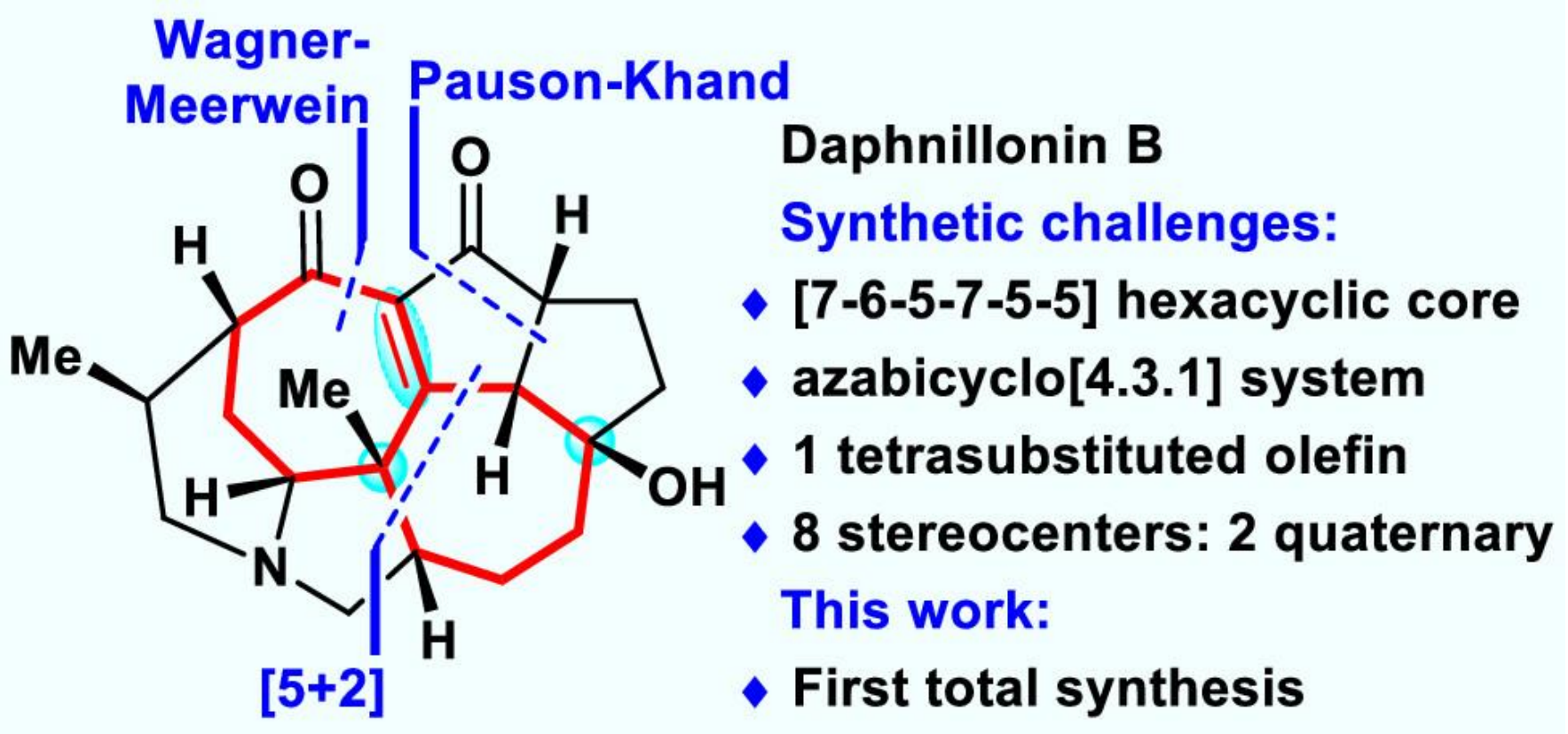
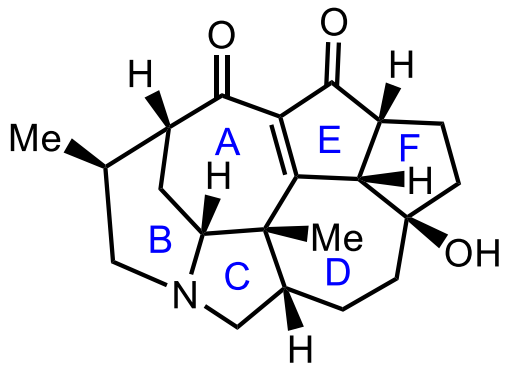
JACS
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY
pubs.acs.org/JACS
Communication

Total Synthesis of (±)- and (−)-Daphnillonin B

Yun-Peng Zou,[#] Zheng-Lin Lai,[#] Meng-Wei Zhang, Jianzhao Peng, Shuai Ning, and Chuang-Chuang Li*

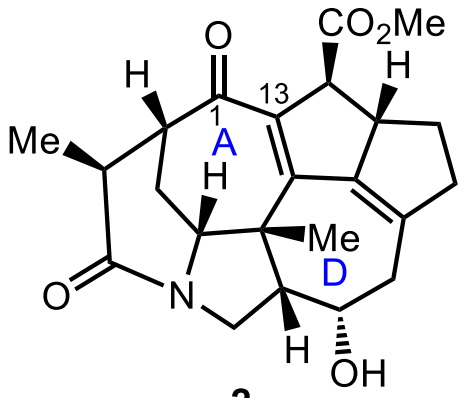


J. Am. Chem. Soc., **2023**, *145*, 10998.



daphnillonin **B** (**1**)

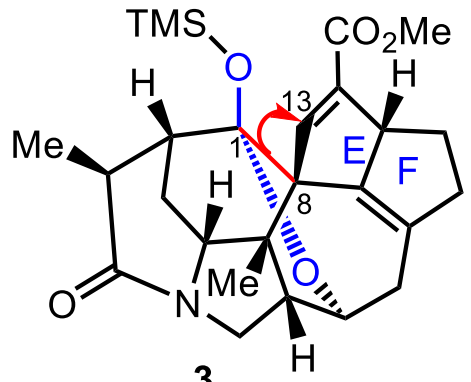
FGI



2

rearrangement

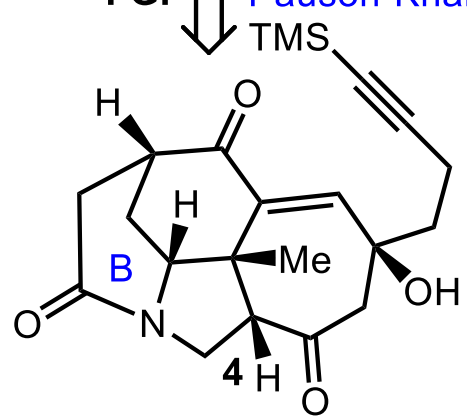
C1→C13



3

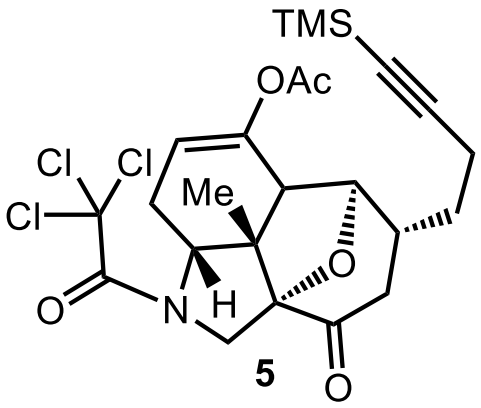
FGI

Pauson-Khand



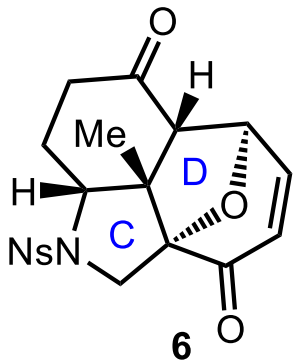
4

radical cylization



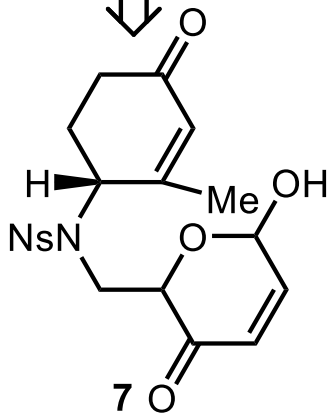
5

FGI



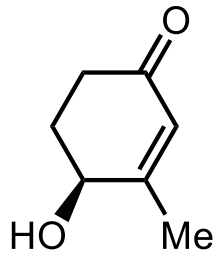
6

type I [5+2]



