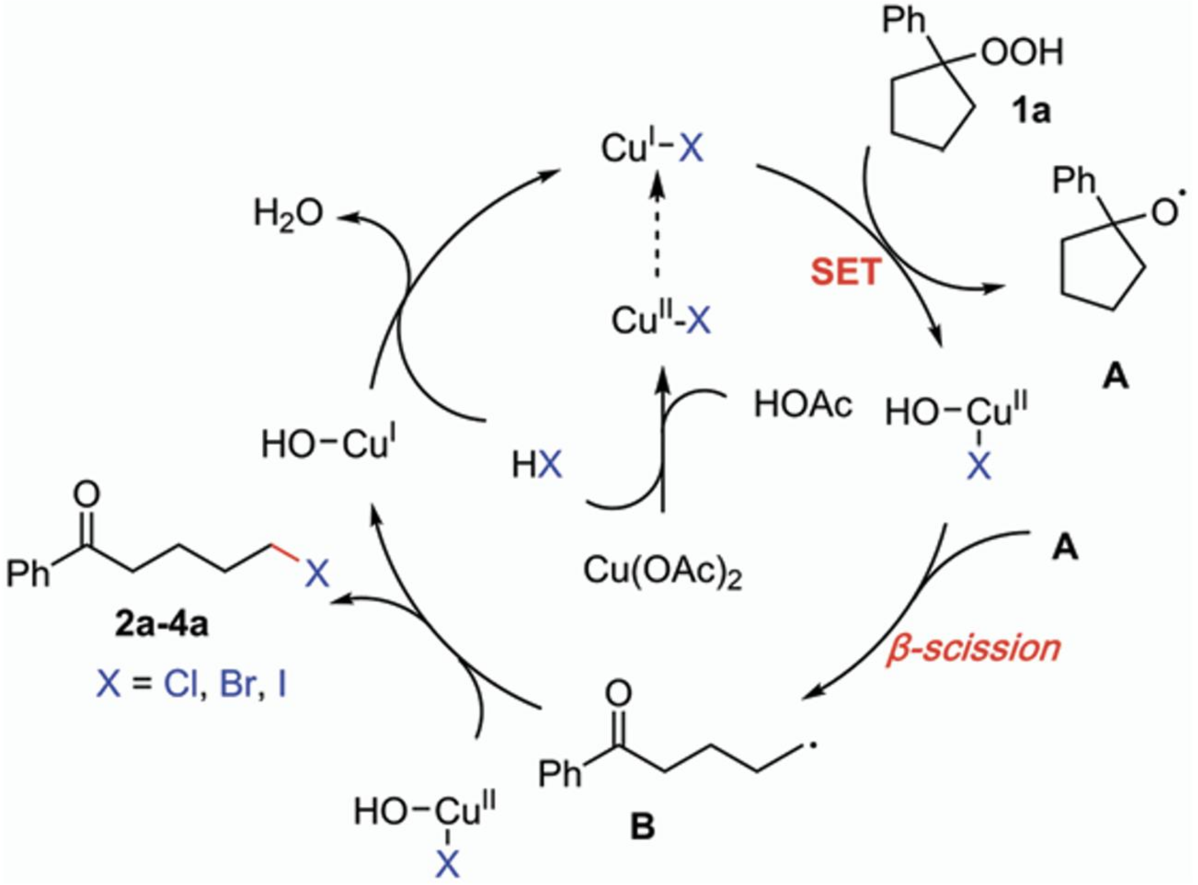
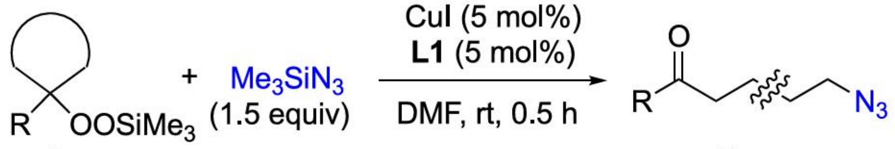
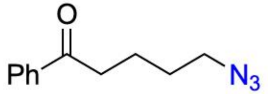
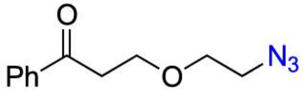
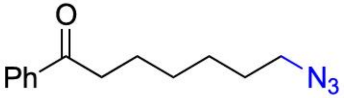
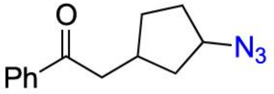


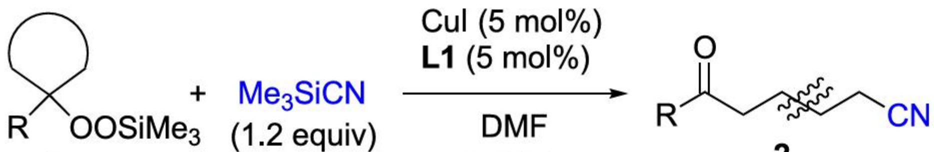


Azidation and Cyanation

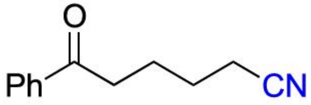
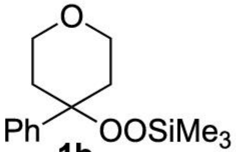
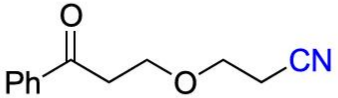
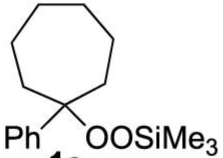
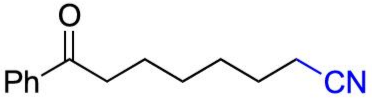
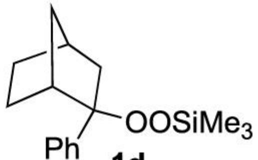
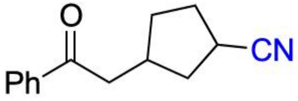


1 7

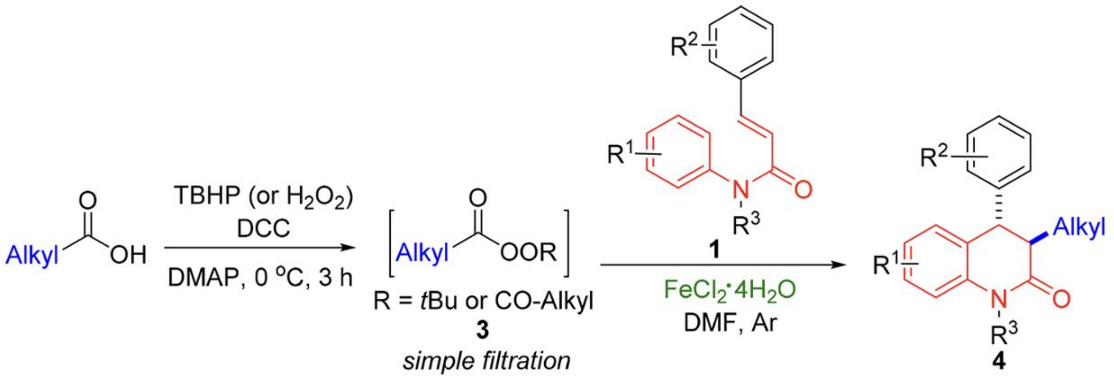
entry	alkylsilyl peroxides	products (%)[b]
1	**1a**	 **7a** (88 (88)[c])
2	**1b**	 **7b** (0, 65[d] (65)[c])
3	**1c**	 **7c** (44, 56[e] (50)[c])
4	**1d**	 **7d** (>99 (dr = 1:1) (76)[c])



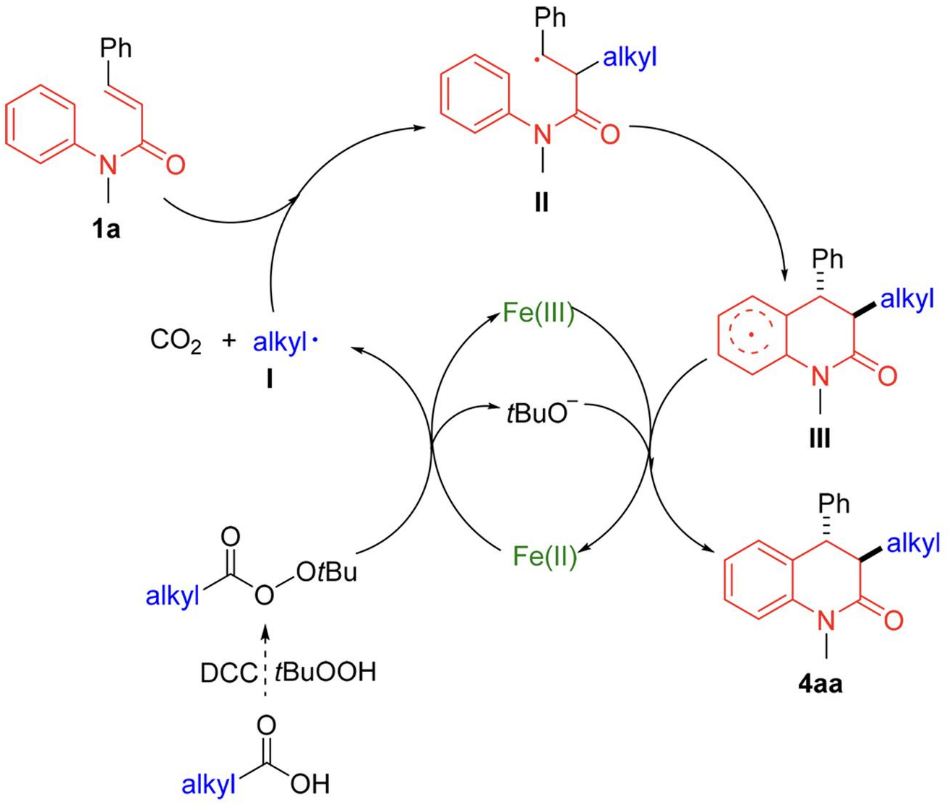
1 2

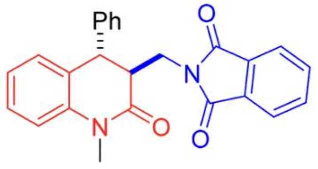
entry	alkylsilyl peroxides	products (%)
1	 **1a**	 **2a** (>99 (91)[c])
2	 **1b**	 **2b** (44, 59[d] (66)[c])
3	 **1c**	 **2c** (72 (68)[c])
4	 **1d**	 **2d** (>99 (dr = 1:1) (86)[c])

