Concise Synthesis of 9,11-Secosteroids Pinnigorgiols B and E

Xinghui Li,[‖] Zeliang Zhang,[‖] Huafang Fan, Yinlong Miao, Hailong Tian, Yucheng Gu, and Jinghan Gui*

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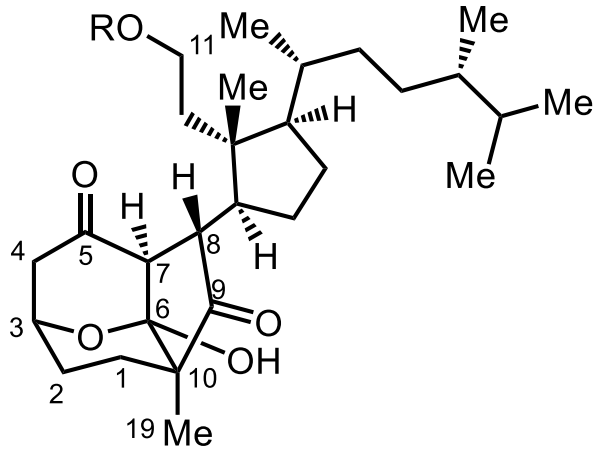
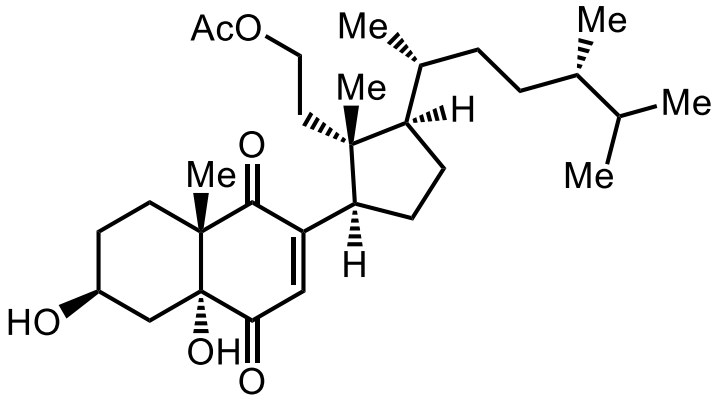
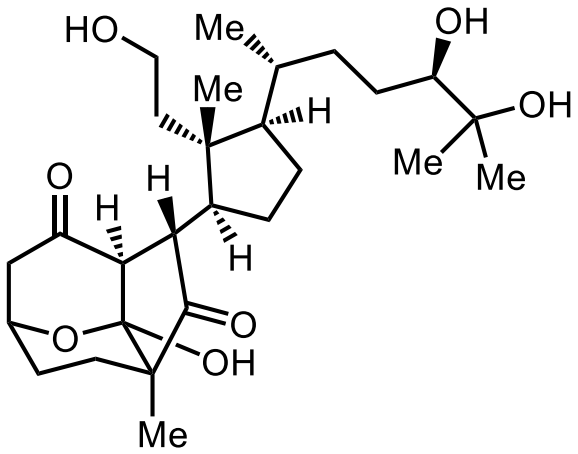


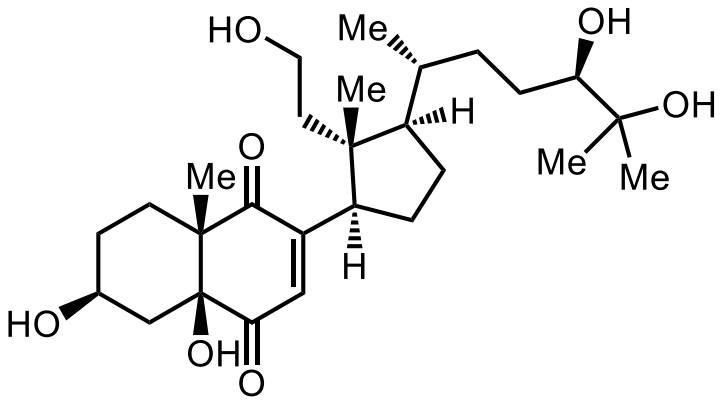
R = H, pinnigorgiol B (**1**)
R = Ac, pinnigorgiol E (**2**)



pinnisterol E (**3**)