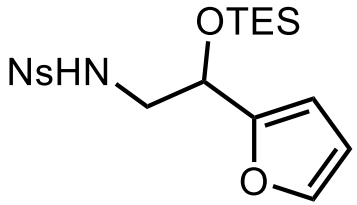
7

Mitsunobu &
Achmatowicz

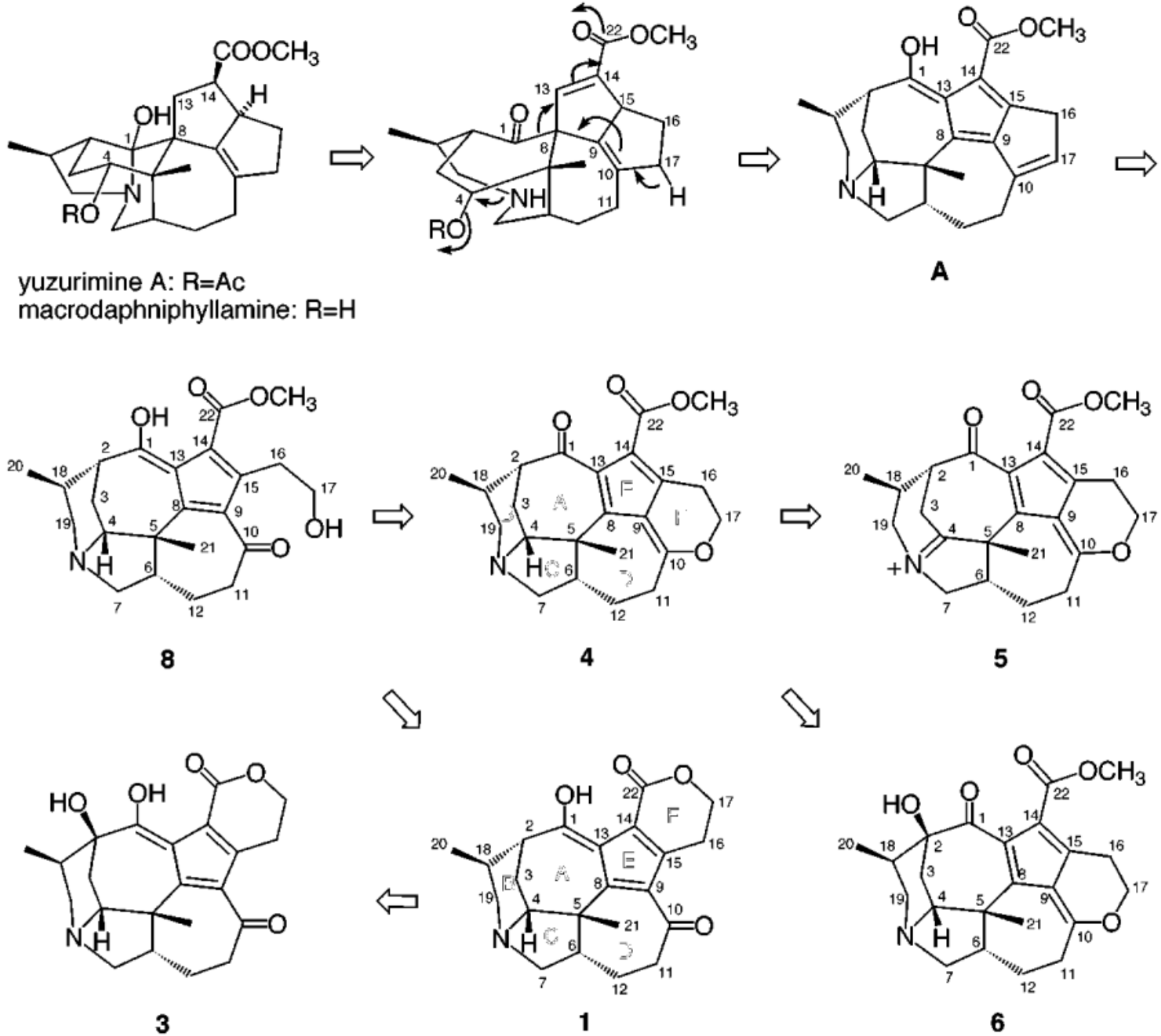


8

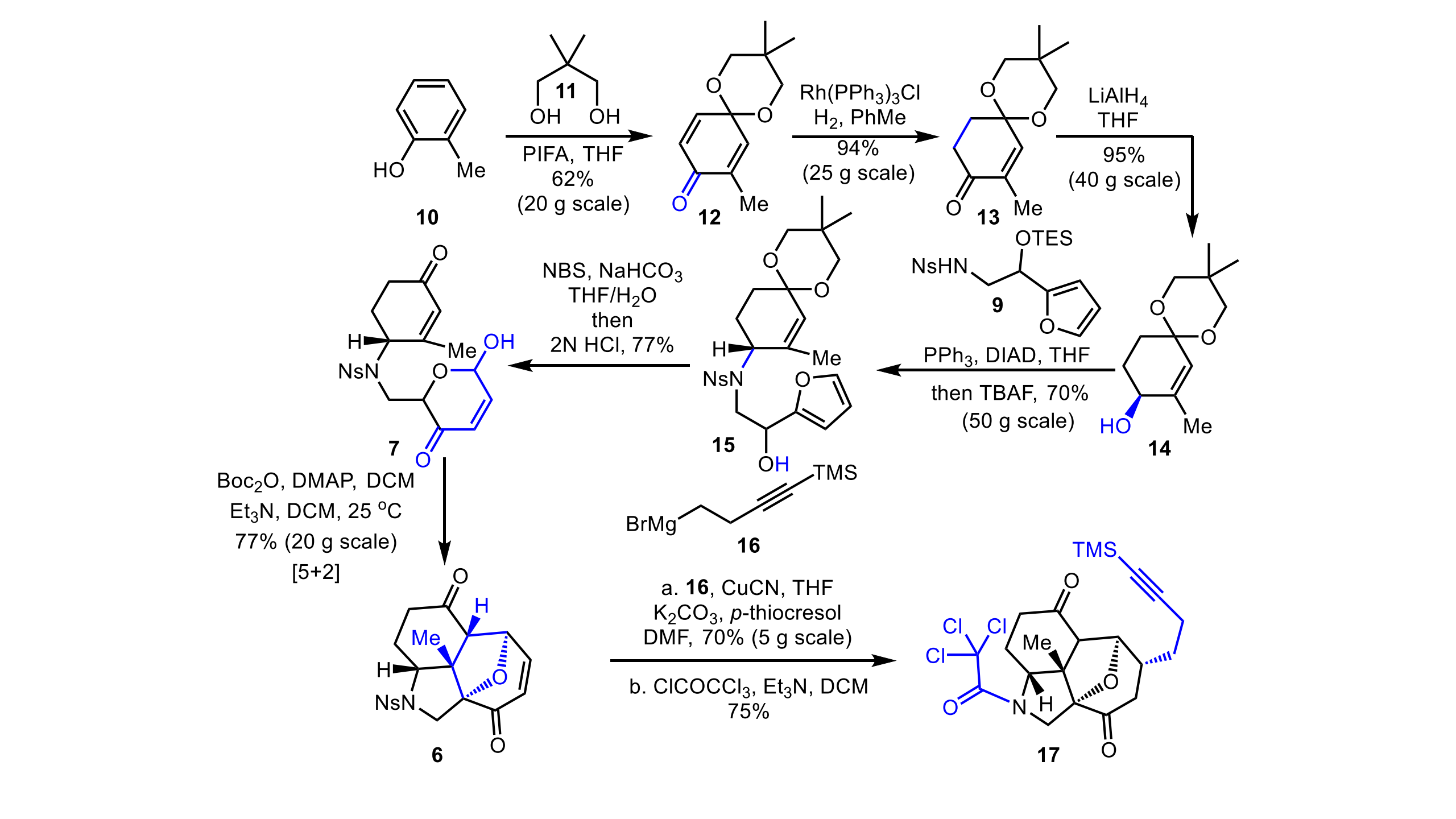
+

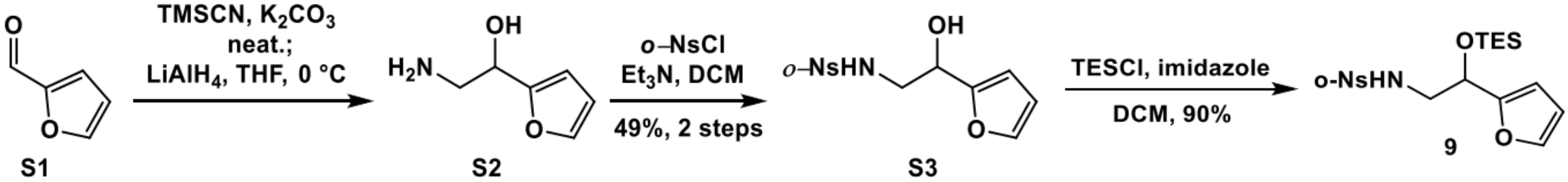


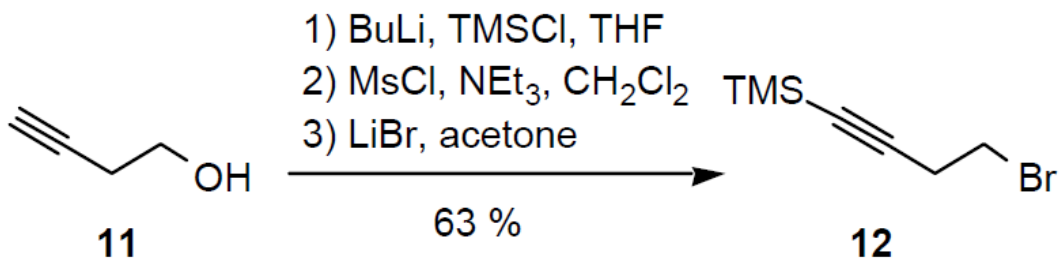
9



J. Am. Chem. Soc., **2001,** *123*, 11402.


10
11
PIFA, THF
62%
(20 g scale)
12
Rh(PPh3)3Cl
H2, PhMe
94%
(25 g scale)
13
LiAlH4
THF
95%
(40 g scale)
14