Alkylation

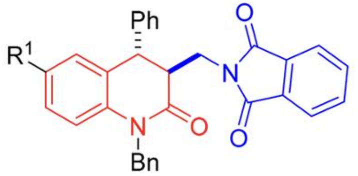


Scheme 4. Plausible Mechanism

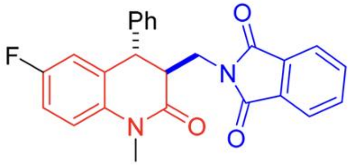




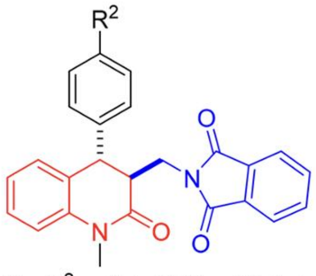
4aa, 64%, >20:1 dr



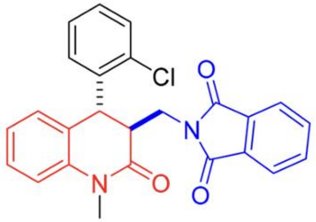
4ba, R^1 = Cl, 50%, >20:1 dr
4ca, R^1 = OMe, 59%, >20:1 dr
4ea, R^1 = CO_2Et, 52%, >20:1 dr