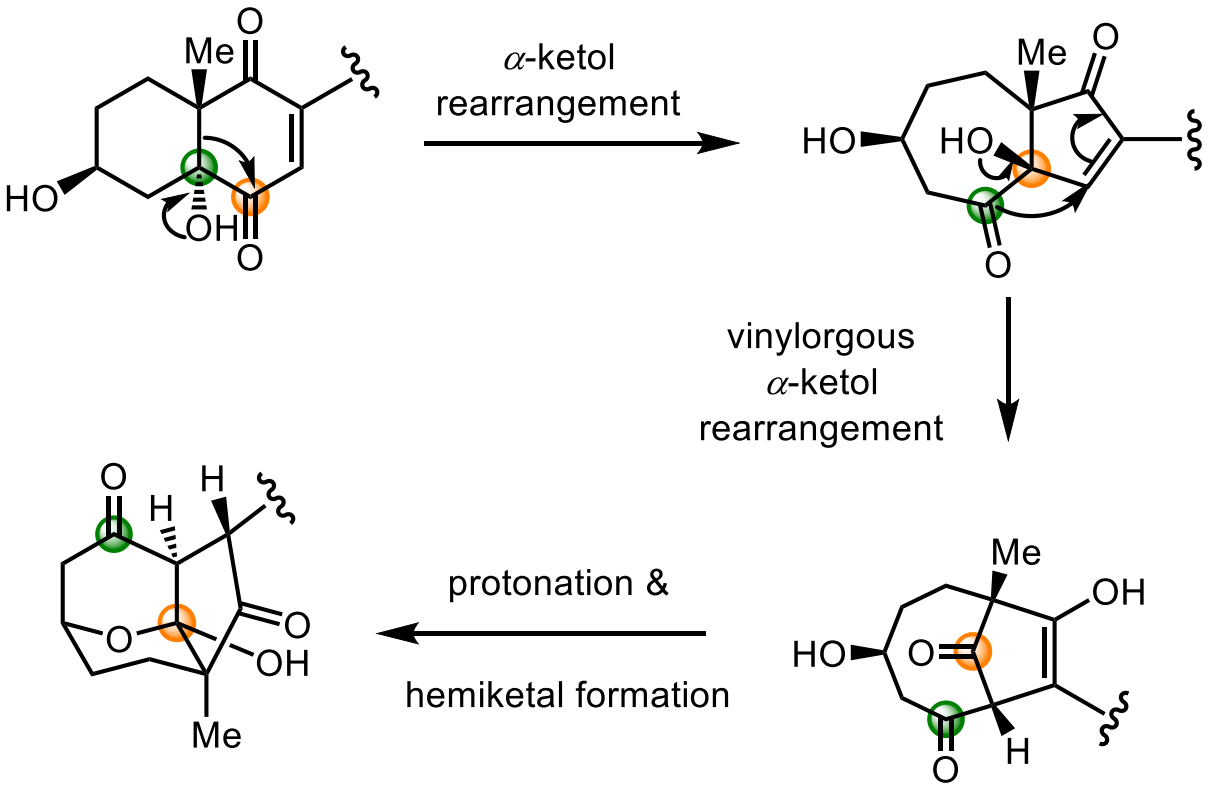


aplysiasecosterol A (**4**)

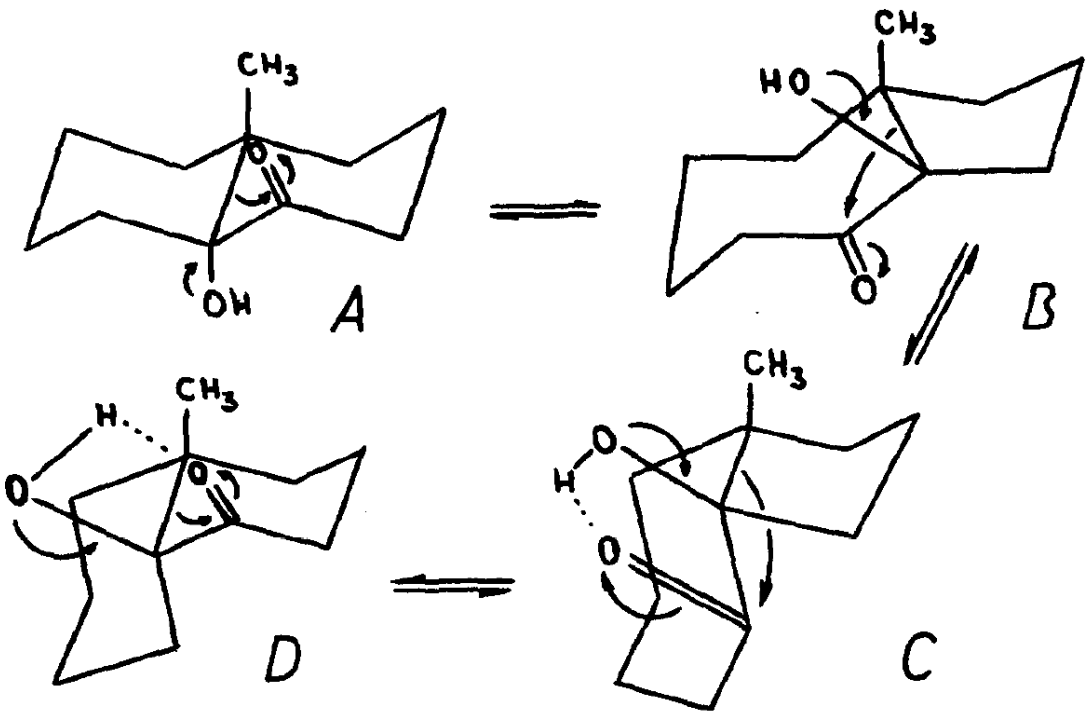


aplysiasecosterol B (**5**)