PPh3, DIAD, THF
then TBAF, 70%
(50 g scale)
9
NBS, NaHCO3
THF/H2O
then
2N HCl, 77%
15
16
7
Boc2O, DMAP, DCM
Et3N, DCM, 25 °C
77% (20 g scale)
[5+2]
6
a. 16, CuCN, THF
K2CO3, p-thiocresol
DMF, 70% (5 g scale)
b. ClCOCCl3, Et3N, DCM
75%
17

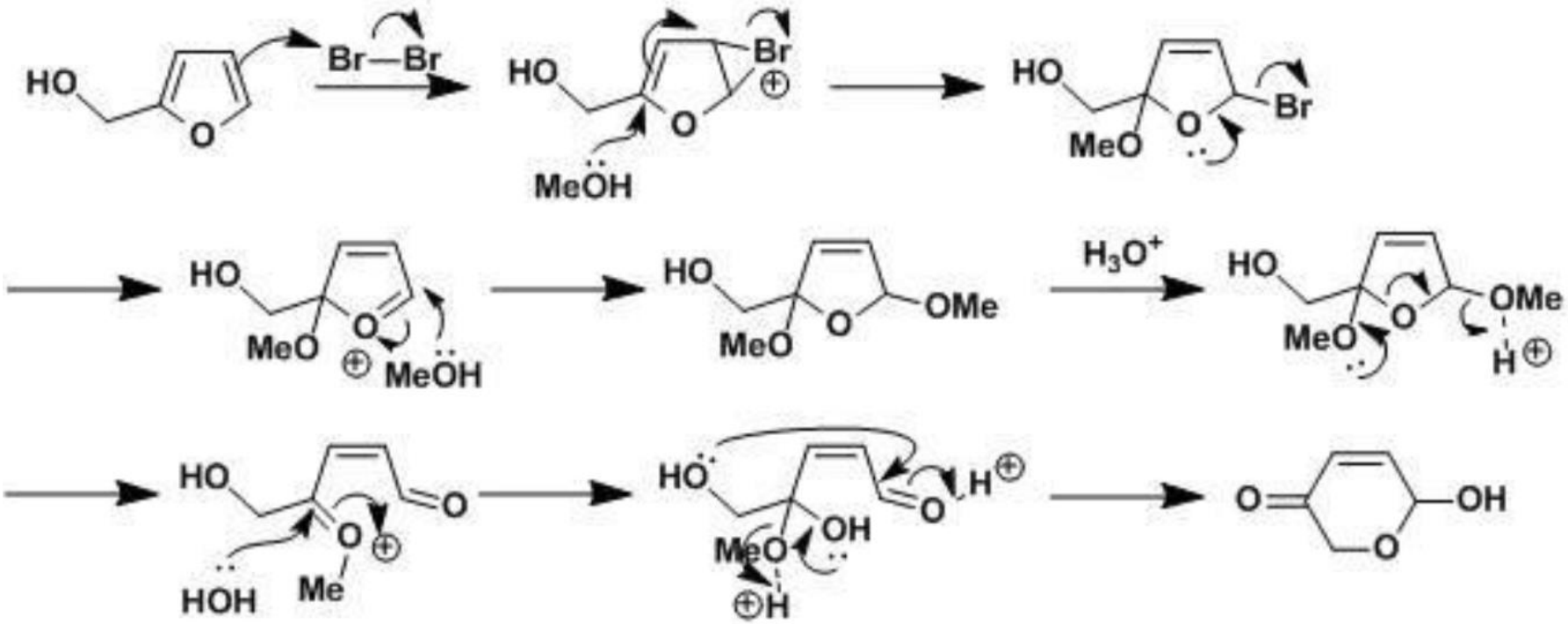




J. Prakt. Chem., **2000**, *342*, 804.

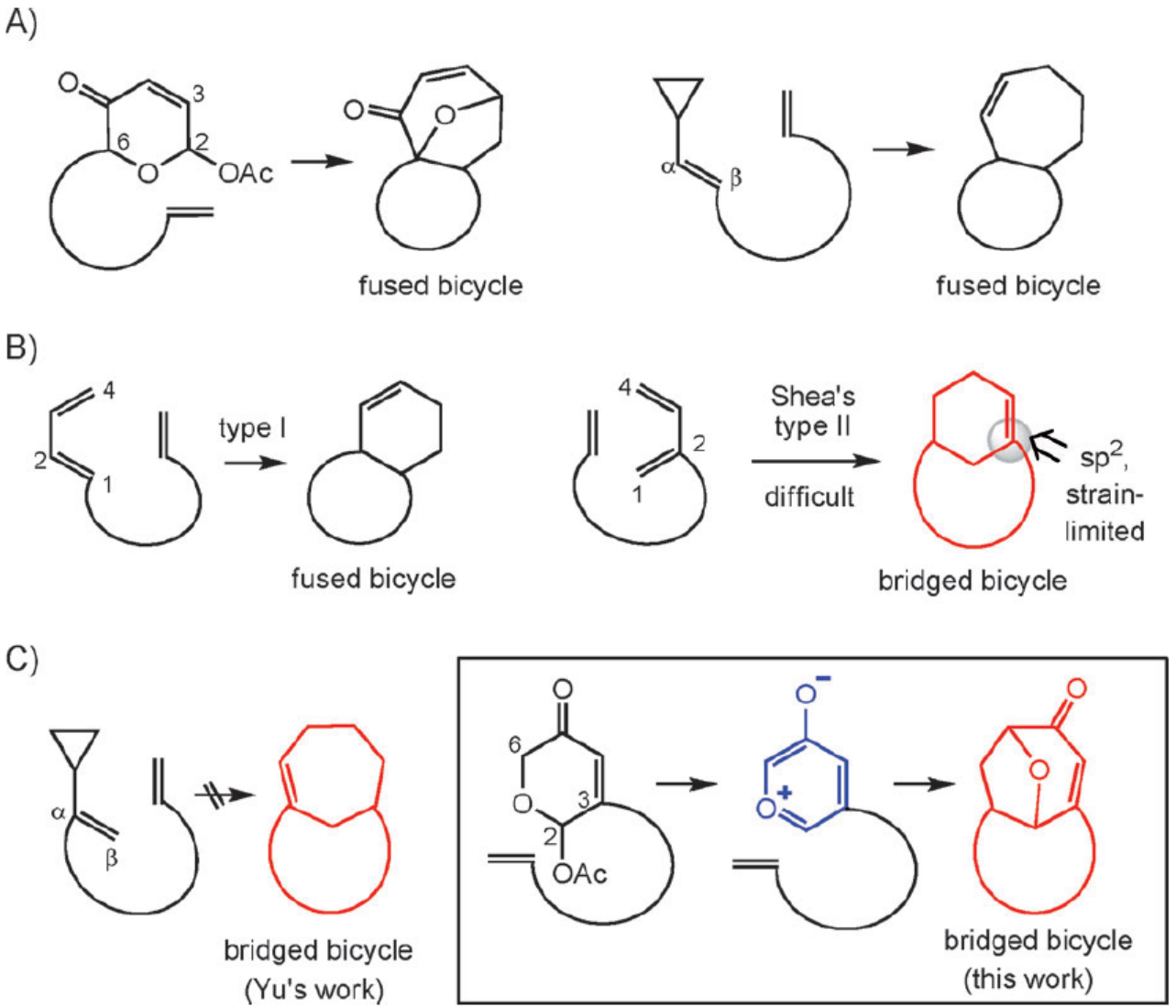
Achmatowicz反应(Achmatowicz Reaction)

