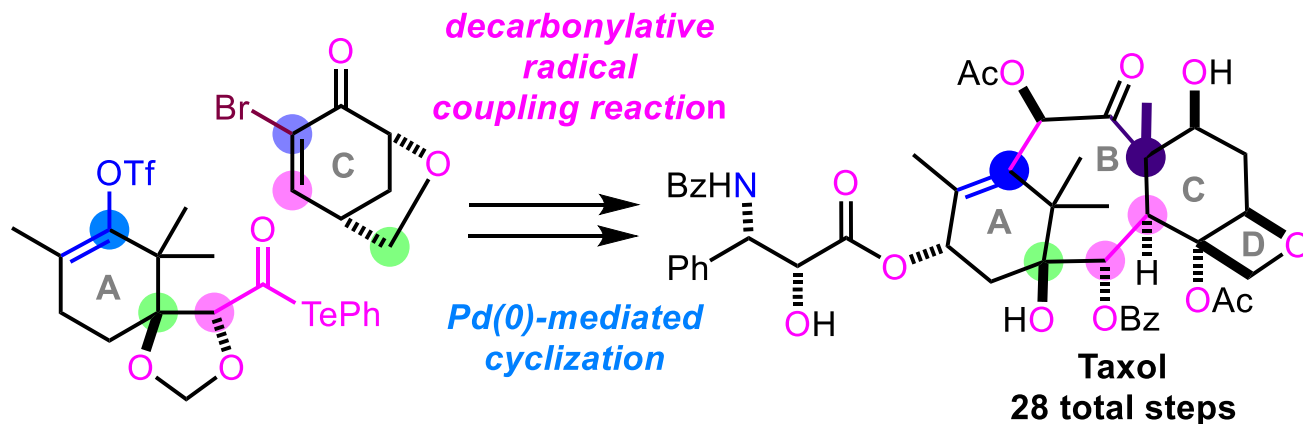
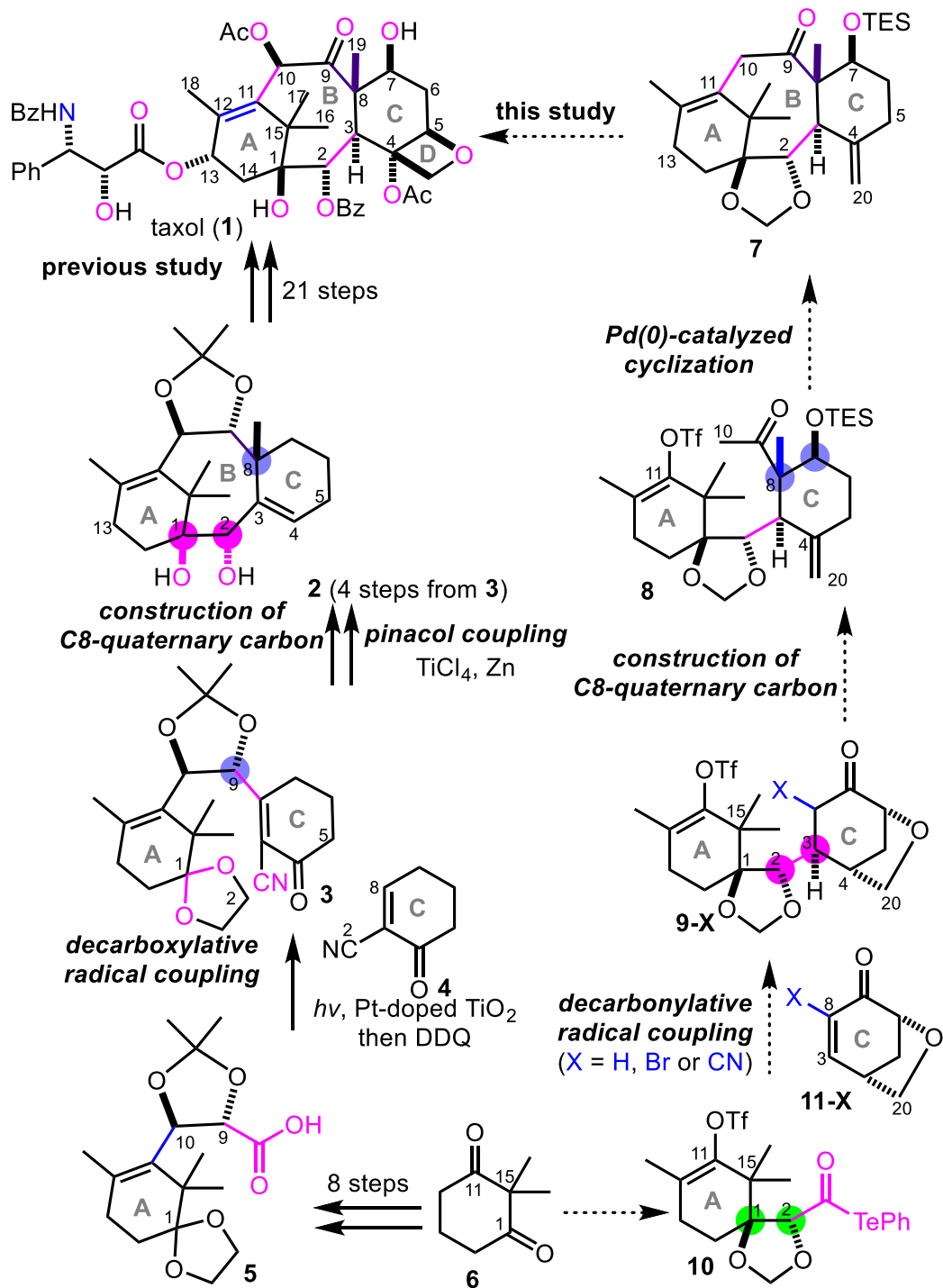