Proposed biosynthetic pathway：tandem α-ketol rearrangement

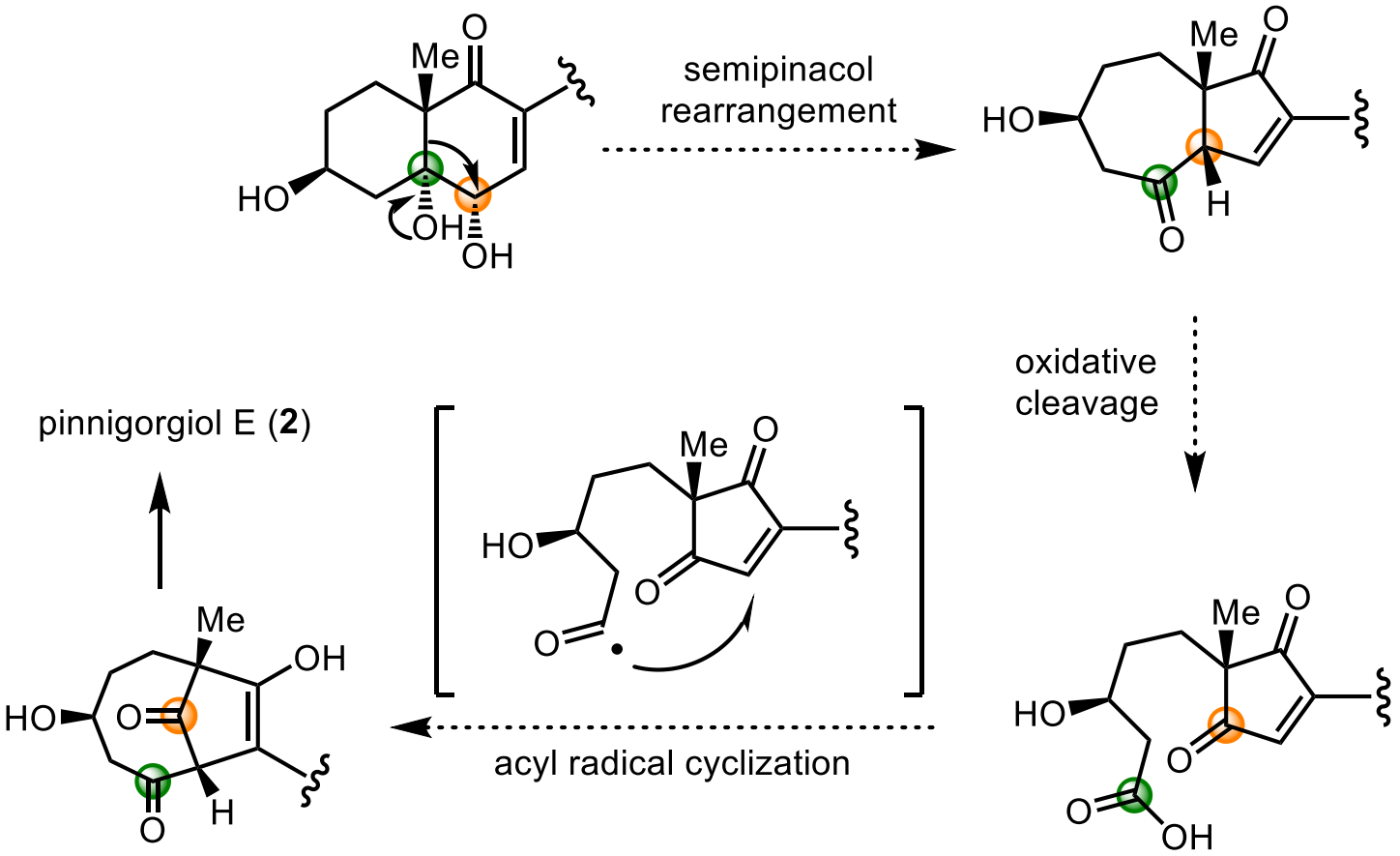


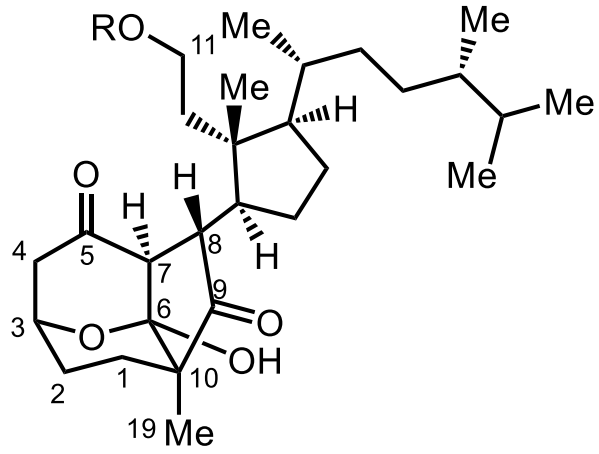
BASE CATALYSED REARRANGEMENTS OF α-KETOLS



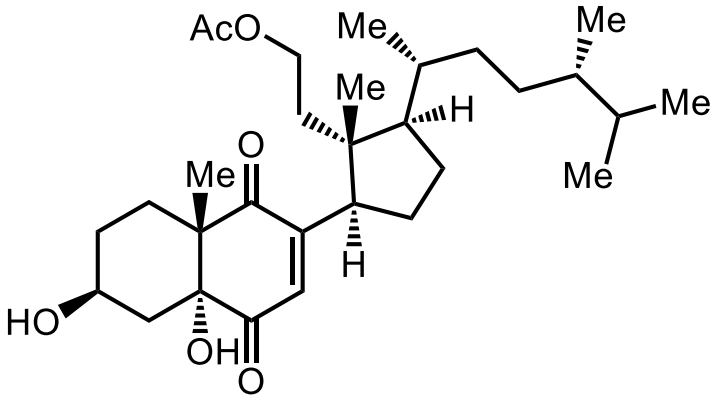
Tetrahedron Lett. **1961**, *2*, 817.

An acyl radical cyclization approach to the core framework

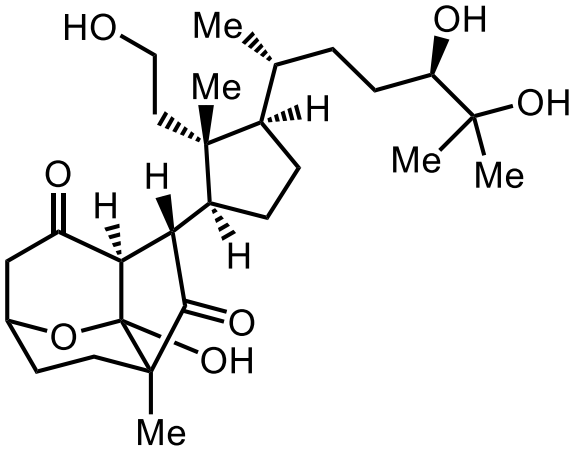




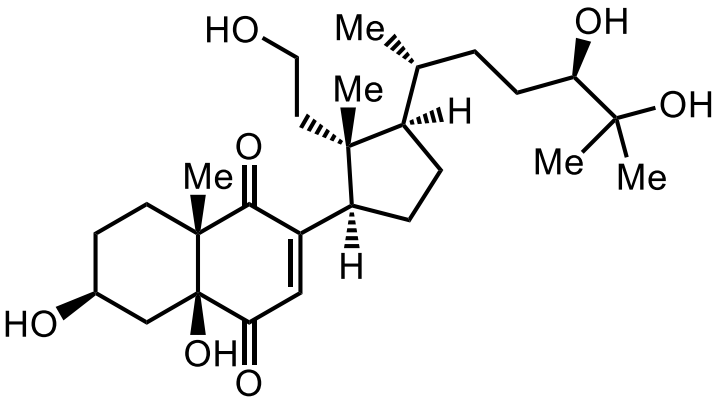
R = H, pinnigorgiol B (**1**)
R = Ac, pinnigorgiol E (**2**)