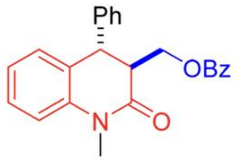
4da, 69%, >20:1 dr



4fa, R^2 = CF_3, 75%, >20:1 dr
4ha, R^2 = Br, 69%, >20:1 dr



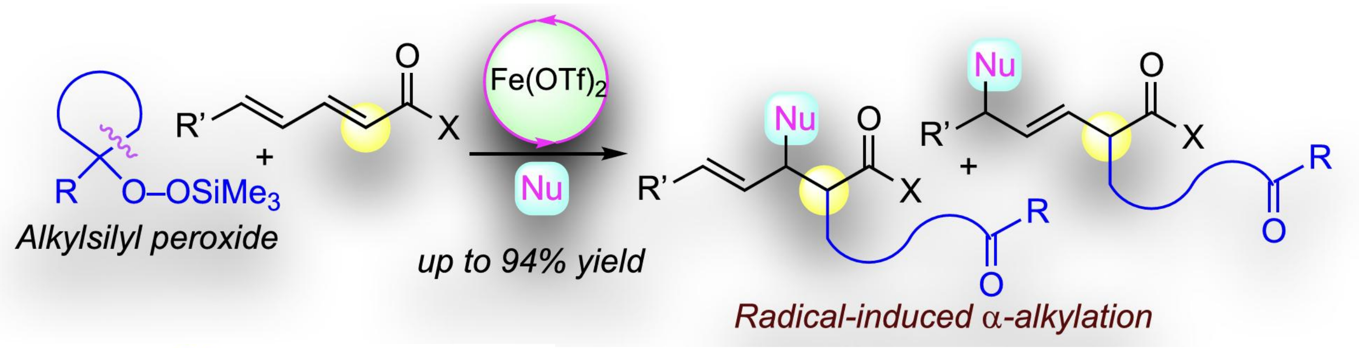
4ga, 72%, >20:1 dr

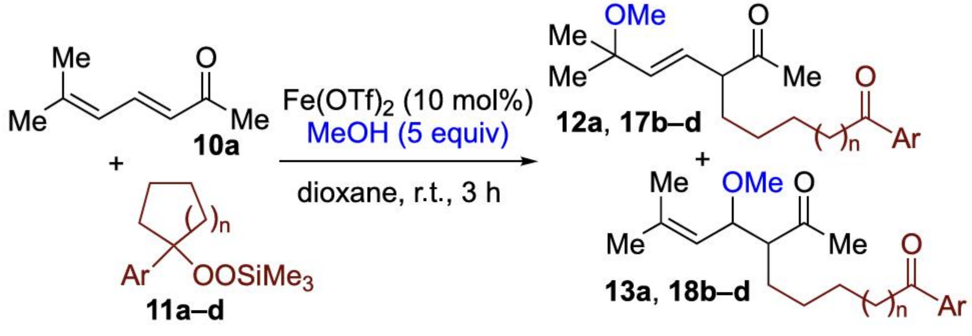


4ab, 70%, >20:1 dr

J. Org. Chem. **2018**, *83*, 5149−5159.

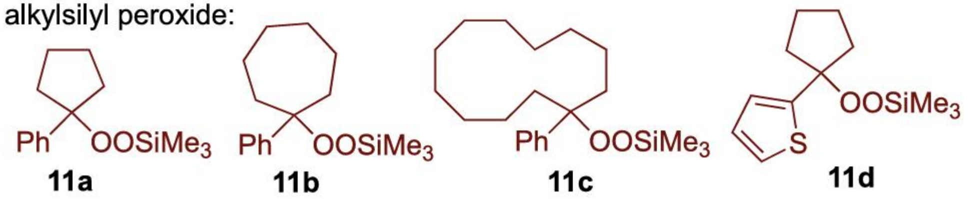
Alkylation

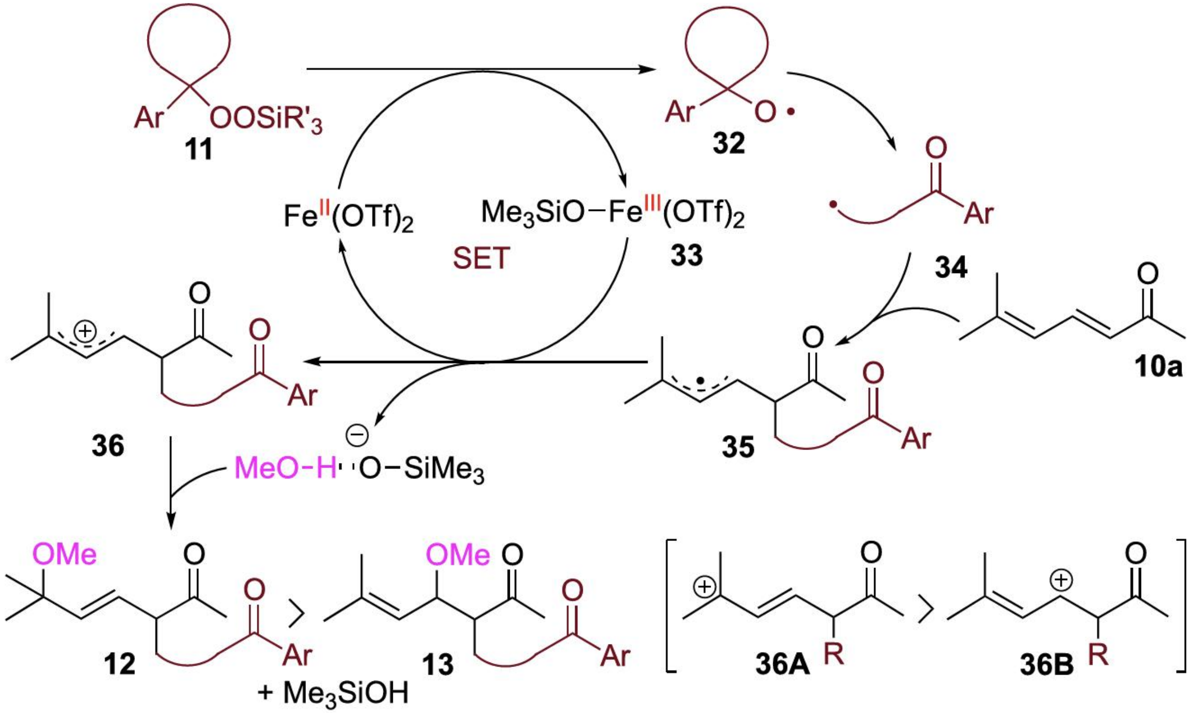




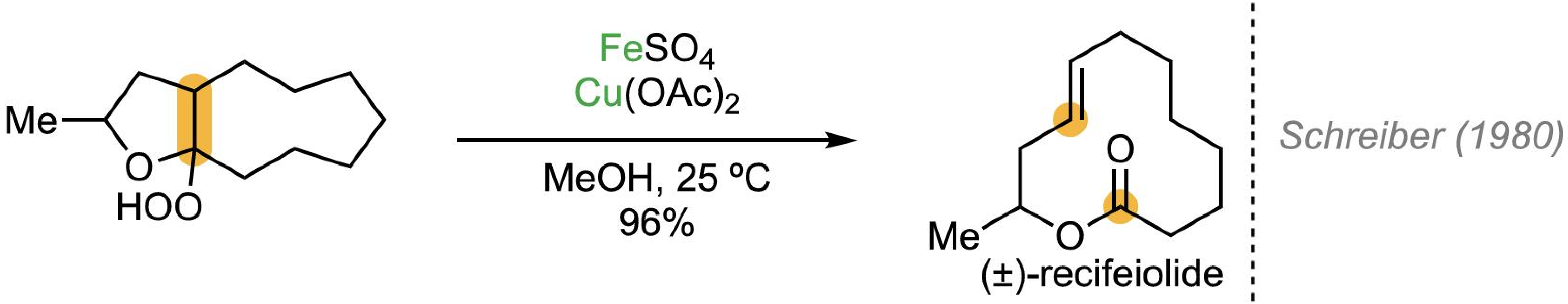
alkylsilyl peroxide	Products
11a	**12a** and **13a** (Ar = Ph; n = 1) : 70% (68%) [83:17 (>20:1)]
11b	**17b** and **18b** (Ar = Ph; n = 3) : 68% (65%) [78:22 (>20:1)]
11c	**17c** and **18c** (Ar = Ph; n = 8) : 72% (75%) [85:15 (>20:1)]
11d	**17d** and **18d** (Ar = 2-thienyl; n = 1) : 56% (52%) [75:25 (>20:1)]

alkylsilyl peroxide:





Olefination



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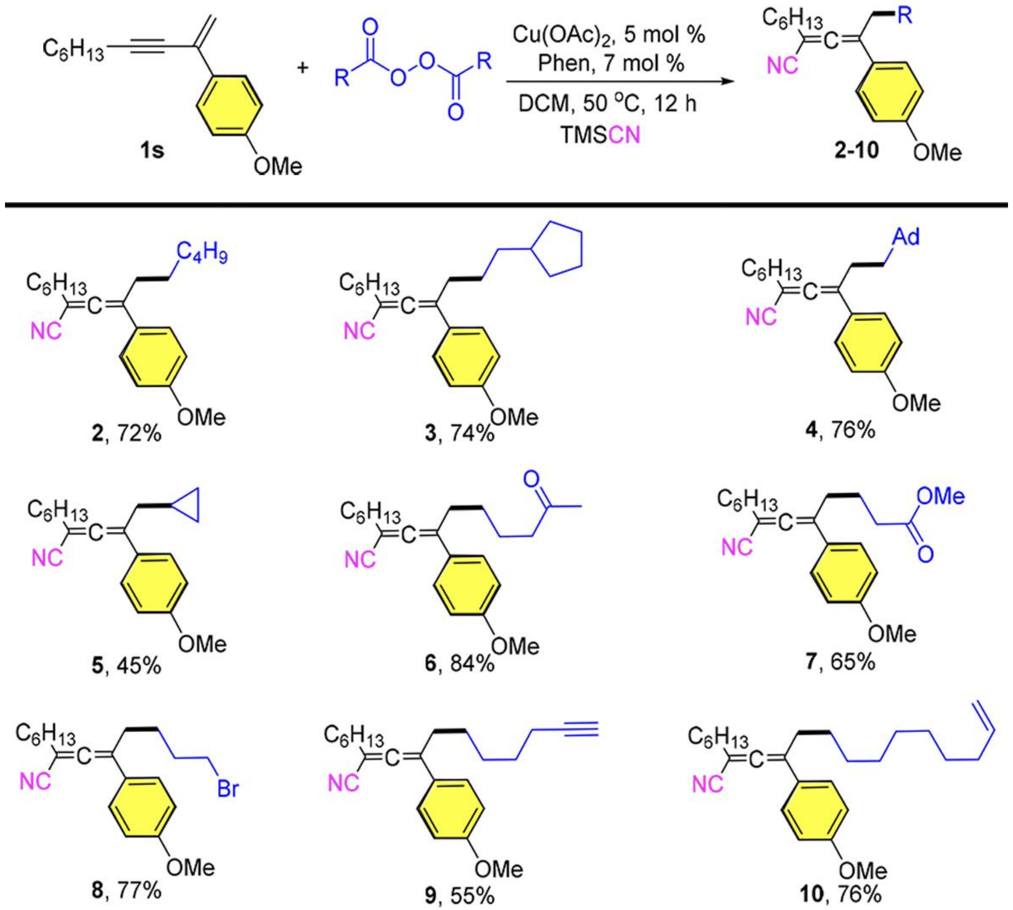

