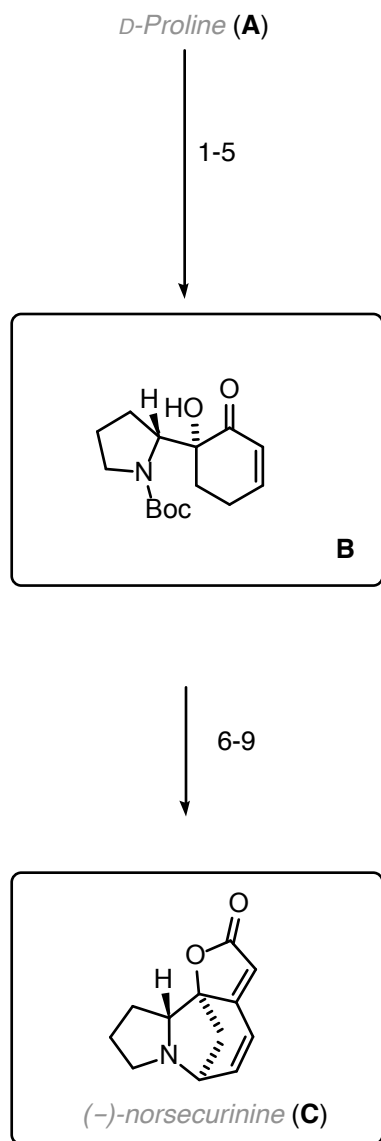


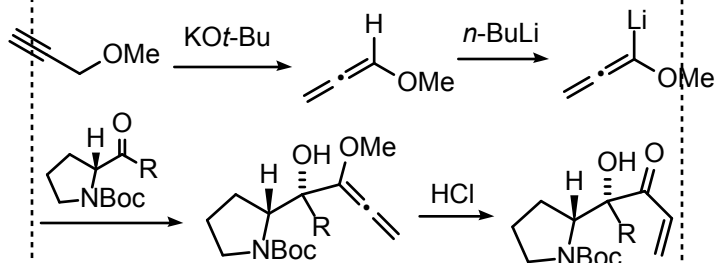
Total synthesis of securinega alkaloids (-)-norsecurinine, (-)-niruroidine and (-)-flueggine A

Nan Ma, Yiwu Yao, Bing-Xin Zhao, Ying Wang, Wen-Cai Ye and Sheng Jiang, *Chem. Commun.* **2014**, 50, 9284–9287.



- 1) (Boc)₂O, NaHCO₃
- 2) CDI, MeNHOMe·HCl, DCM
- 3) 4-Bromo-1-butene, BrCH₂CH₂Br, Mg
- 4) Methyl propargyl ether, KO^tBu; *n*-BuLi
then product of Step 3; HCl
- 5) 2nd generation Grubbs catalyst

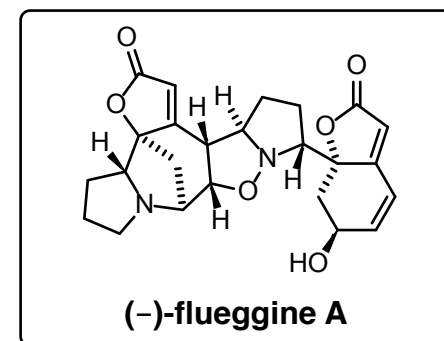
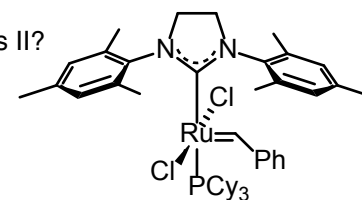
Mechanism of Step 4



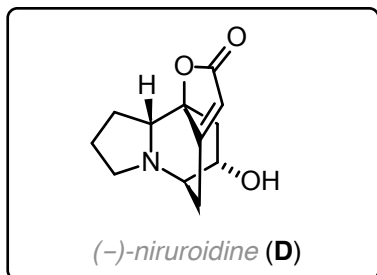
- 6) NBS, AIBN, CCl₄, reflux
- 7) TFA, then Et₃N
- 8) DCC, diethylphosphonoacetic acid
- 9) NaH, THF

Step 3: What is the role of BrCH₂CH₂Br?
Activation of the magnesium surface
Mechanism of Step 4.

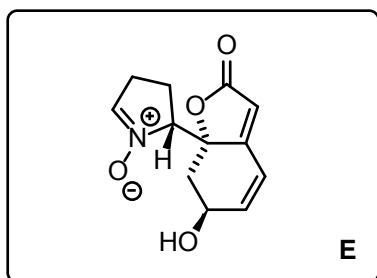
Structure of Grubbs II?



