Asymmetric Total Synthesis of Cerorubenic Acid-III

Liu, X.; Liu, J.; Wu, J.; Huang, G.; Liang, R.; Chung, L. W.; Li, C.-C.

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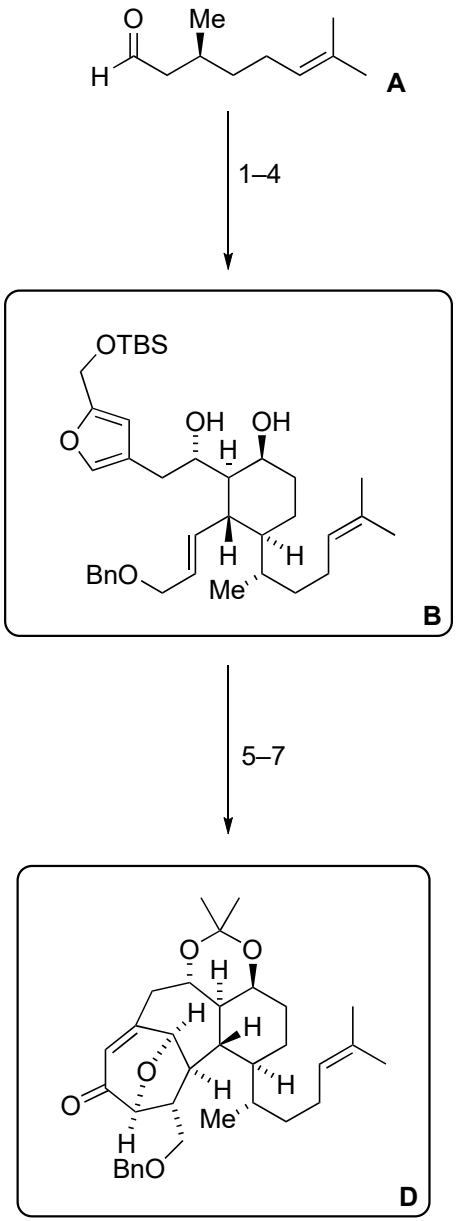
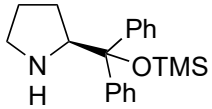
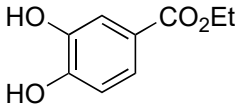


W =



1) MVK, **W** cat. **X** cat.
2) $LiOH•H_2O$ cat. *i*-PrOH
3) **Y**, *n*-BuLi *then* CuCN, MeLi; add substrate *then* TMSCl, Et_3N
4) *n*-BuLi *then* $ZnBr_2$, **Z** *then* DIBAL-H

X =



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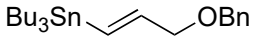

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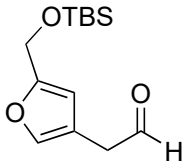


5) PTSA, acetone *then* TBAF
6) $VO(acac)_2$ cat. *t*-BuOOH *then* Ac_2O, DMAP, Et_3N
7) TMP, MeCN, 170 °C

Name of the starting material?

(*S*)-citronellal

Please provide the mechanism of the reaction in **Step 1 and 2**.

See below

Please provide the mechanism of the reaction in **Step 3 and 4**.

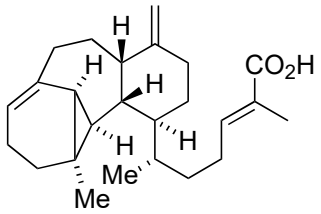
See below

Please provide the name and mechanism of the reaction in **Step 6**.

Achmatowicz reaction; see below

Key step: Please classify the reaction in **Step 7** and provide a mechanism.

