

Total Synthesis Cyclopiamine B

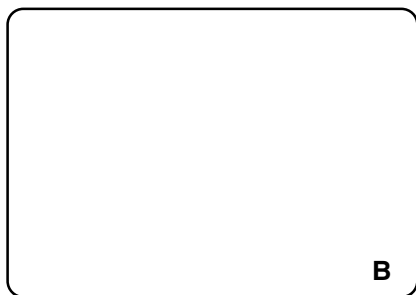
E. V. Mercado-Marin, P. Garcia-Reynaga, S. Romminger, E. F. Pimenta, D. K. Romney, M. W. Lodewyk, D. E. Williams, R. J. Andersen, S. J. Miller, D. J. Tantillo, R. G. S. Berlinck, R. Sarpong, *Nature* **2014**, *509*, 318–324.

(*R*)-Proline

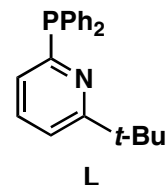
↓ 1–7



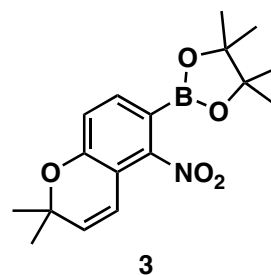
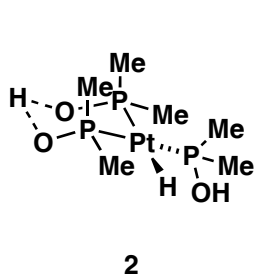
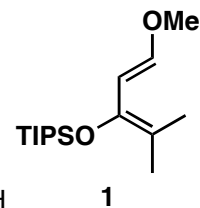
↓ 8–13



- 1) Boc_2O , NaHCO_3
- 2) $\text{BH}_3 \cdot \text{THF}$
- 3) $(\text{COCl})_2$, DMSO, *i*- Pr_2NEt
- 4) $\text{N}_2\text{CHPO}(\text{OMe})_2$, K_2CO_3
- 5) HCl
- 6) 2-cyanoacetylchloride, NEt_3
- 7) $[\text{Ru}(\text{Cp})(\text{MeCN})\text{L}_2]\text{PF}_6$, H_2O , 70°C



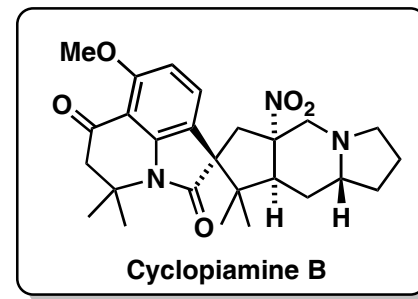
- 8) **1**, SnCl_4
- 9) I_2 , py, DMAP
- 10) **2**, EtOH, H_2O
- 11) PIFA, MeOH
- 12) **3**, dppfPdCl_2 , K_3PO_4
- 13) Zn , NH_4Cl , HCO_2NH_4 , *p*- TsOH



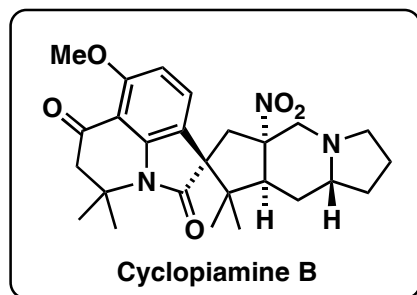
Step 4: Please name the reaction. How would you prepare this reagent?

Step 7: Hint: Two reactions take place.

Step 10: What is the name of the catalyst? What is the mechanism?



14–21



- 14) NaCNBH₃, HCl
- 15) Pd(OAc)₂, benzoquinone, H₂SO₄
- 16) Me₂S, MsOH
- 17) oxone, NaHCO₃, acetone
- 18) Me₃OBF₄
- 19) NaCNBH₃
- 20) NaH, DMF, 60 °C
- 21) MeI, K₂CO₃

Step 15: Please name the reaction. What is the role of benzoquinone?