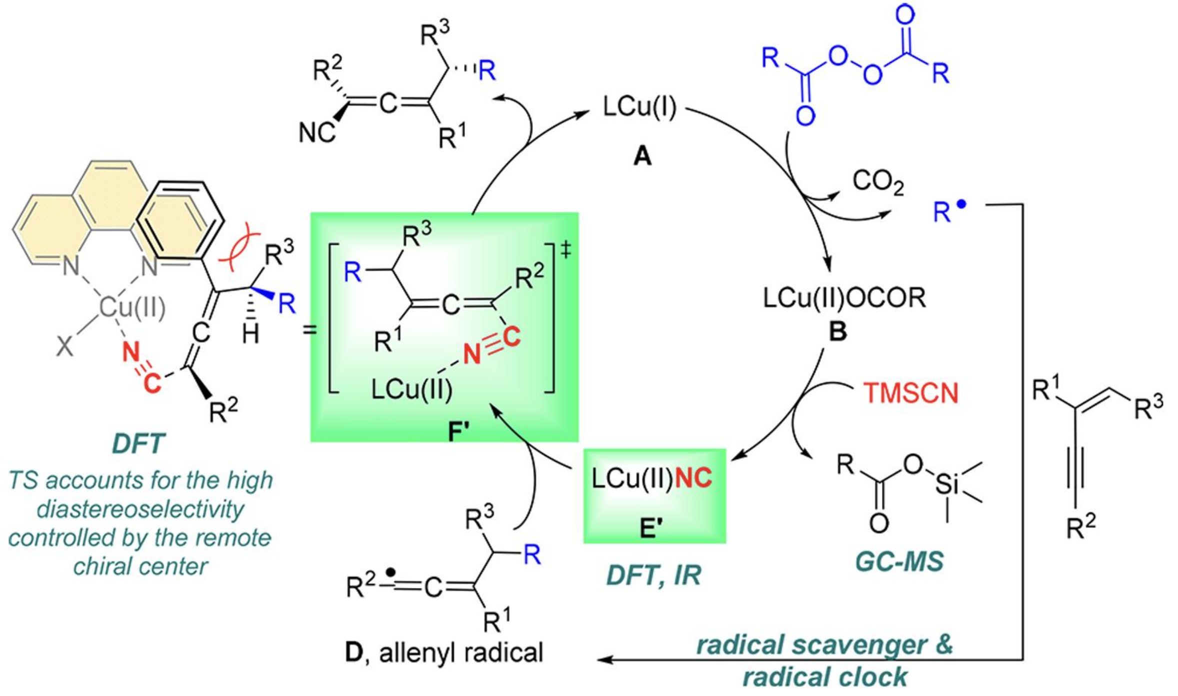

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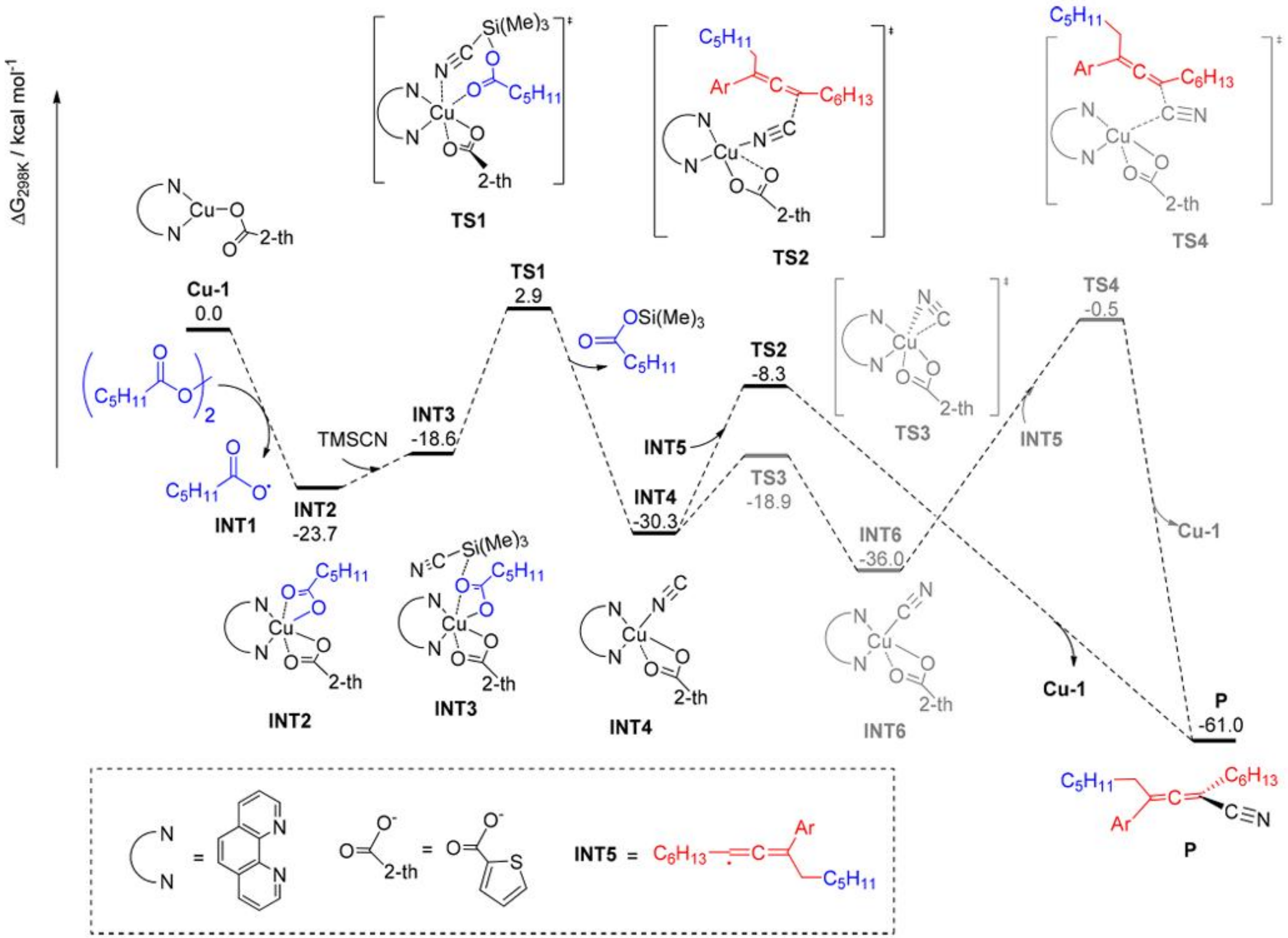
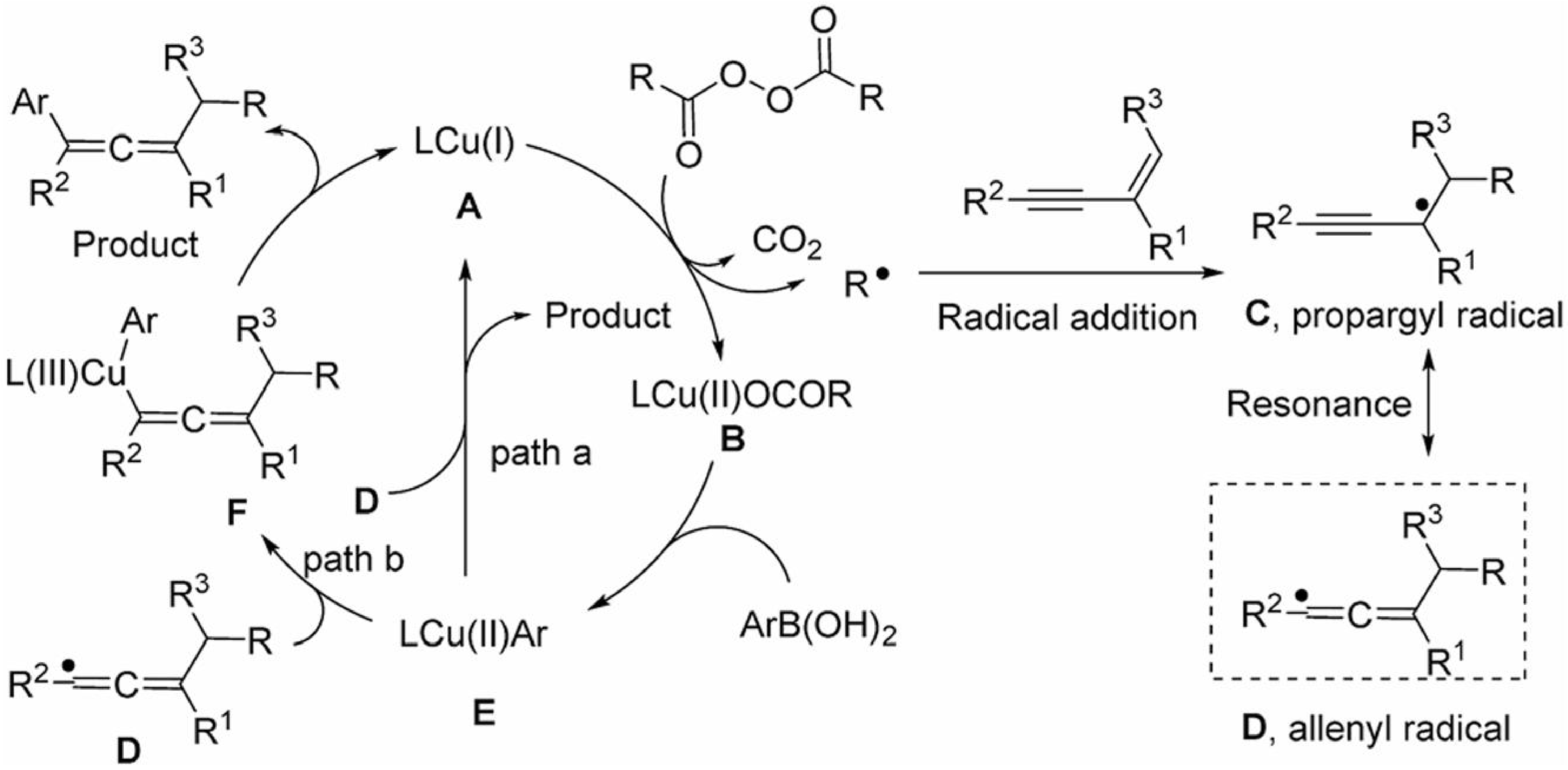
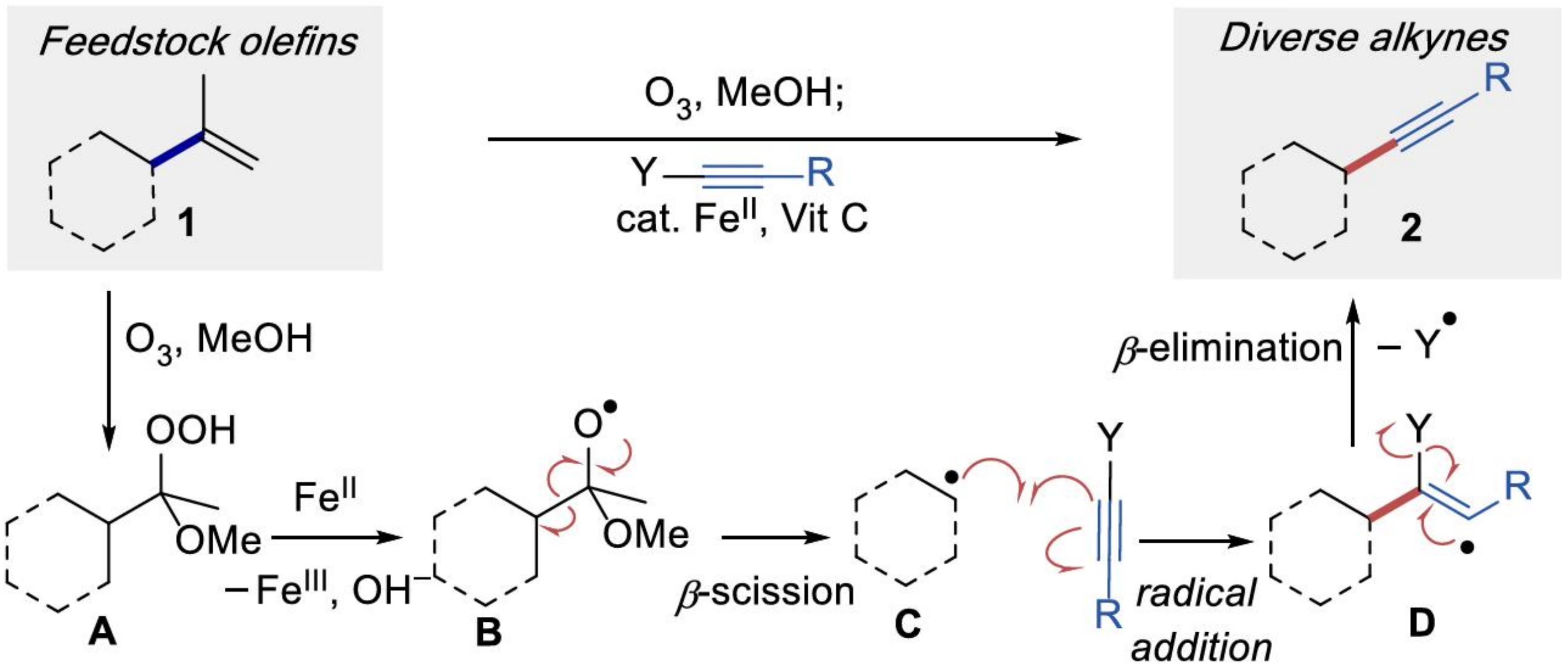