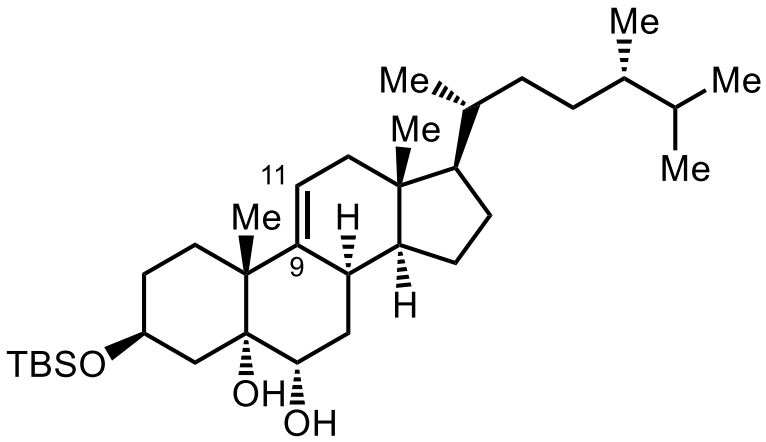
pinnisterol E (**3**)



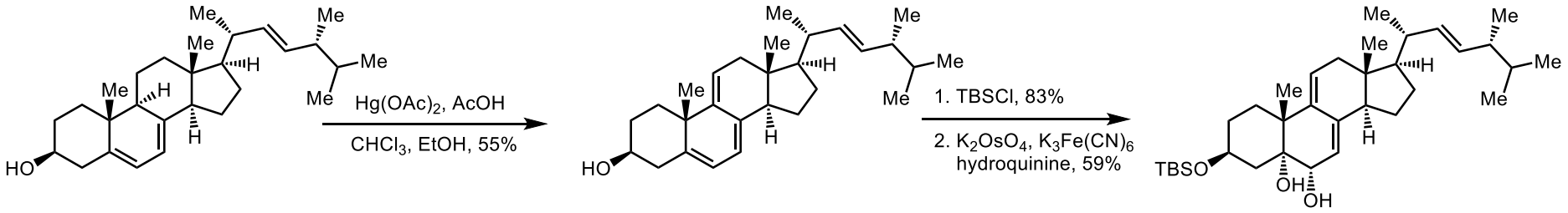
aplysiasecosterol A (**4**)



aplysiasecosterol B (**5**)

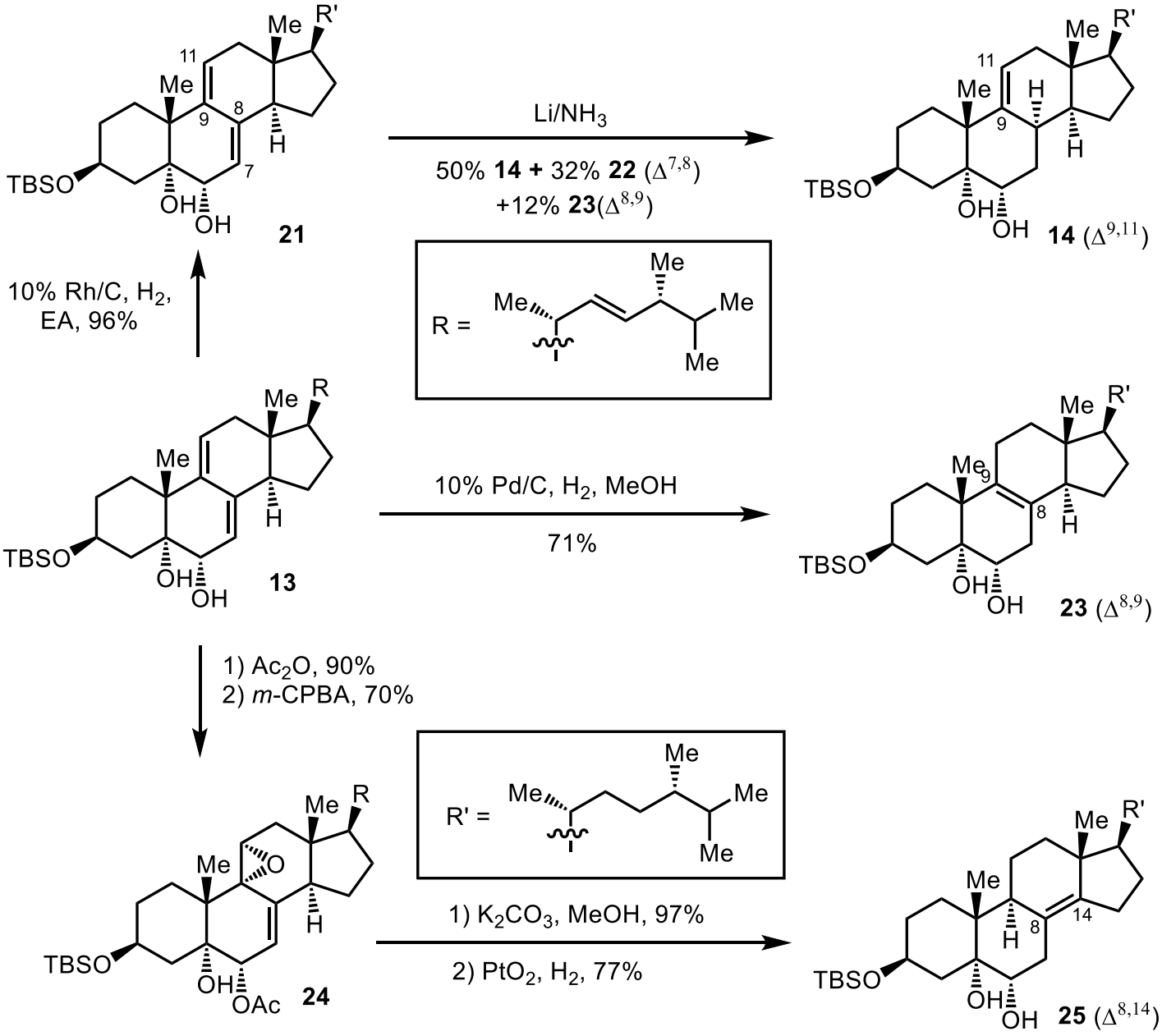


14 ($\Delta^{9,11}$)

