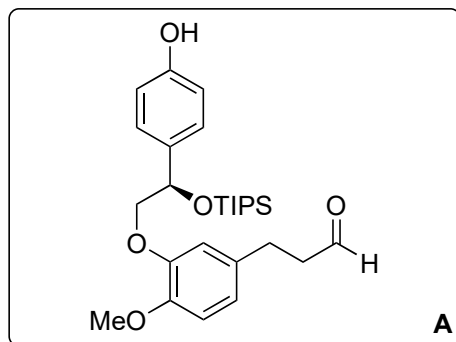


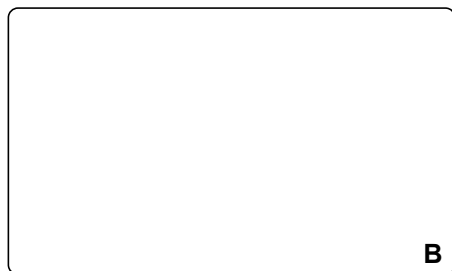
Gram-Scale Enantioselective Formal Synthesis of Morphine

M. Tissot, R. J. Phipps, C. Lucas, R. M. Leon, R. D. M. Pace, T. Ngouansavanh, M. J. Gaunt
Angew. Chem. Int. Ed. **2014**, *53*, 13498–13501



1

1) $\text{PhI}(\text{OAc})_2$, TFE, $-40\text{ }^\circ\text{C}$

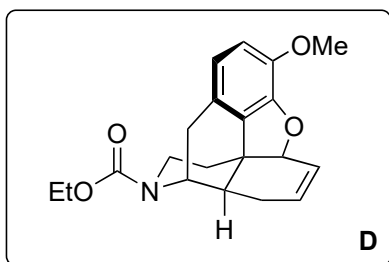


2-4

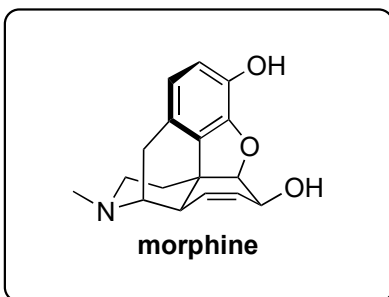
2) DBU (0.1 equiv), CH_2Cl_2
3) NaClO_2 , NaH_2PO_4 , *t*-BuOH/ H_2O , 2-methyl-2-butene
4) DPPA, NEt_3 , *t*-BuOH



5-10



seven steps



- 5) TBAF, THF
- 6) MsCl, Et₃N, DMAP, CH₂Cl₂
- 7) DBU, MeCN, 85 °C
- 8) NaBH₄, CeCl₃, MeOH
- 9) HCl (aq.), 80 °C, MW
- 10) NaBH(OAc)₃, AcOH/DCE *then* ClCO₂Et, Et₃N

Please provide a mechanism for step 9.

Bonus question

Please develop a route to convert **D** into morphine.