J. Am. Chem. Soc. **2019**, *141*, 548−559.

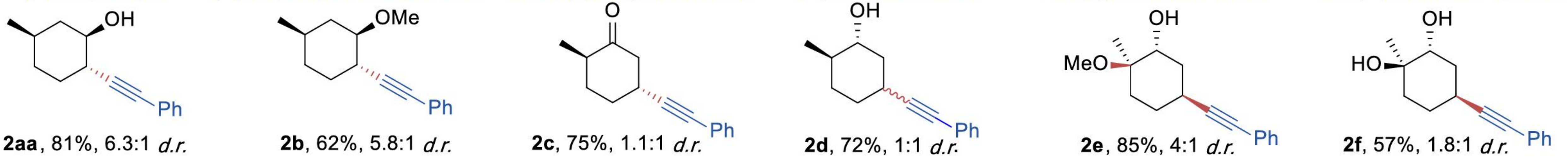
Olefination



Alkynylation



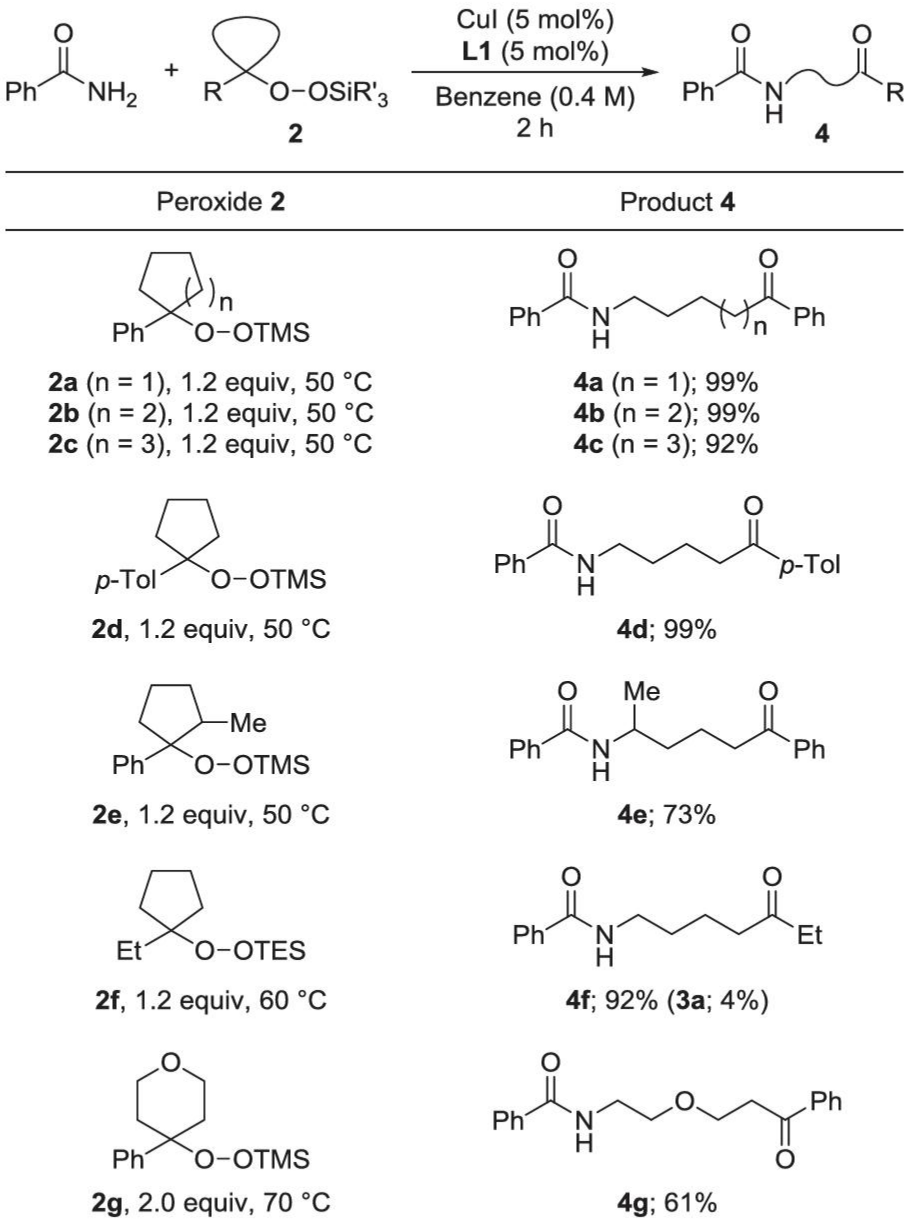
(−)-isopulegol | (−)-isopulegol methyl ether | trans-(+)-dihydrocarvone | (−)-dihydrocarveol | cis-(+)-limonene oxide | cis-(−)-limonene-1,2-diol



2aa, 81%, 6.3:1 *d.r.* | **2b**, 62%, 5.8:1 *d.r.* | **2c**, 75%, 1.1:1 *d.r.* | **2d**, 72%, 1:1 *d.r.* | **2e**, 85%, 4:1 *d.r.* | **2f**, 57%, 1.8:1 *d.r.*

J. Am. Chem. Soc. **2022**, *144*, 14828−14837.

Amination



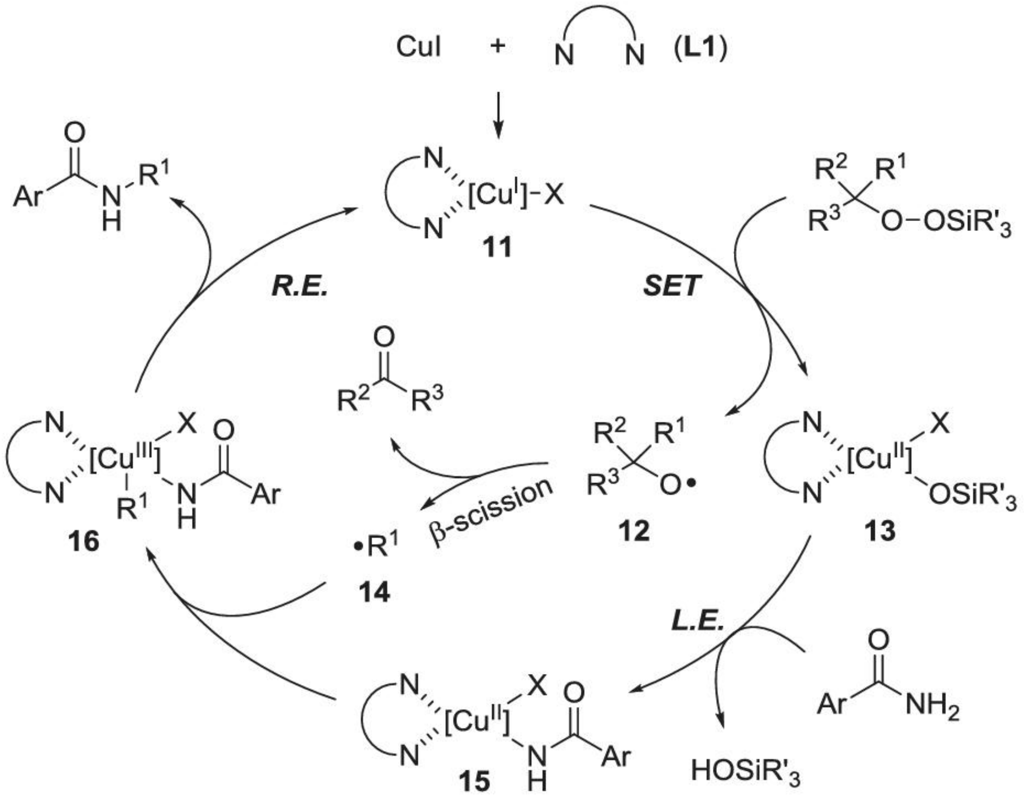
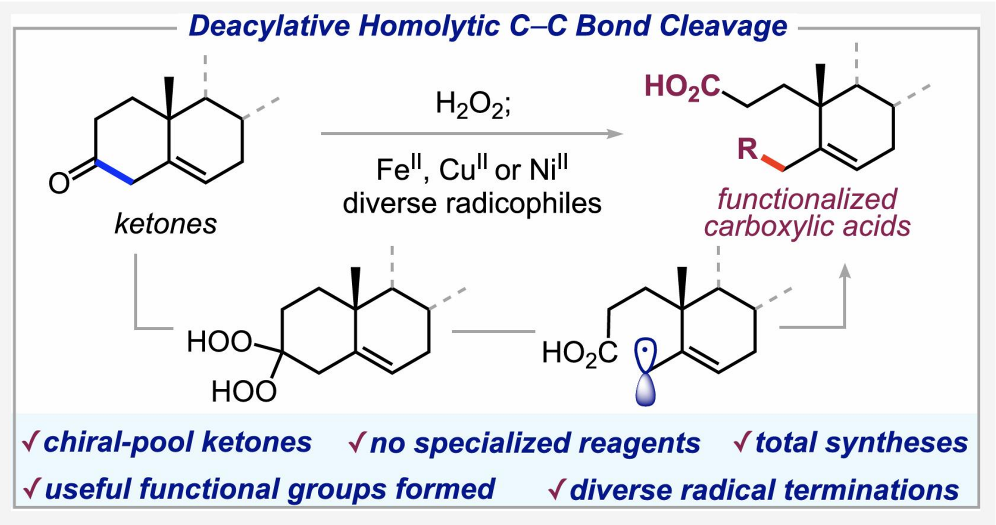
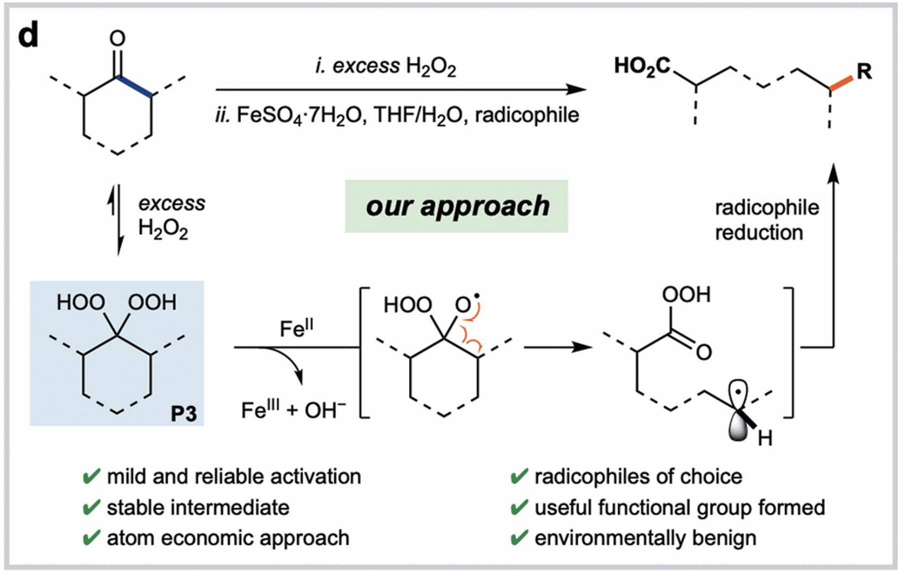
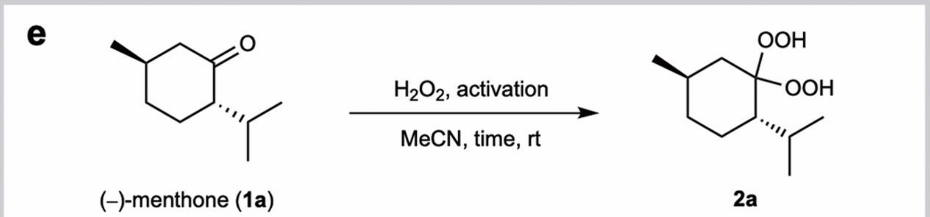