反应机理



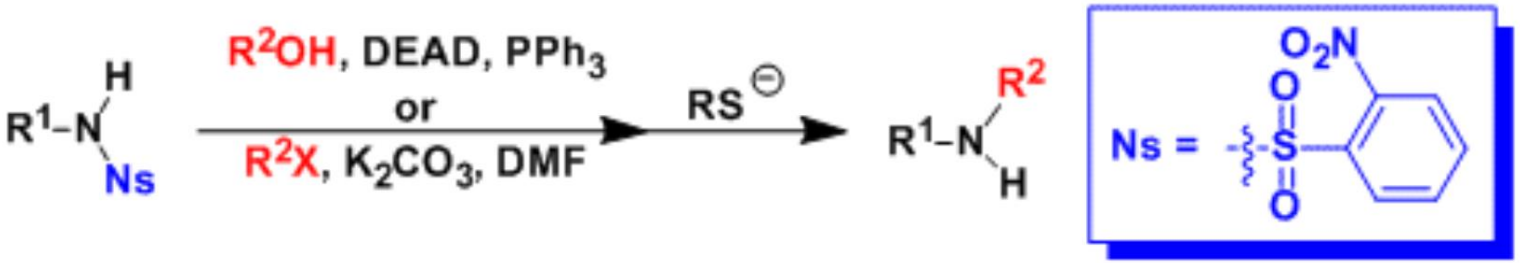
Type II Intramolecular [5+2] Cycloaddition: Facile Synthesis of Highly Functionalized Bridged Ring Systems**

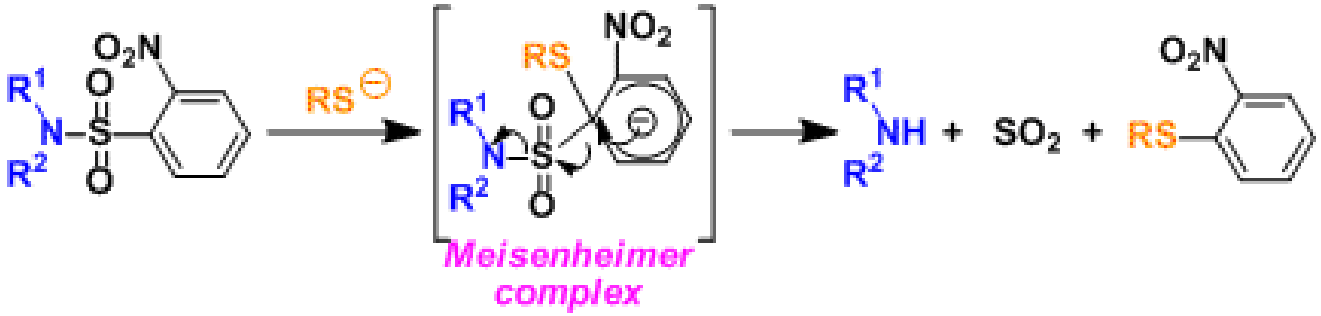
*Guangjian Mei, Xin Liu, Chuang Qiao, Wei Chen, and Chuang-chuang Li**

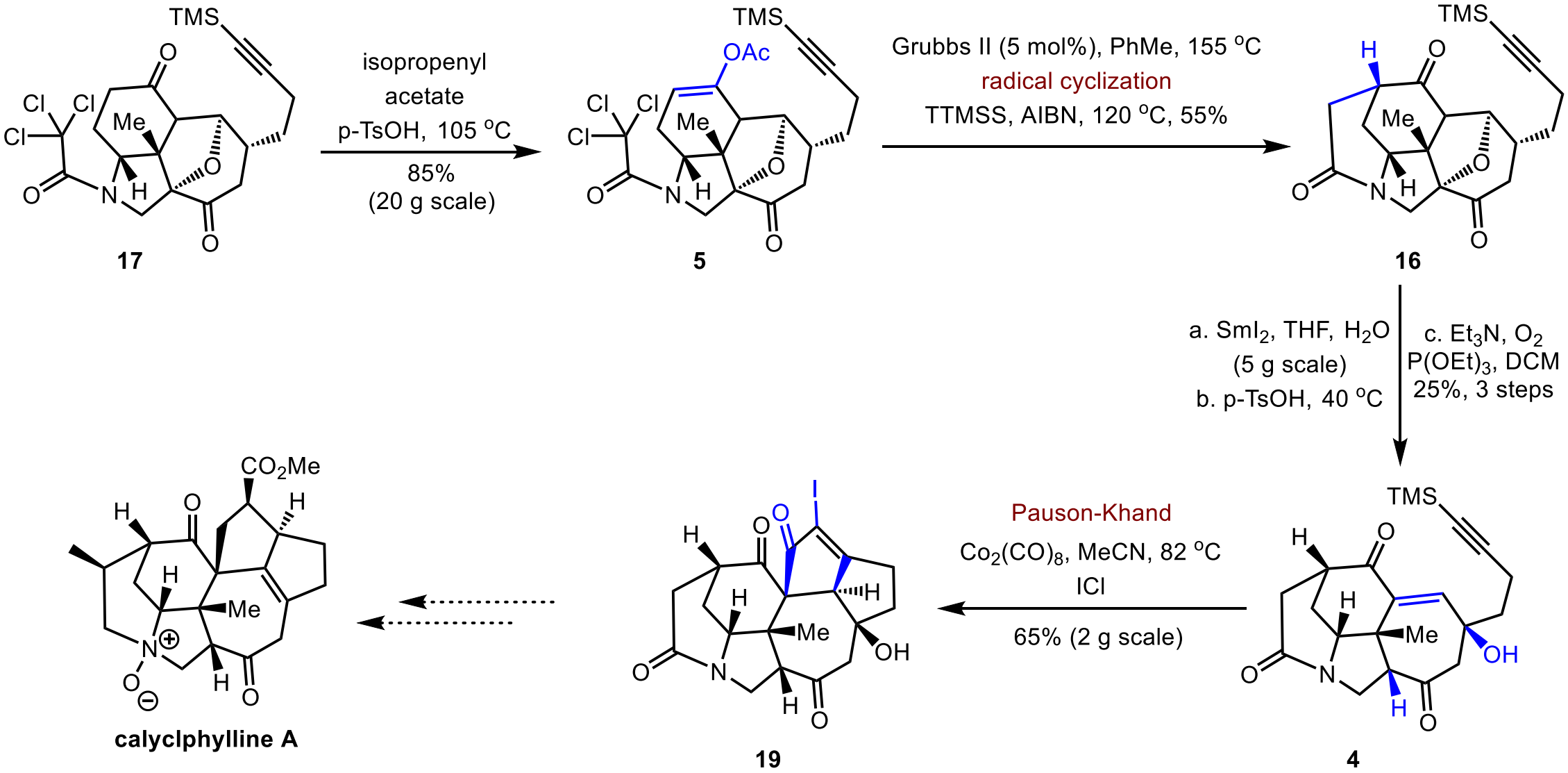


Angew. Chem. Int. Ed., **2015**, *54*, 1754.