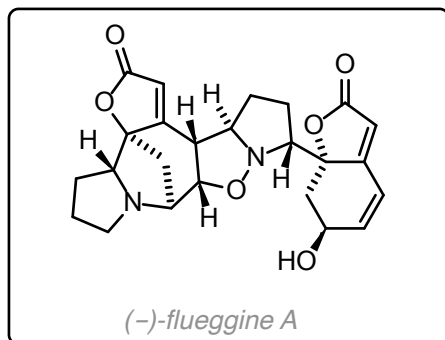
10-12



13-15



16



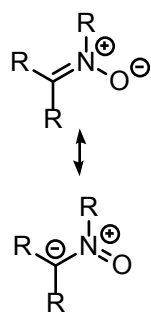
- 10) TrocCl, K₂CO
 11) AgBF₄, acetone, H₂O, 60 °C
 12) Zn, AcOH, H₂O
 then NH₃·H₂O

Further methods for nitrene formation:

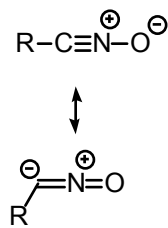
- 13) Dess-Martin periodinane
 14) NaBH₄, MeOH
 15) Na₂WO₄, H₂O₂

- 16) (-)-norsecurinine (**C**), PhMe, reflux

Allyl anion type



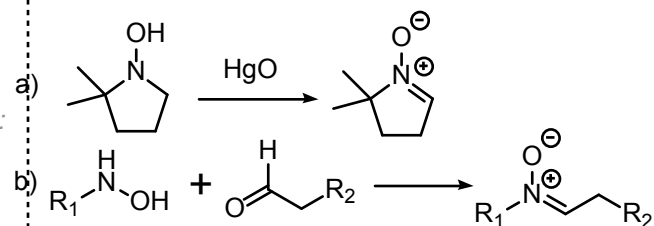
Propargyl/allenyl anion type



Step 11 results in a single diastereomer. Explain this exclusive selectivity.

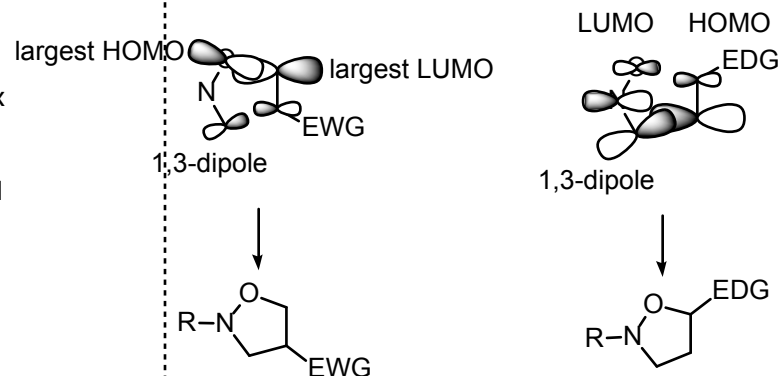
neighboring group participation (anchimeric assistance)

Treatment of **D** with PPh₃ and DIAD results in an efficient skeletal rearrangement (87%). Please provide the product and a possible mechanism for this transformation.



Please provide a mechanism for Step 15.
 What other methods for forming this 1,3-dipole do you know?

Assign the 1,3-dipole to its respective type.
 Explain the regiochemistry of this reaction by frontier orbital interactions.

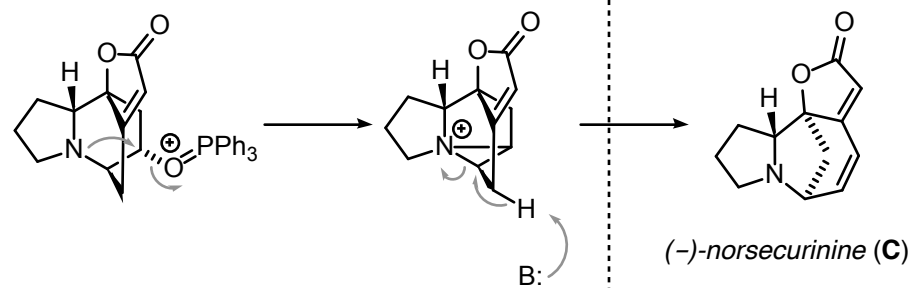


EWG = electron withdrawing group

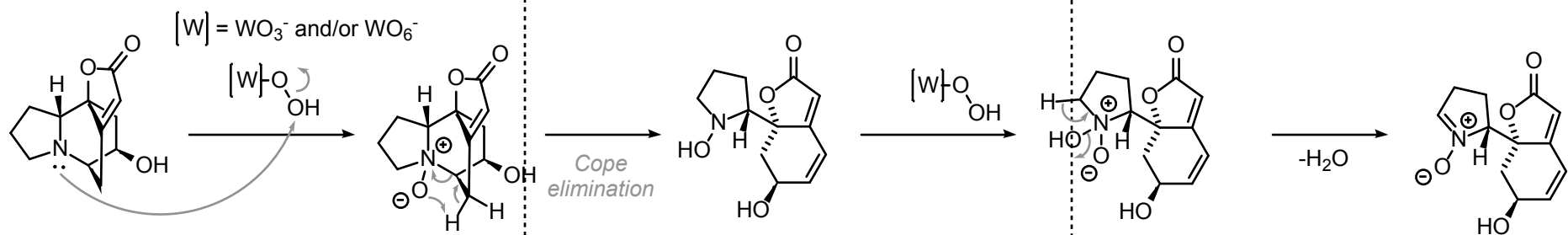
EDG = electron donating group

The overlap of the highest orbital coefficients of HOMO and LUMO determine the regioselectivity

Treatment of **D** with PPh_3 and DIAD



Mechanism of Step 13^[4]



4) S. Murahashi, H. Mitsui, T. Shiota, T. Tsuda and S. Watanabe, *J. Org. Chem.* **1990**, 55, 1736.

References

- 1) Brueckner, R. "Organic Mechanisms — Reactions, Stereochemistry and Synthesis", pages 674–686.
- 2) Sustmann, R. *Heterocycles* **1995**, 40, 1-18.
- 3) Houk, K. N. *JACS* **1972**, 94, 8953.