Fig. 2. A plausible mechanism.

Deacylative Homolysis of Ketone





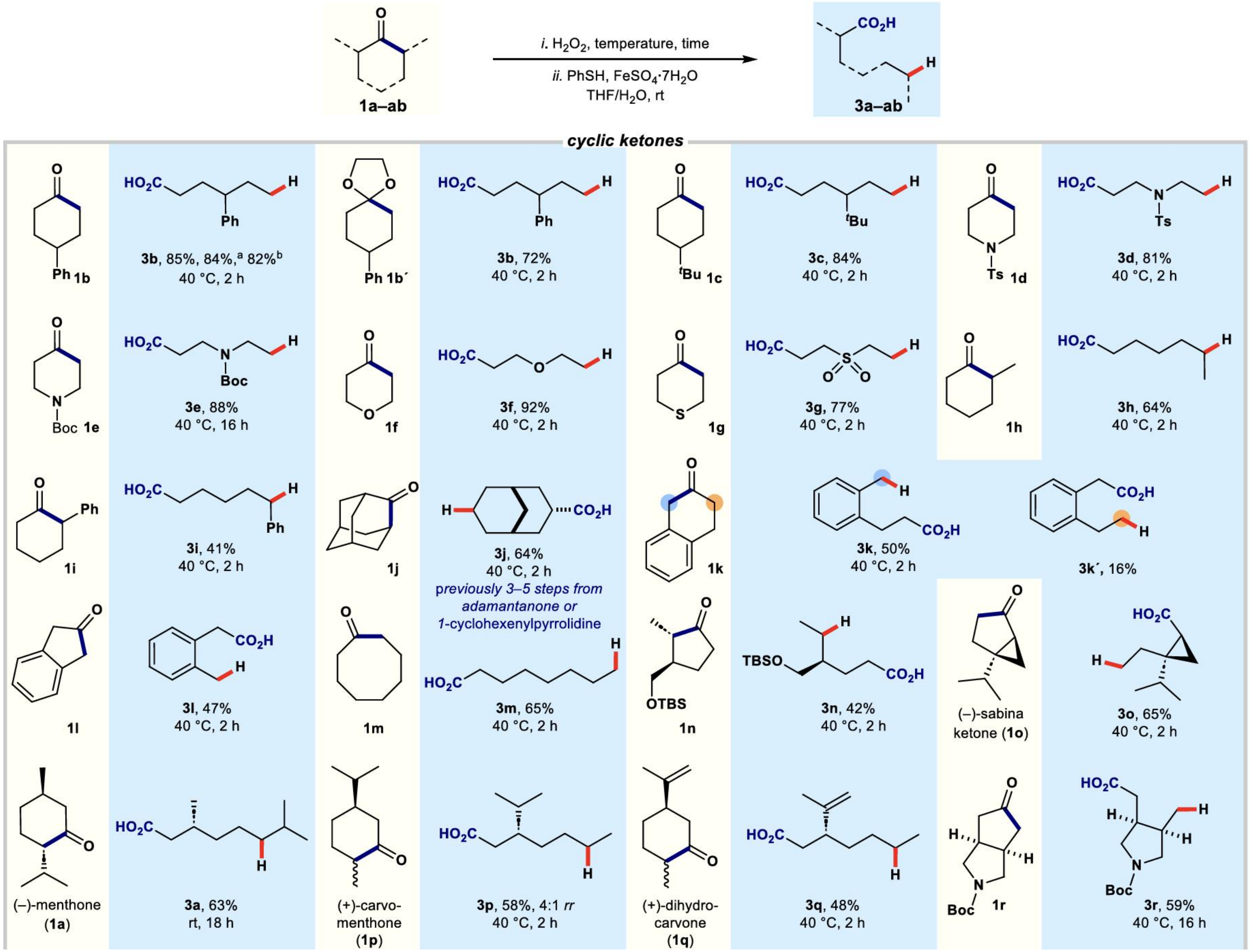


Entry	Activation	Time (h)	2a (%)[a]	Entry	Activation	Time (h)	2a (%)[b]
1	none	48	0	6	$SiO_2 \cdot NaHSO_4$	48	12
2	I_2	48	traces	7	$Sc(OTf)_3$	8	26
3	pTsOH·H_2O	48	traces	8	PMA	6	26
4	H_2SO_4	48	traces	9[c]	Re_2O_7	18	37
5	HCl	48	traces	10[d]	azeotropic drying	3	79

[a]Determined by ^{1}H NMR of the crude reaction mixture in MeCN-d_3. [b]Isolated yield. [c]Dry H_2O_2 solution in Et_2O. [d]Azeotropically dried with MeCN three times and aged.

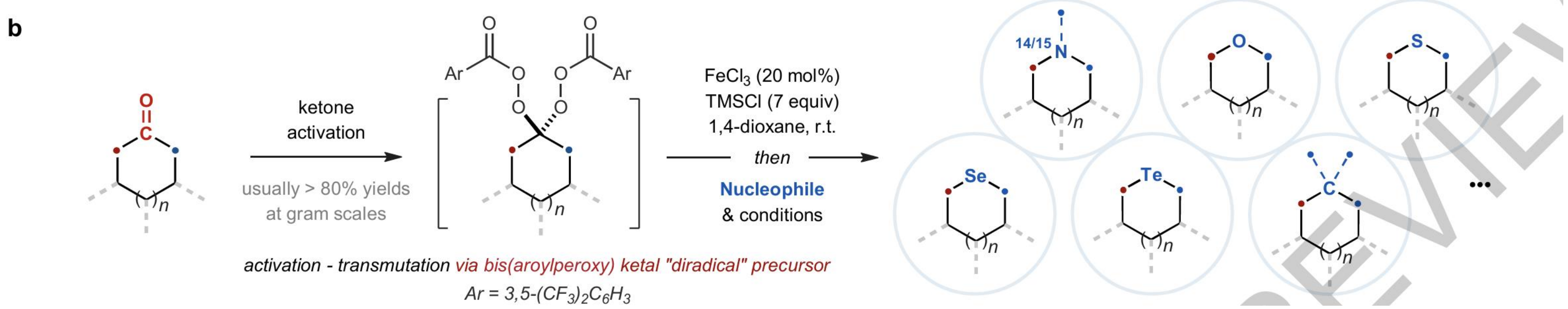
J. Am. Chem. Soc. **2025**, *147*, 2664−2674.