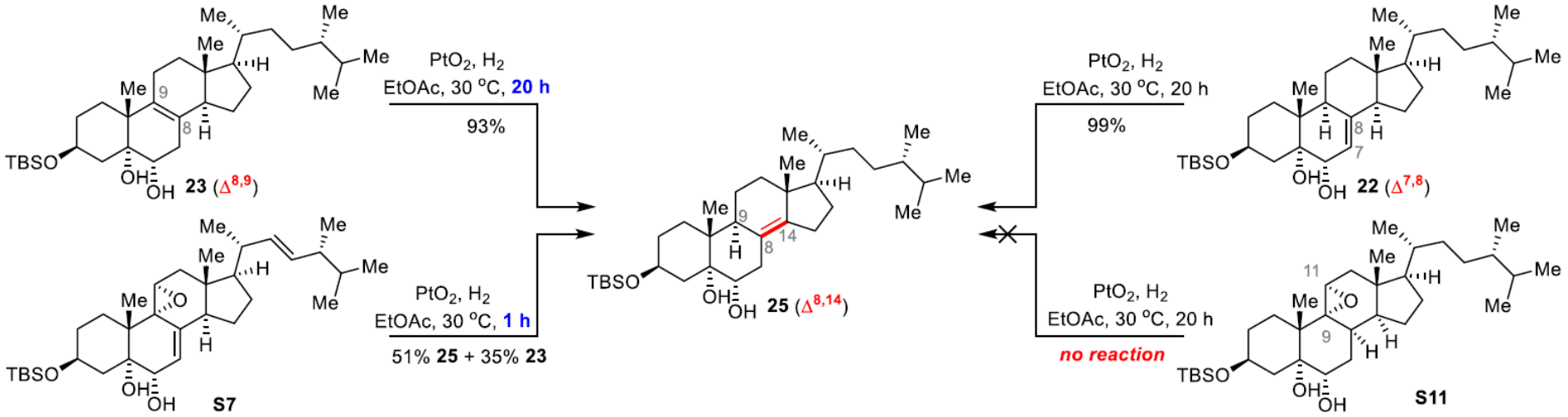


ergosterol **12** **13**

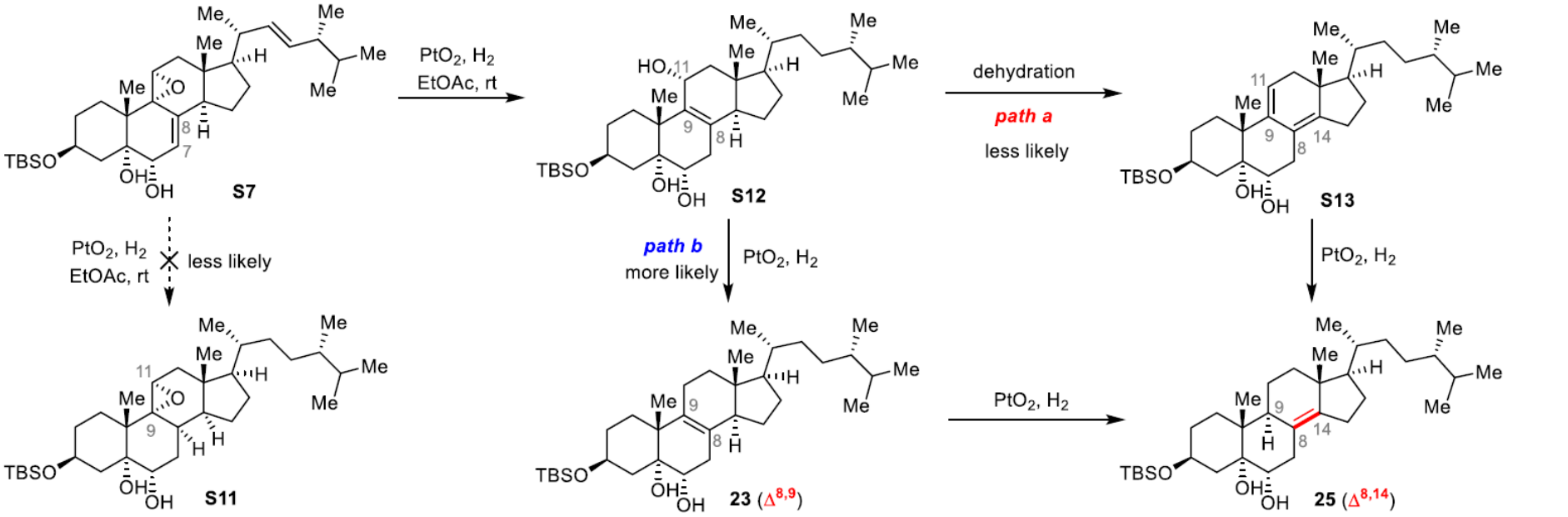
Regioselective-Hydrogenation-Enabled Divergent Access to Regioisomeric Olefins

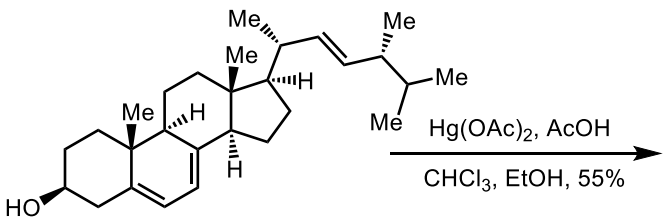


Scheme S4. Mechanistic Rationale for the Selective Formation of 25



Proposed pathways for the formation of **25**:

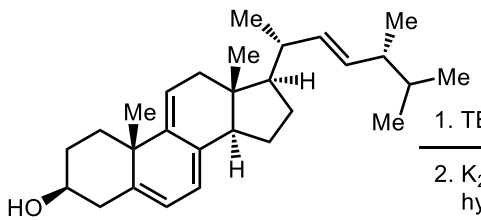




ergosterol

$Hg(OAc)_2$, AcOH

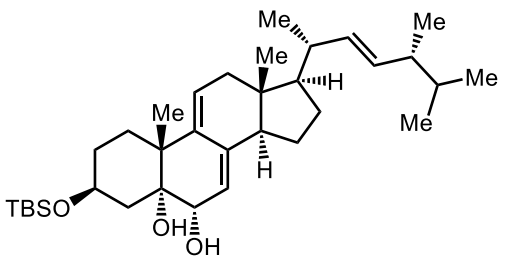
$CHCl_3$, EtOH, 55%



12

1. TBSCl, 83%

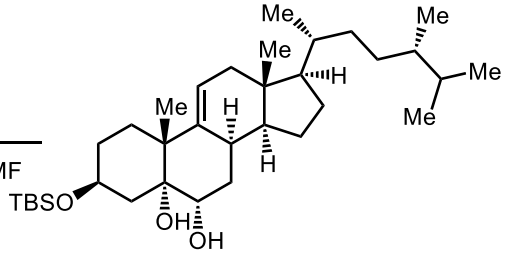
2. K_2OsO_4, $K_3Fe(CN)_6$
hydroquinine, 59%