Type II [5+2] cycloaddition; see below

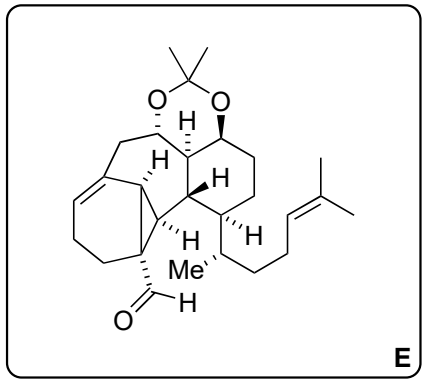


Cerorubenic Acid-III

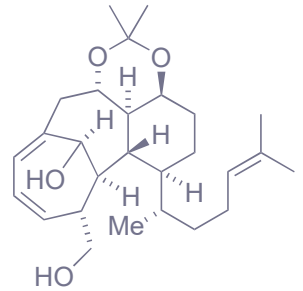
8–13

8) DIBAL-H
9) KHMDS, THF, 0 °C *then* 1-tosylimidazole *then* LiBr
10) sodium naphthalenide, H_2O, THF
11) TBSOTf, Et_3N *then* KHMDS 1-tosylimidazole *then* TBAF
12) DMP
13) *t*-BuOK, *t*-BuOH

Hint: sodium naphthalenide cleaves in total 2 C–O bonds and reduces a double bond. Under anhydrous conditions a diene can be isolated. Provide its structure.



E



diene that can be isolated

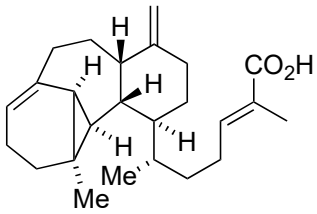
14–19

14) N_2H_4•H_2O, KOH, $(CH_2OMe)_2$, 190 °C *then* AcOH:H_2O:THF (4:2:1), RT
15) Ac_2O, DMAP, Et_3N *then* DMP
16) KHMDS
17) $NiCl_2$•$6H_2O$, $NaBH_4$, MeOH
18) CH_3PPh_3Br, *n*-BuLi
19) methacrylaldehyde, Grubbs II *then* $AgNO_3$, NaOH

Please provide the name of the rection in **Step 14**.

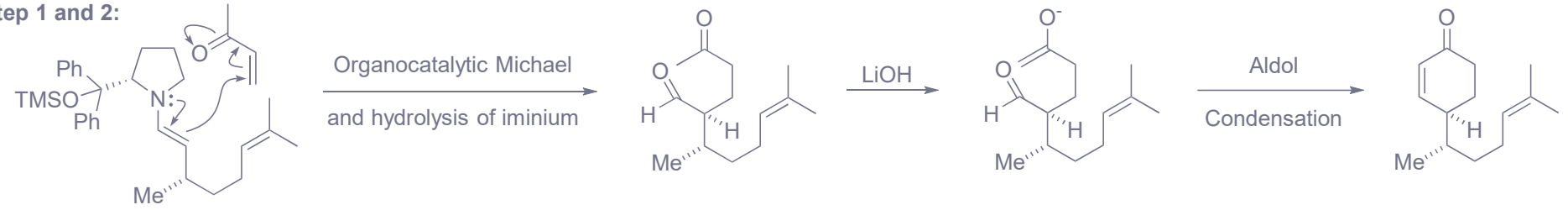
Wolff–Kishner reduction; Huang modification