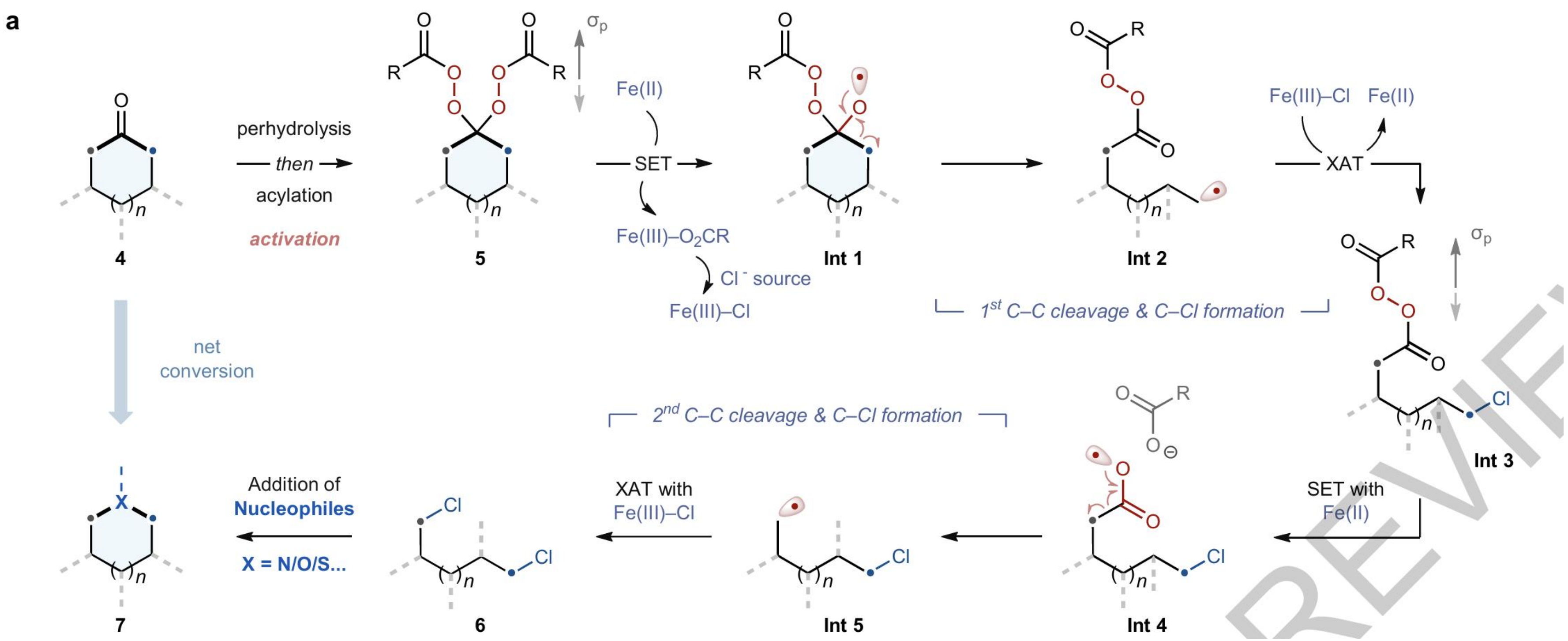
Deacylative Homolysis of Ketone



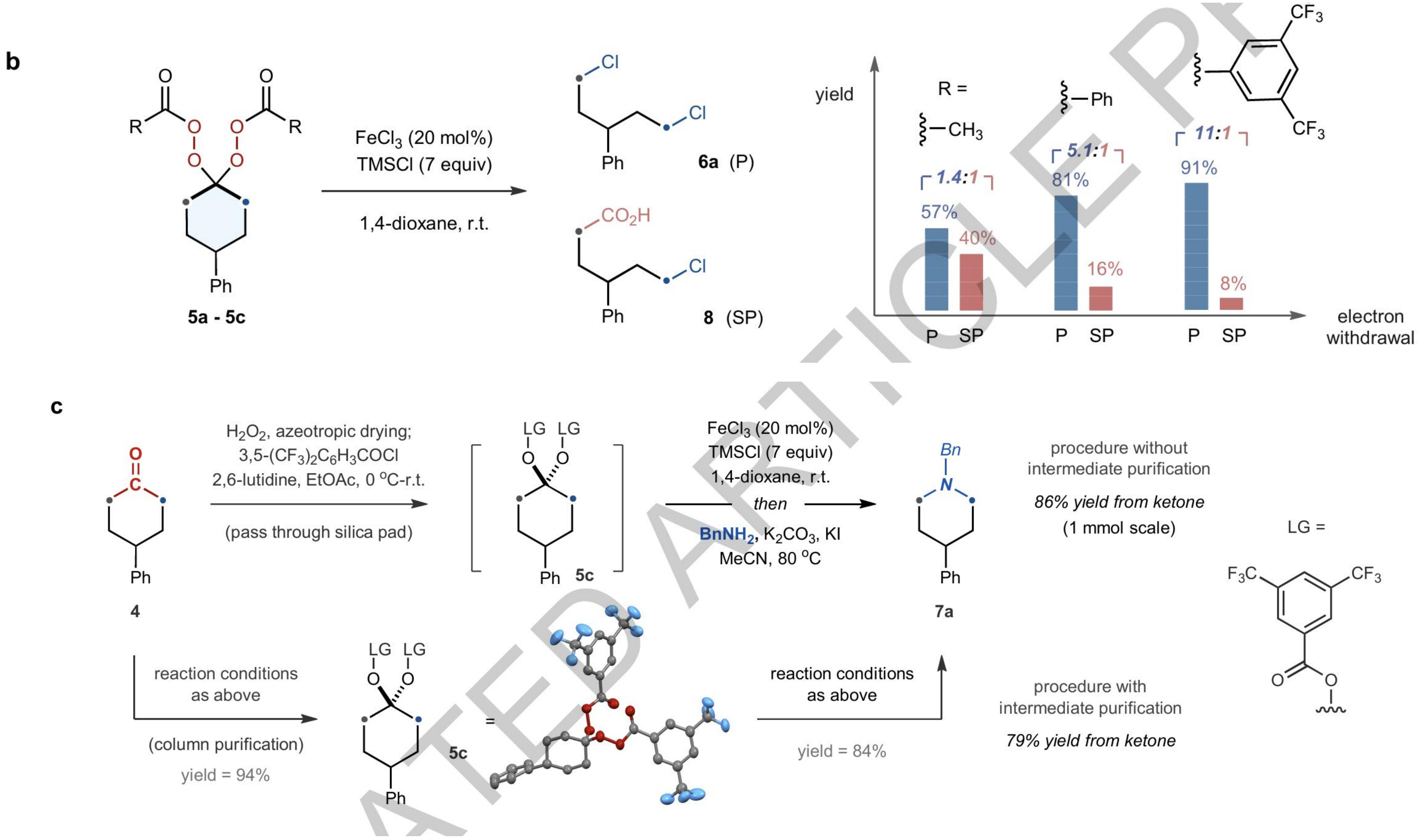
J. Am. Chem. Soc. **2025**, *147*, 2664−2674.