13

3. 10% Rh/C, H_2, 96%

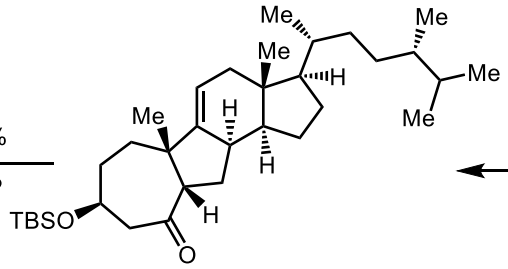
4. Li, NH_3, 50%



14

5. MsCl, NEt_3, 98%

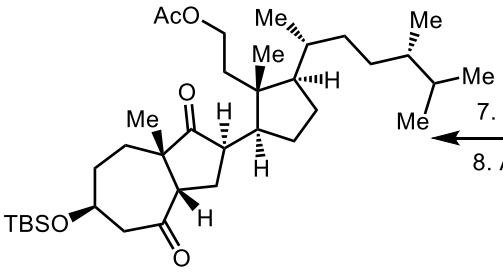
6. $CaCO_3$, NEt_3, DMF
125 ^oC, 92%



15

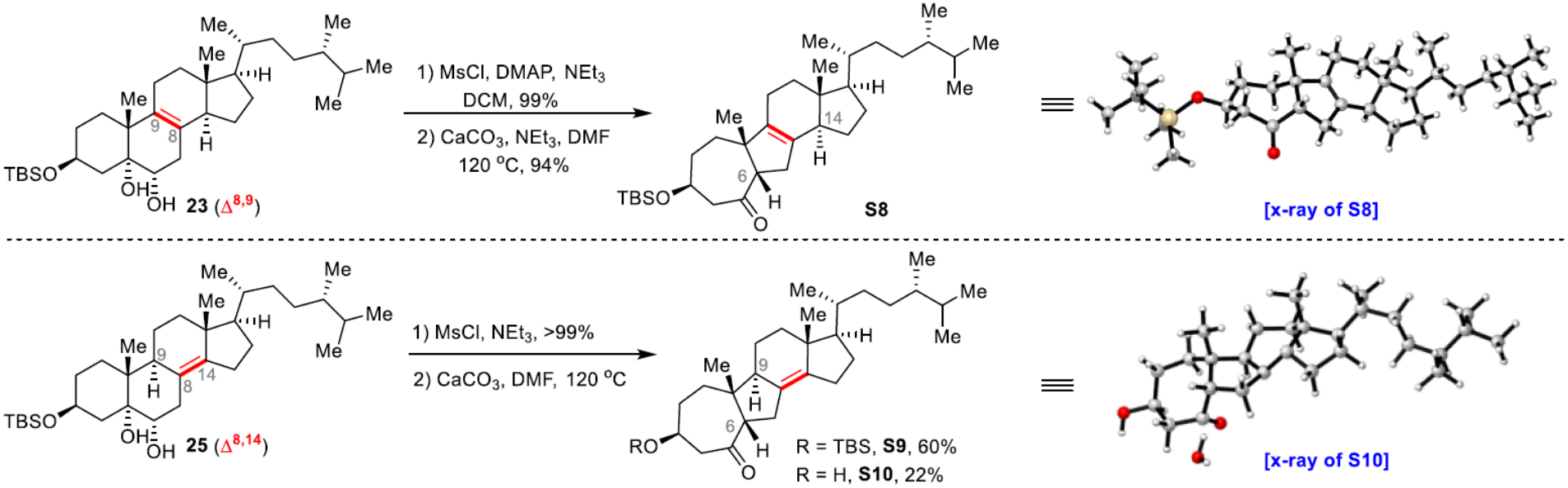
7. O_3, $NaBH_4$, 60%

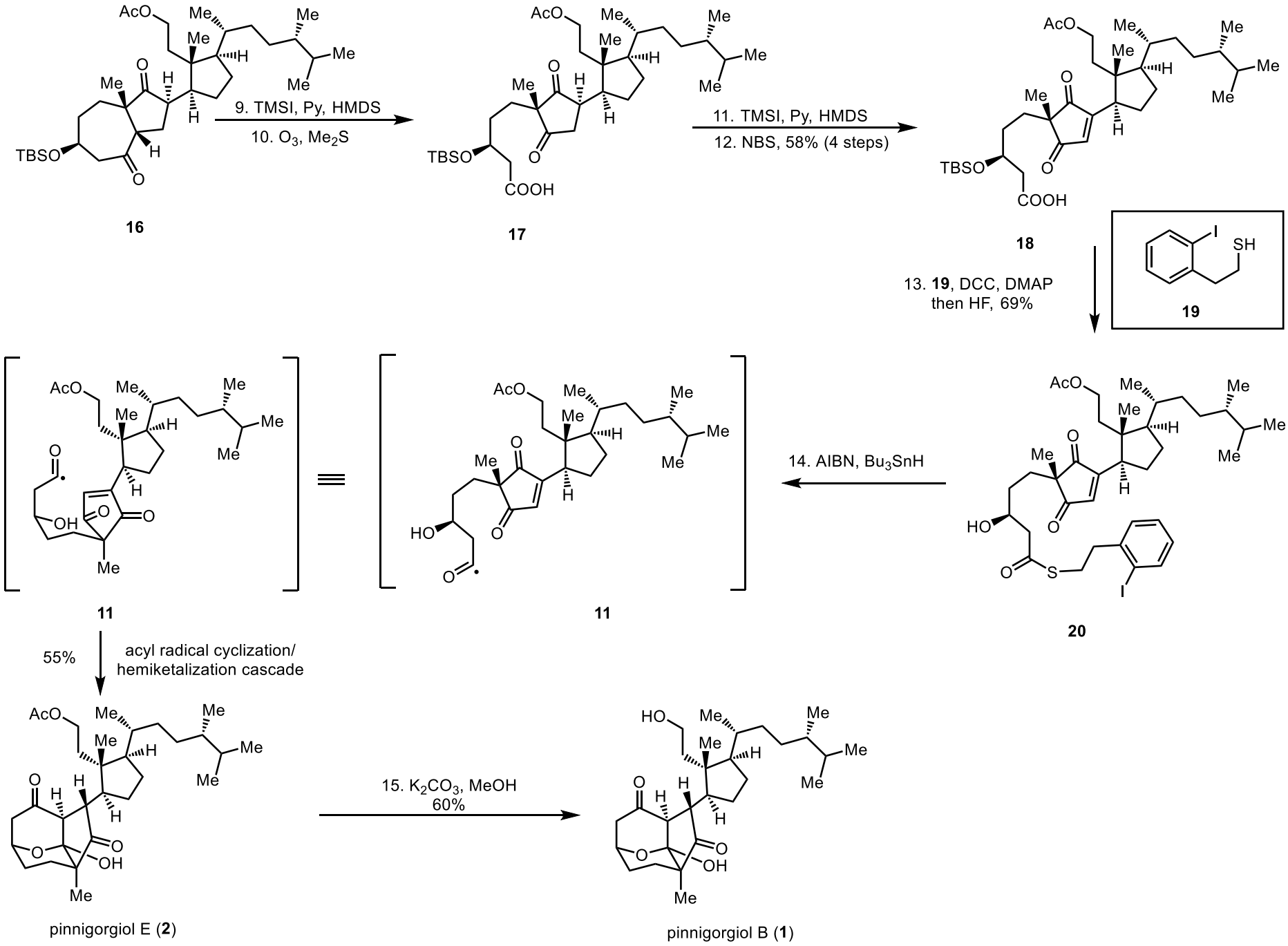
8. Ac_2O, then DMP
94%

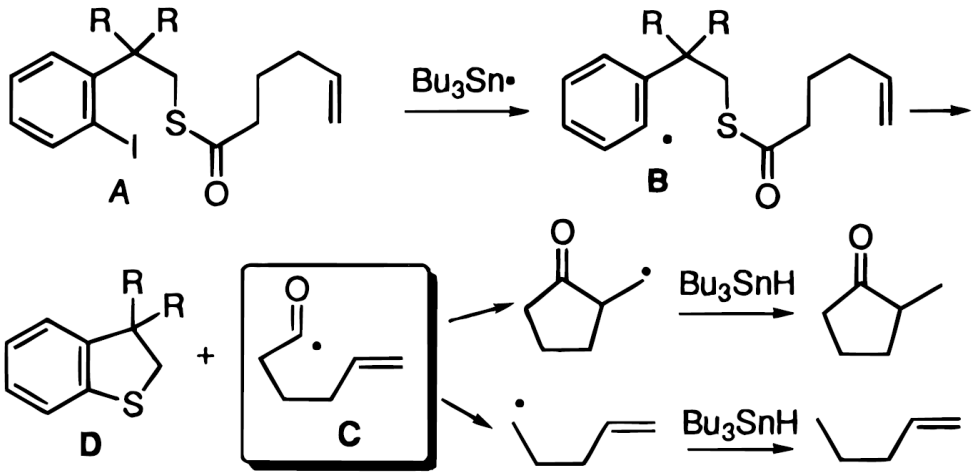