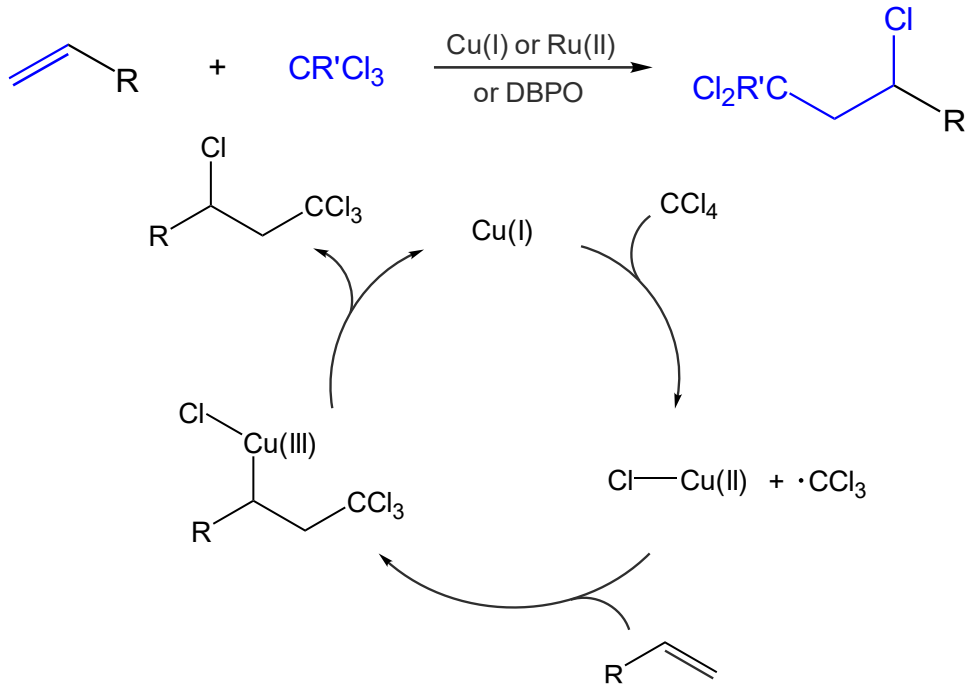
福山胺的合成法(Fukuyama Amine Synthesis)

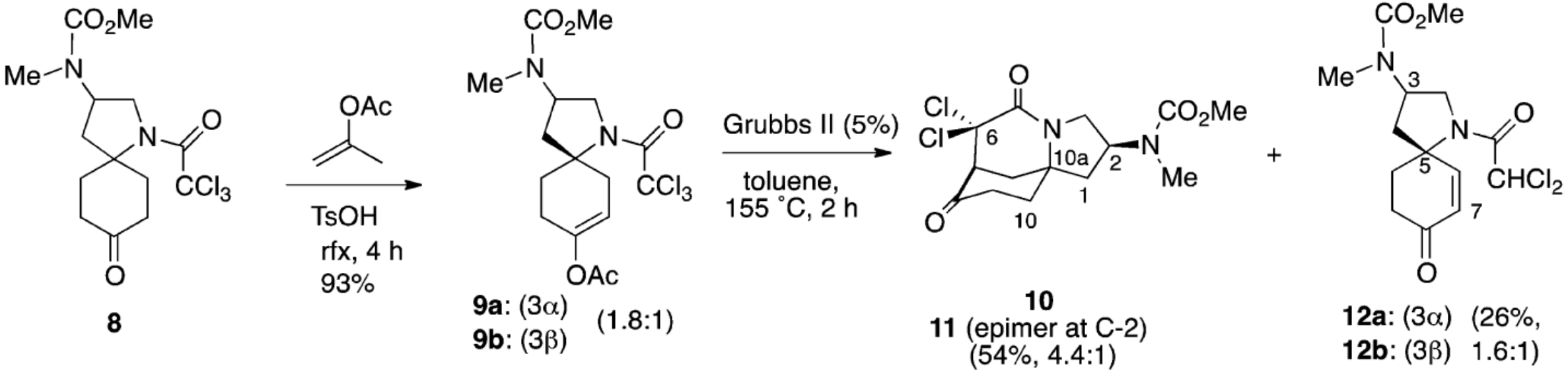




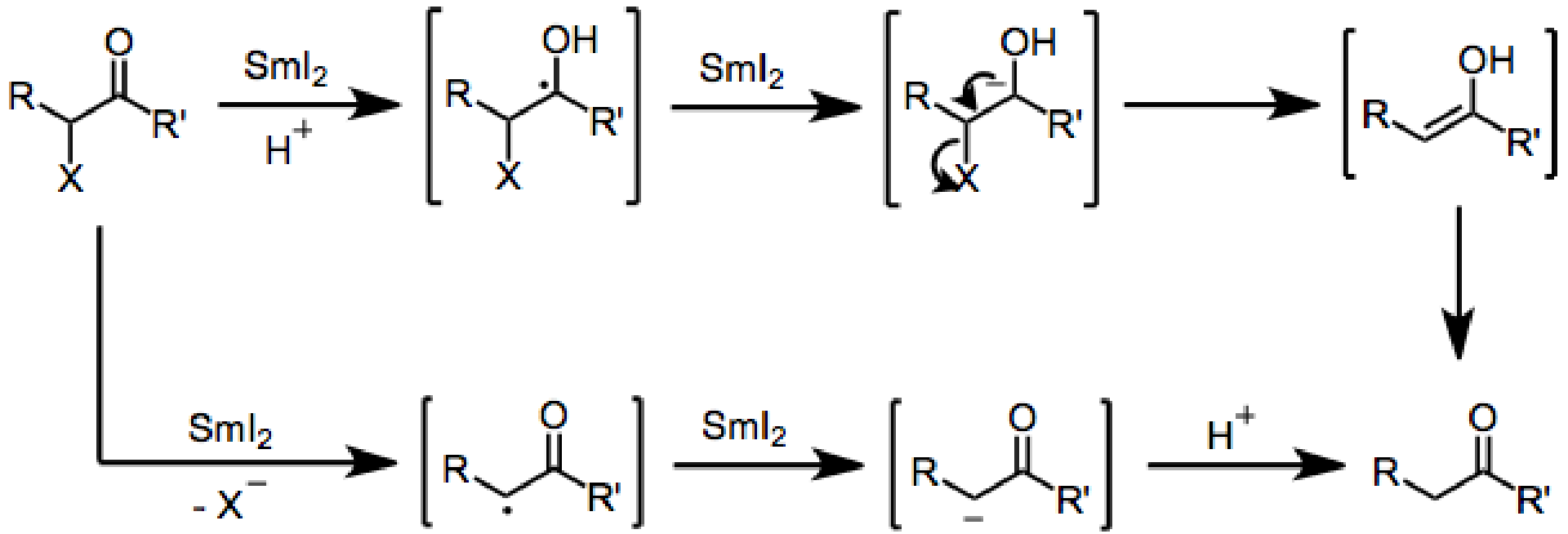

TMS
Cl
Cl
Cl
Me
O
N
H
17
isopropenyl
acetate
p-TsOH, 105 °C
85%
(20 g scale)
OAc
5
Grubbs II (5 mol%), PhMe, 155 °C
radical cyclization
TTMSS, AIBN, 120 °C, 55%
16
a. SmI2, THF, H2O
(5 g scale)
b. p-TsOH, 40 °C
c. Et3N, O2
P(OEt)3, DCM
25%, 3 steps
4
Pauson-Khand
Co2(CO)8, MeCN, 82 °C
ICl
65% (2 g scale)
I
OH
19
CO2Me
calyclphylline A