Carbonyl swapping





Carbonyl swapping



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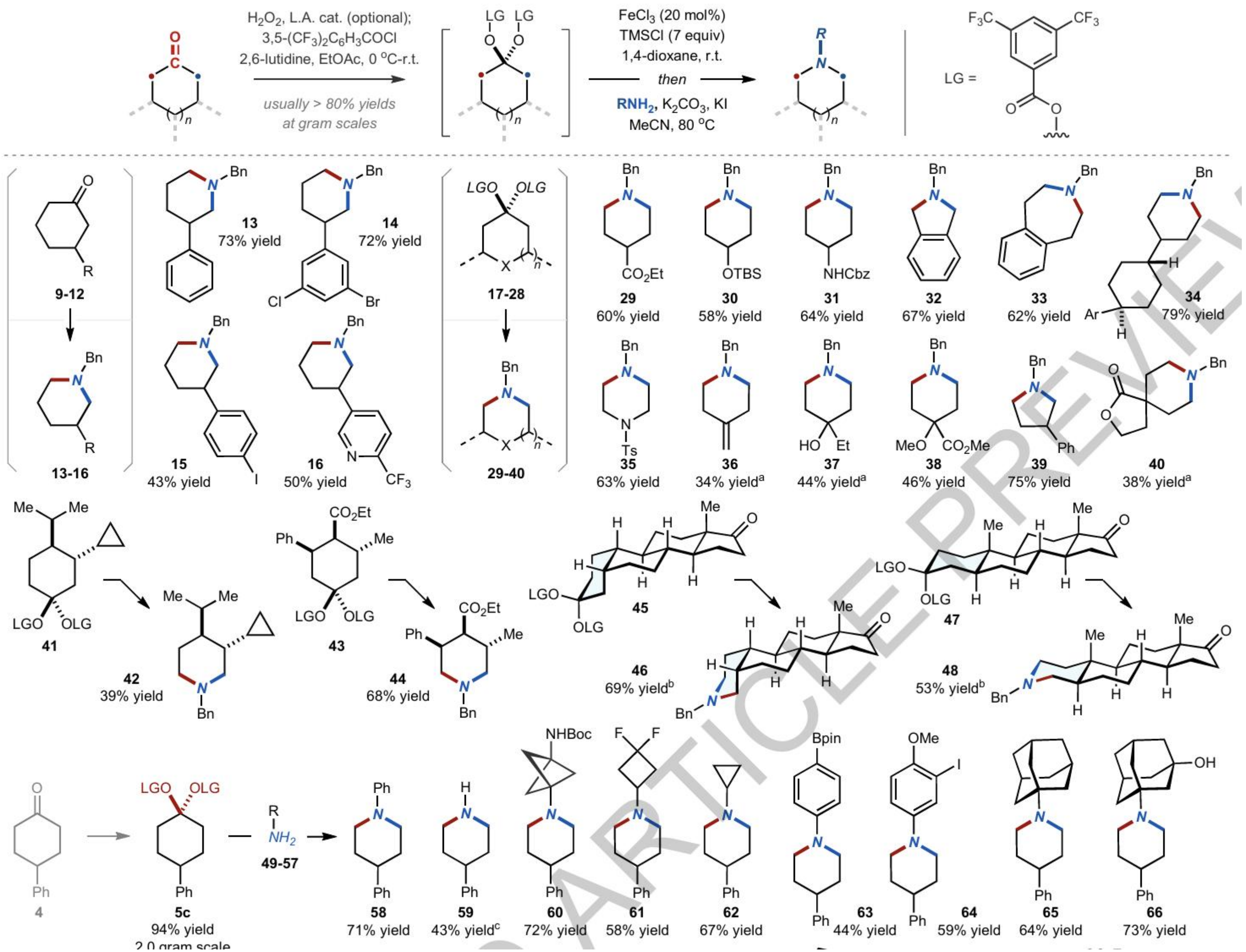
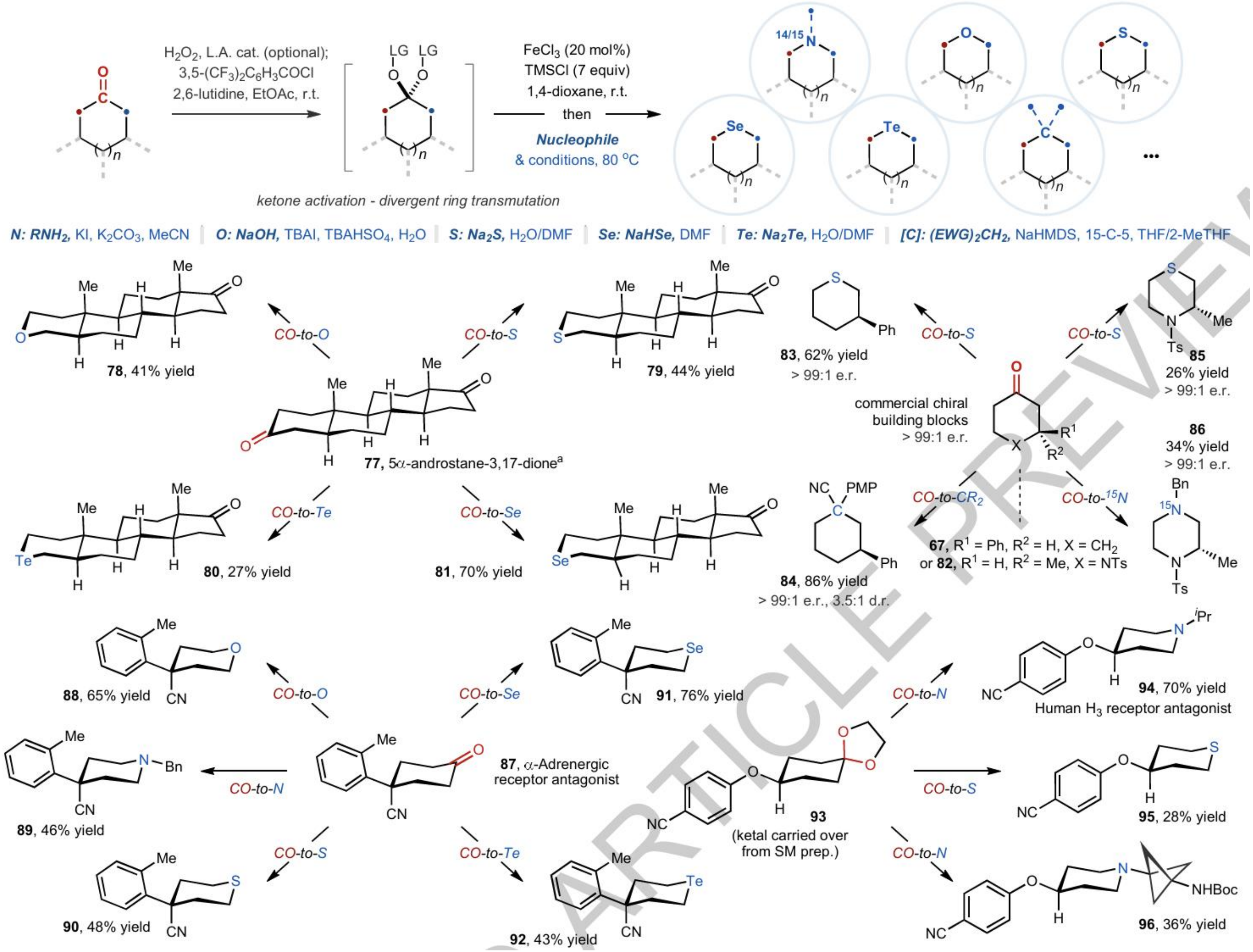
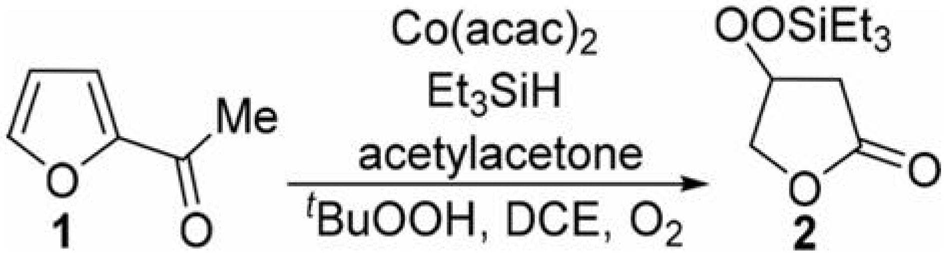


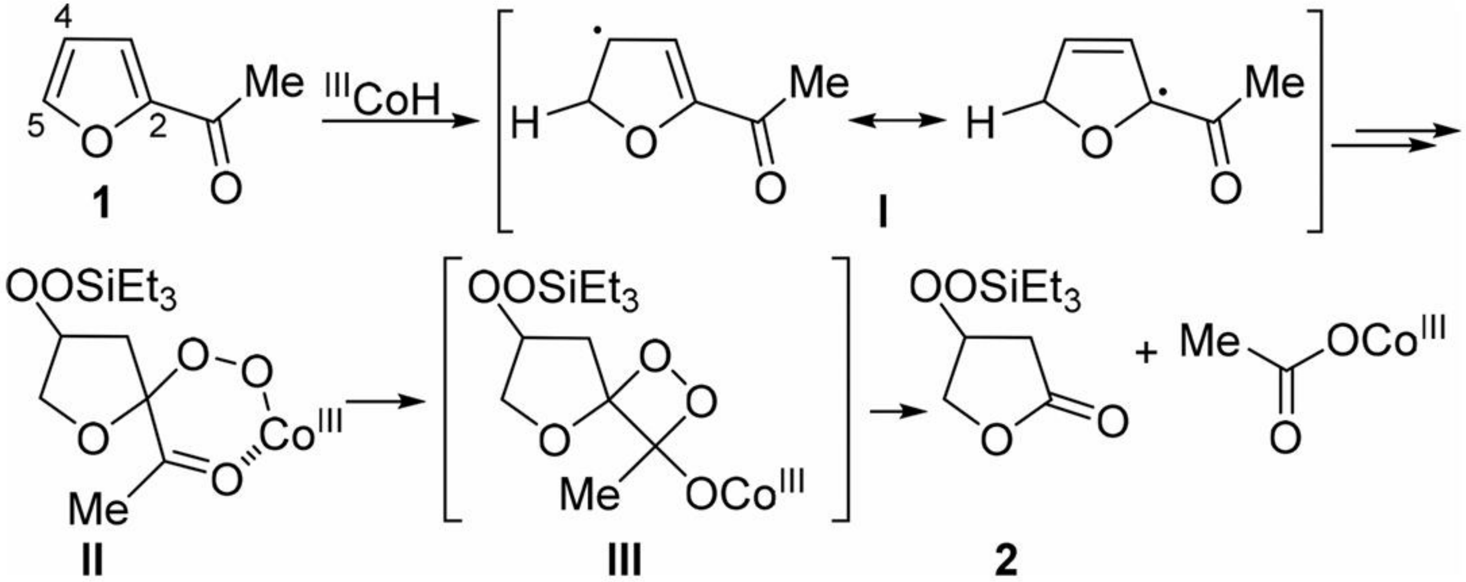
Nature https:// doi.org/10.1038/s41586-026-10508-5 (2026)

Carbonyl swapping



Nature https:// doi.org/10.1038/s41586-026-10508-5 (2026)





J. Org. Chem. **2018**, *83*, 9067−9075.