16

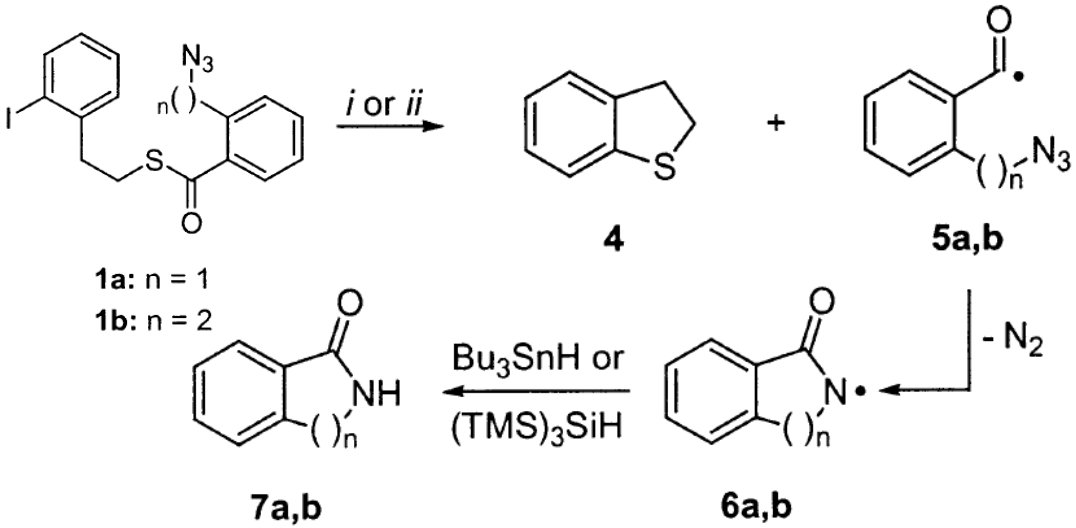
Scheme S3. Structural Elucidation of Olefins 23 and 25




16
9. TMSI, Py, HMDS
10. O3, Me2S
17
11. TMSI, Py, HMDS
12. NBS, 58% (4 steps)
18
13. 19, DCC, DMAP
then HF, 69%
19
20
14. AIBN, Bu3SnH
11
11
55%
acyl radical cyclization/
hemiketalization cascade
pinnigorgiol E (2)
15. K2CO3, MeOH
60%
pinnigorgiol B (1)