Kharasch Addition



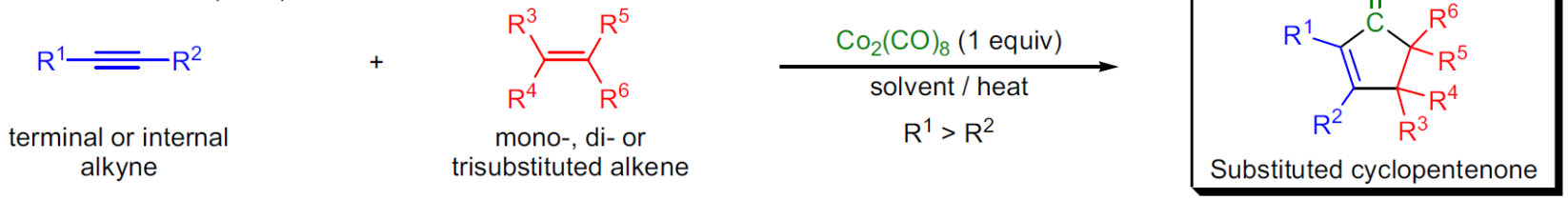


J. Org. Chem., **2014**, *79*, 9365.

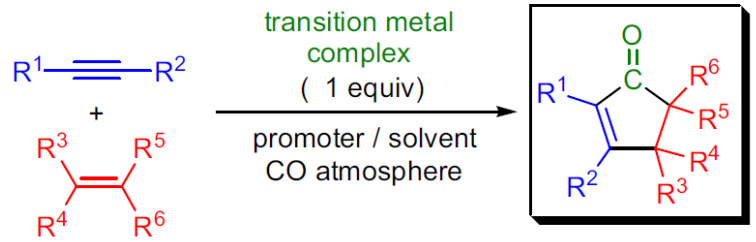

R
O
R'
X
SmI2
H+
OH
SmI2
OH
OH
SmI2
- X−
O
SmI2
O
H+
O

PAUSON-KHAND REACTION

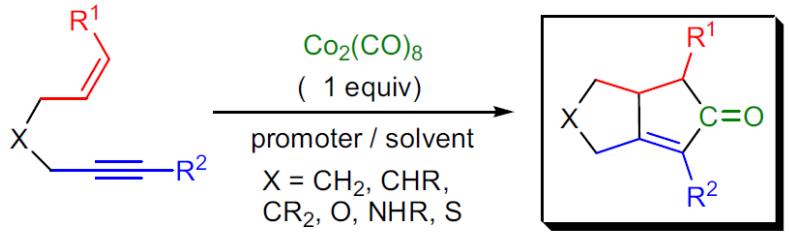
Pauson & Khand (1973):

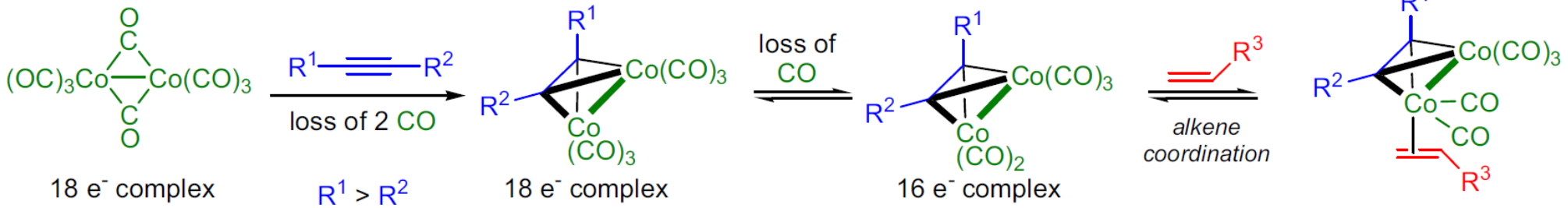


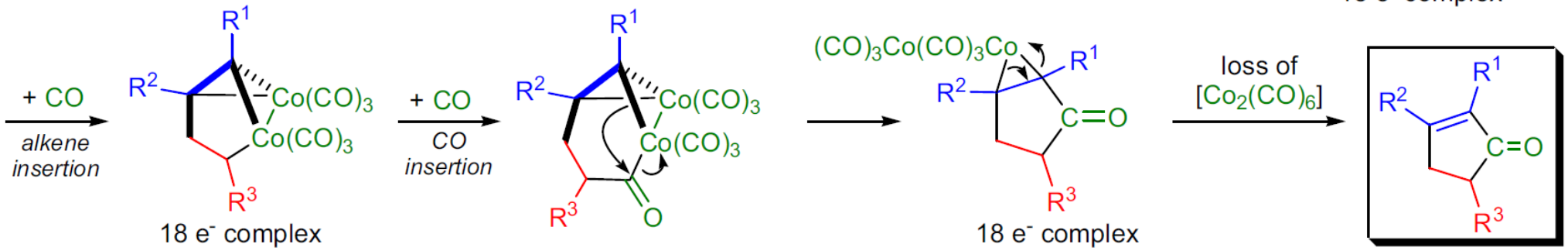
Modified P-K reaction:

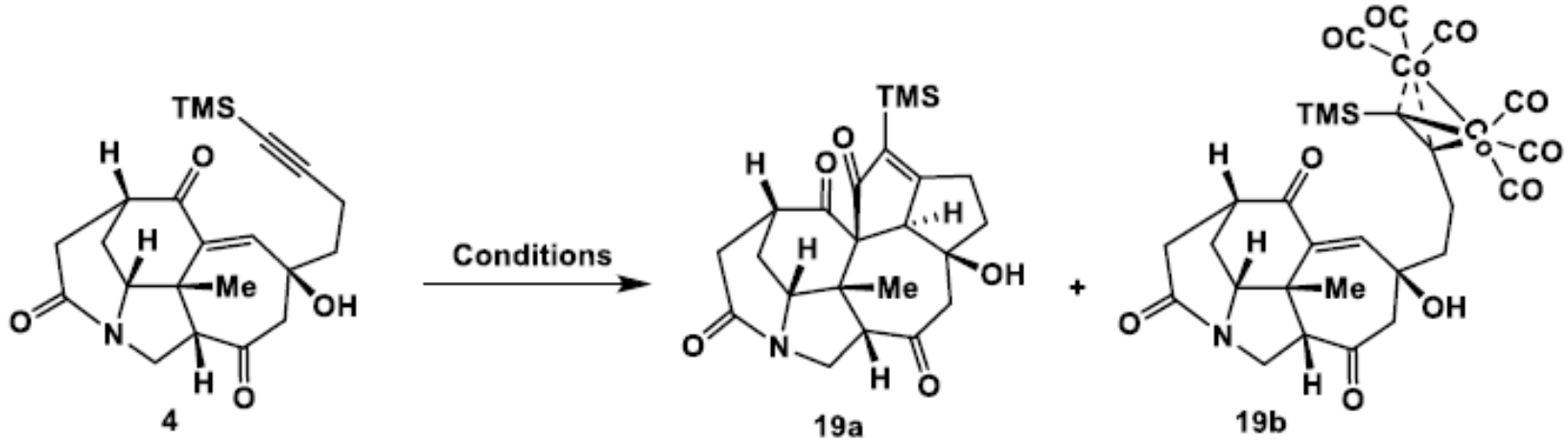


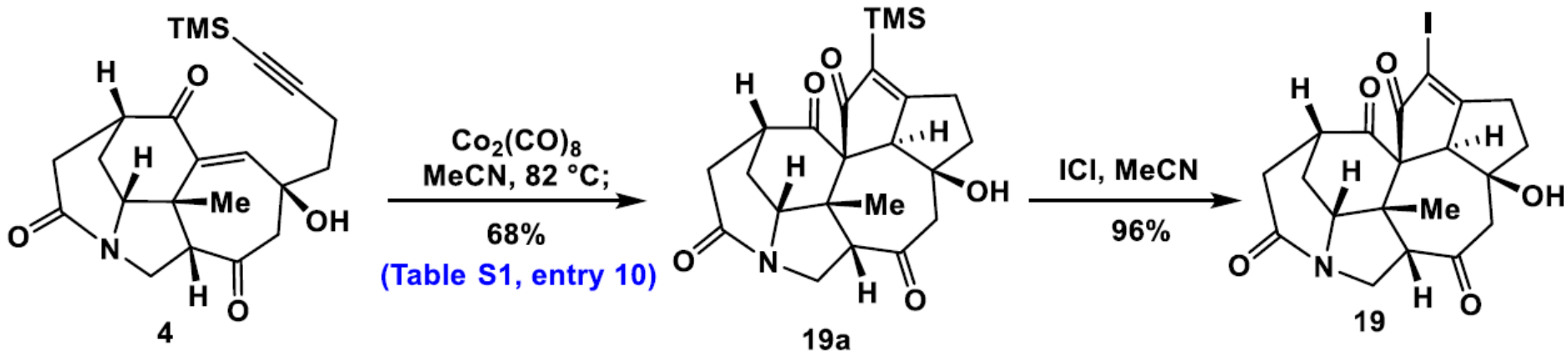
Intramolecular variant:

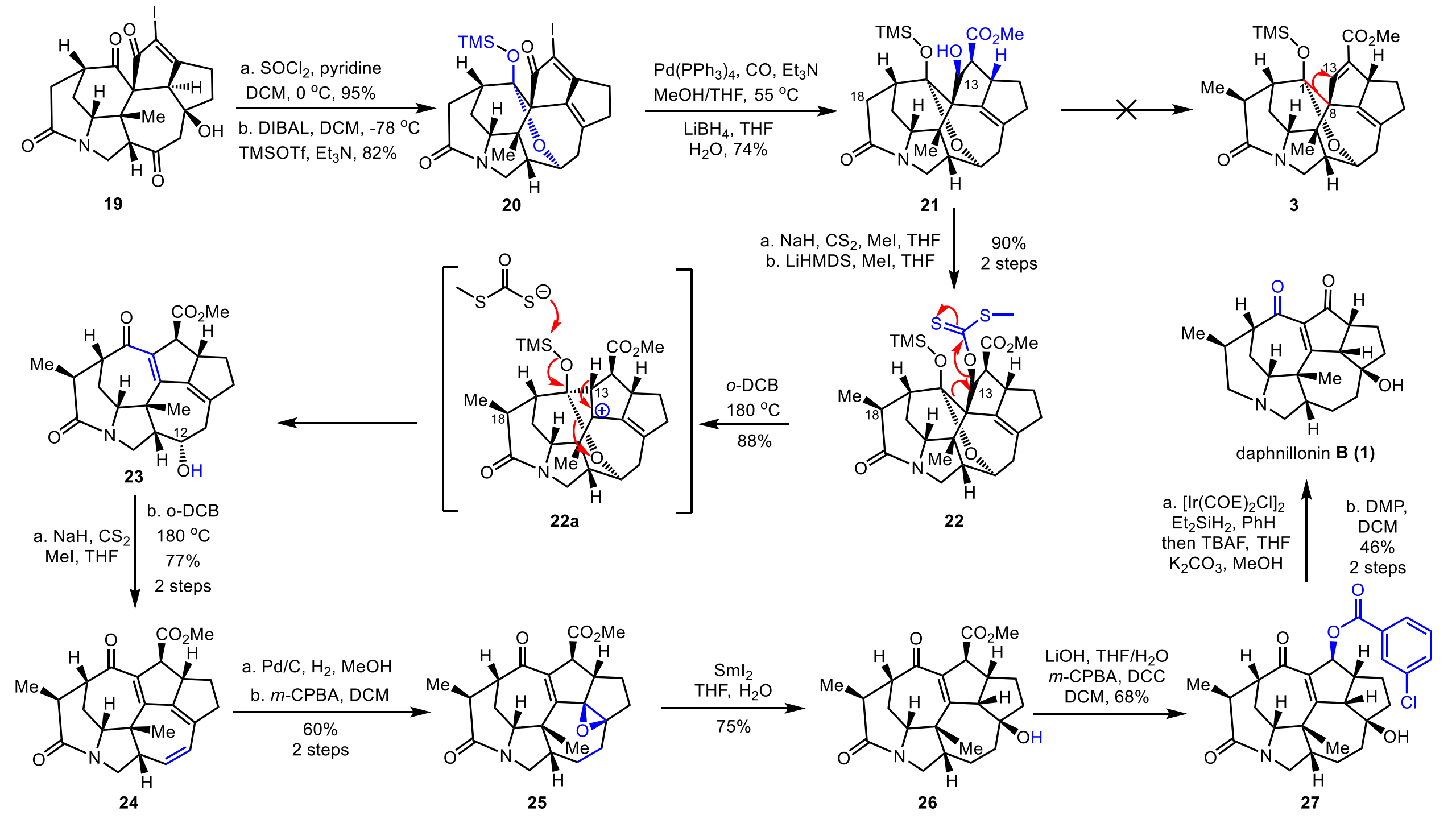


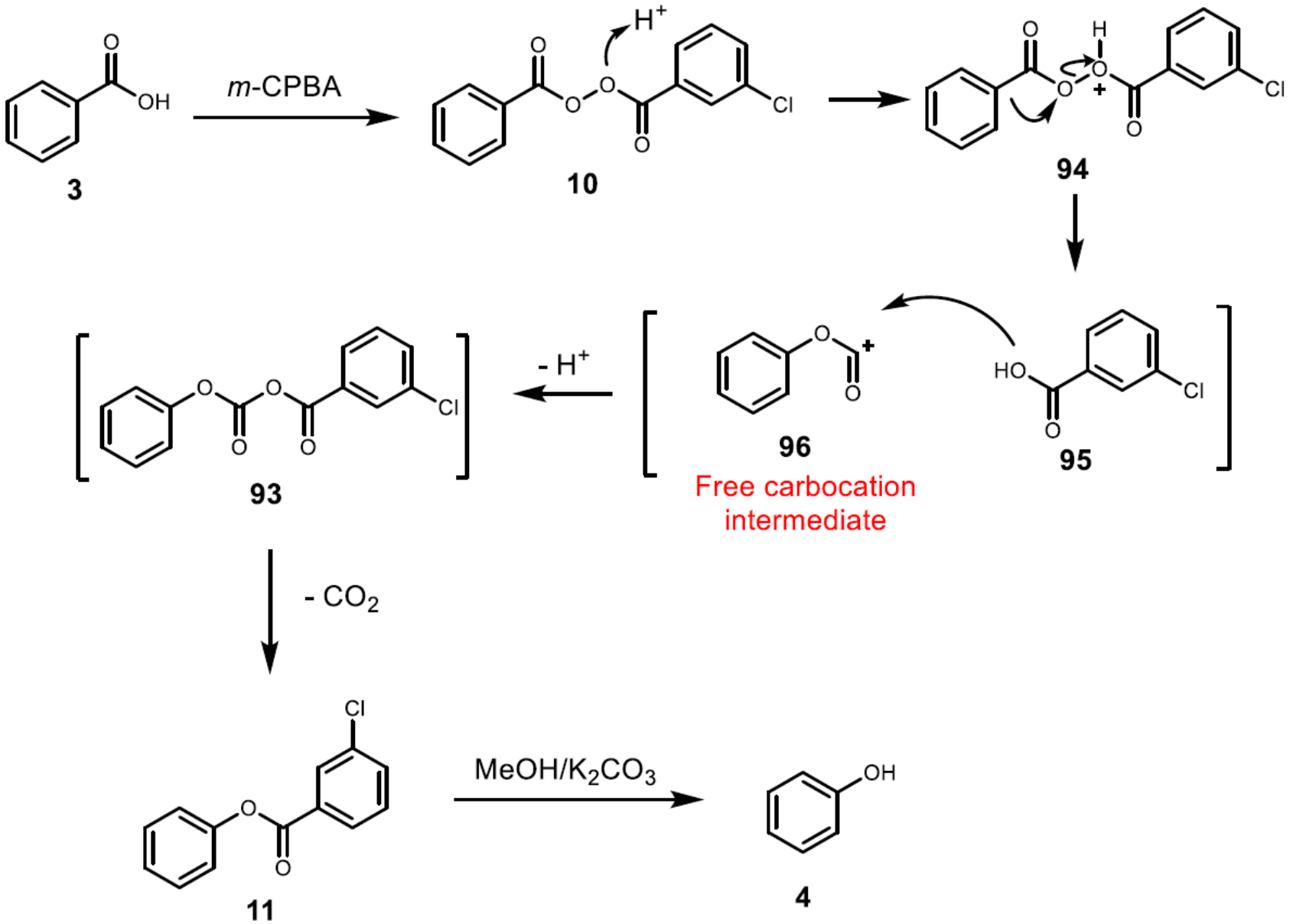





TMS
H
O
H
Me
OH
O
N
H
O
4
Conditions
TMS
H
O
H
Me
OH
O
N
H
O
19a
+
OC
OC
CO
Co
TMS
CO
Co
CO
CO
H
O
H
Me
OH
O
N
H
O
19b