$AgNO_3$ and NaOH forms Ag_2O *in situ*

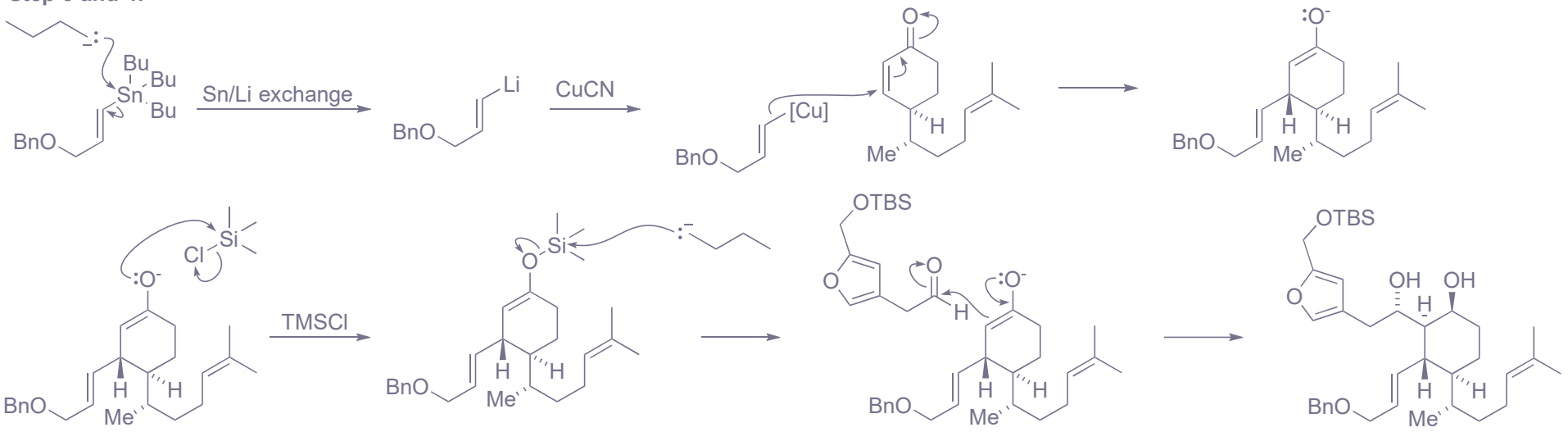


Cerorubenic Acid-III

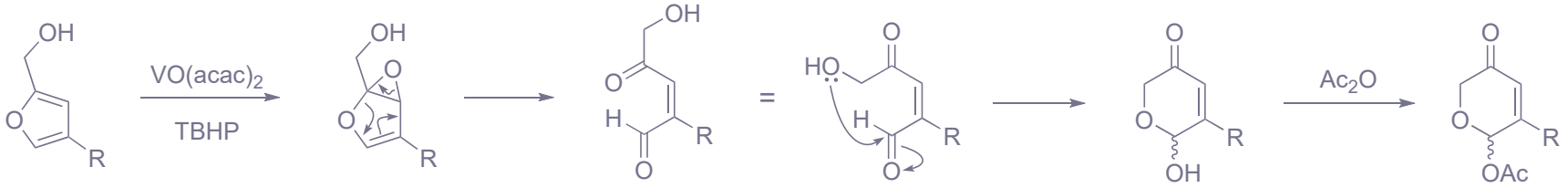
Step 1 and 2:



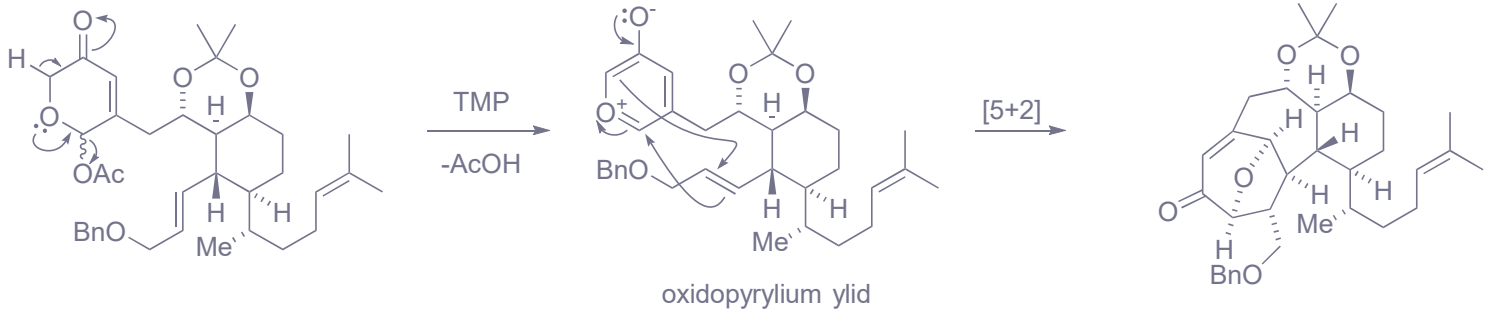
Step 3 and 4:



Step 6:



Step 7:



oxidopyrylium ylid