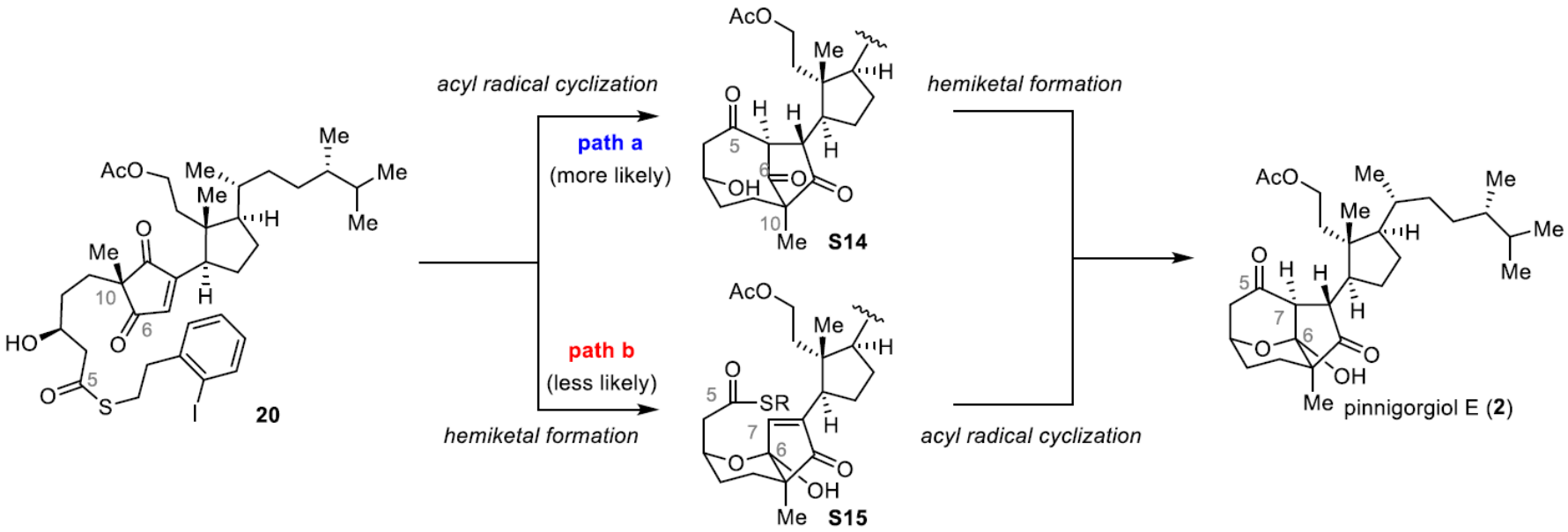


J. Org. Chem. **1996,** *61,* 3566−3570



[a] Reagents: (i) Bu_3SnH/AIBN; (ii) $(TMS)_3SiH$/AIBN.

Scheme S5. Mechanistic study of the Key Acyl Radical Cyclization



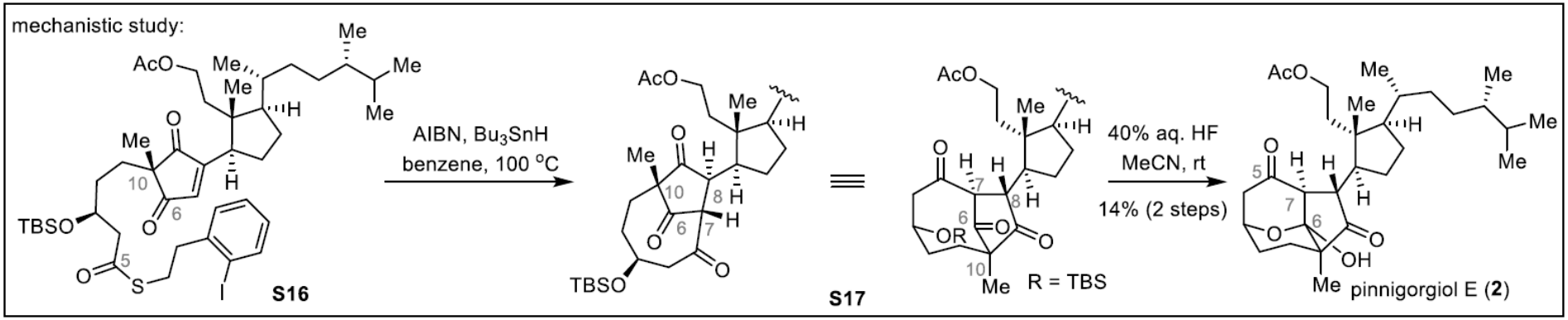
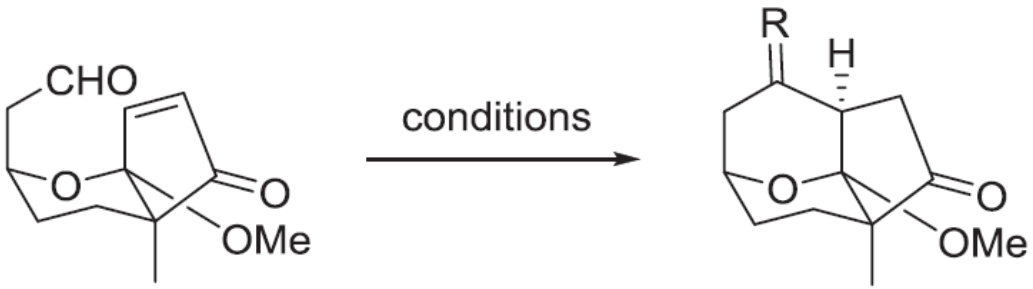


Table 1
Study of Intramolecular Radical Cyclization.



5

18 : R = OH, H
4 : R = O

Entry	Conditions	Result
1	SmI_2, THF, 0 °C	dimer of **5**
2	Bu_3SnH, AIBN benzene, reflux	**18**: ca. 10%
3	TTMSS, AIBN toluene, reflux	complex mixture
4	*t*-dodecanthiol, V-40 toluene, reflux	**4**: 74%

Tetrahedron Lett. **2017**, *58*, 3327.