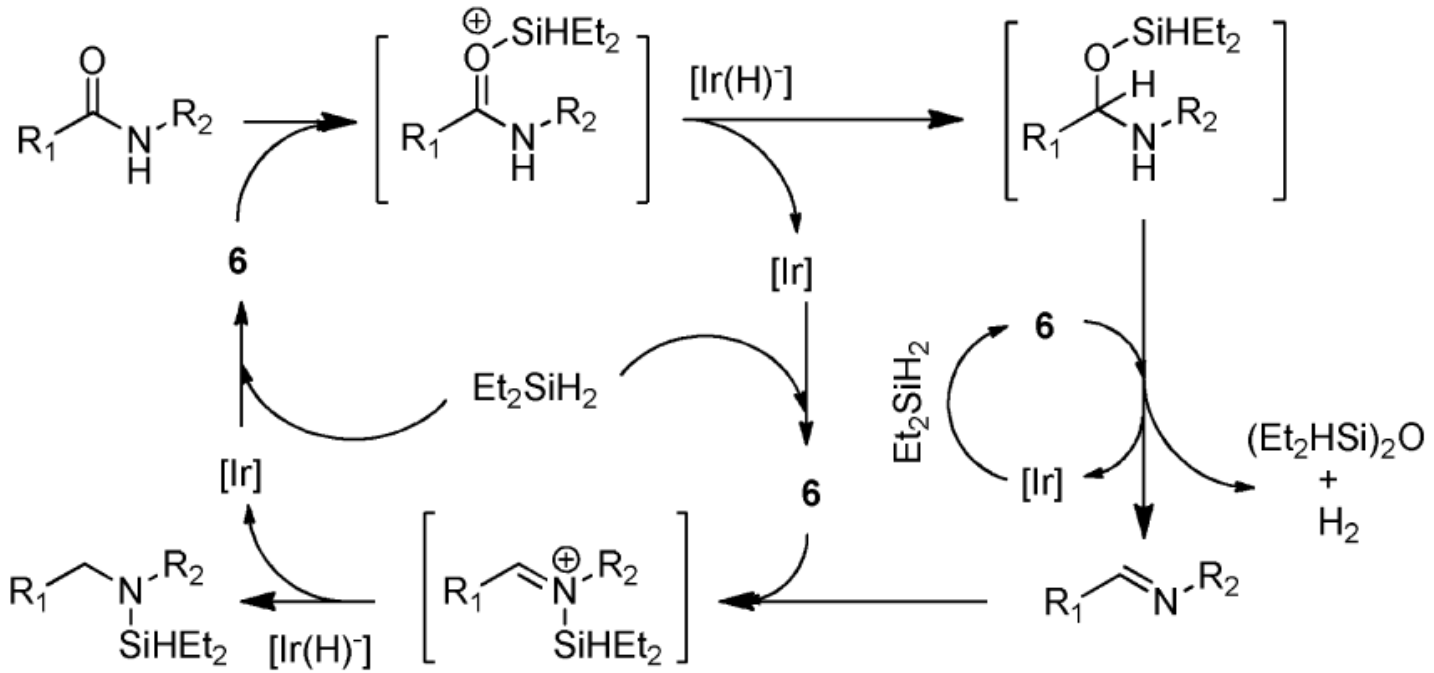

TMS
H
O
H
Me
OH
O
N
H
O
4
Co2(CO)8
MeCN, 82 °C;
68%
(Table S1, entry 10)
TMS
H
O
H
Me
OH
O
N
H
O
19a
ICl, MeCN
96%
I
H
O
H
Me
OH
O
N
H
O
19
Co2(CO)8, MeCN, 82 °C; ICl
65% (2 g scale)

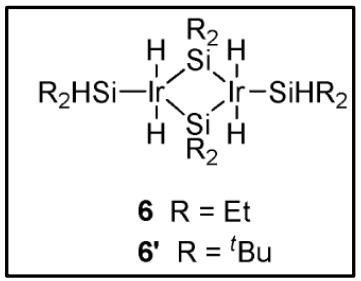

19
a. SOCl2, pyridine
DCM, 0 °C, 95%
b. DIBAL, DCM, -78 °C
TMSOTf, Et3N, 82%
20
Pd(PPh3)4, CO, Et3N
MeOH/THF, 55 °C
LiBH4, THF
H2O, 74%
21
3
a. NaH, CS2, MeI, THF
b. LiHMDS, MeI, THF
90%
2 steps
22
o-DCB
180 °C
88%
22a
23
a. NaH, CS2
MeI, THF
b. o-DCB
180 °C
77%
2 steps
daphnillonin B (1)
a. [Ir(COE)2Cl]2
Et2SiH2, PhH
then TBAF, THF
K2CO3, MeOH
b. DMP,
DCM
46%
2 steps
24
a. Pd/C, H2, MeOH
b. m-CPBA, DCM
60%
2 steps
25
SmI2
THF, H2O
75%
26
LiOH, THF/H2O
m-CPBA, DCC
DCM, 68%
27



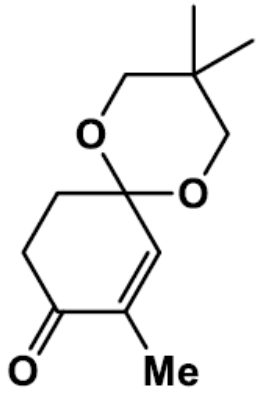
J. Am. Chem. Soc., **2022**, *144*, 15894.

Scheme 2. Proposed Mechanism for Iridium-Catalyzed Reduction of Secondary Amides to *N*-Silylamines





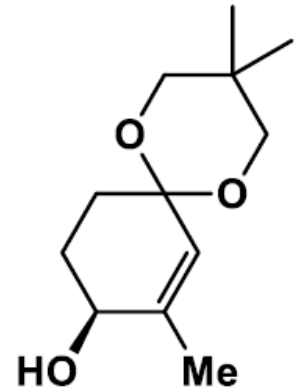
J. Am. Chem. Soc., **2012**, *134*, 11304.



13

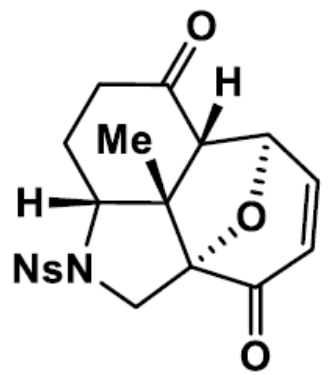
(*R*)-Me-CBS
$BH_3 \cdot Me_2S$, THF

95%, 96% *ee*
(50 g scale)



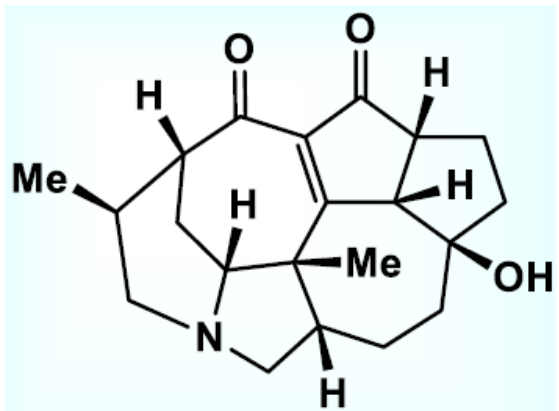
(-)-14

see Scheme 2



(-)-6 (X-ray)
>99% *ee*

see Scheme 2-3



(-)-daphnillonin B (1)