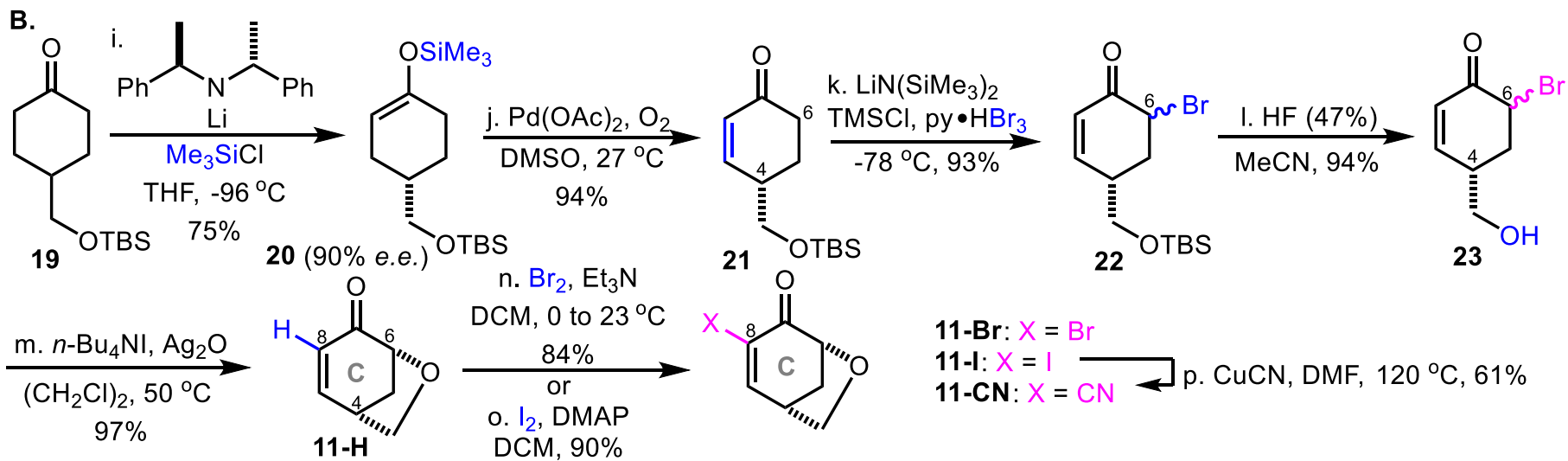
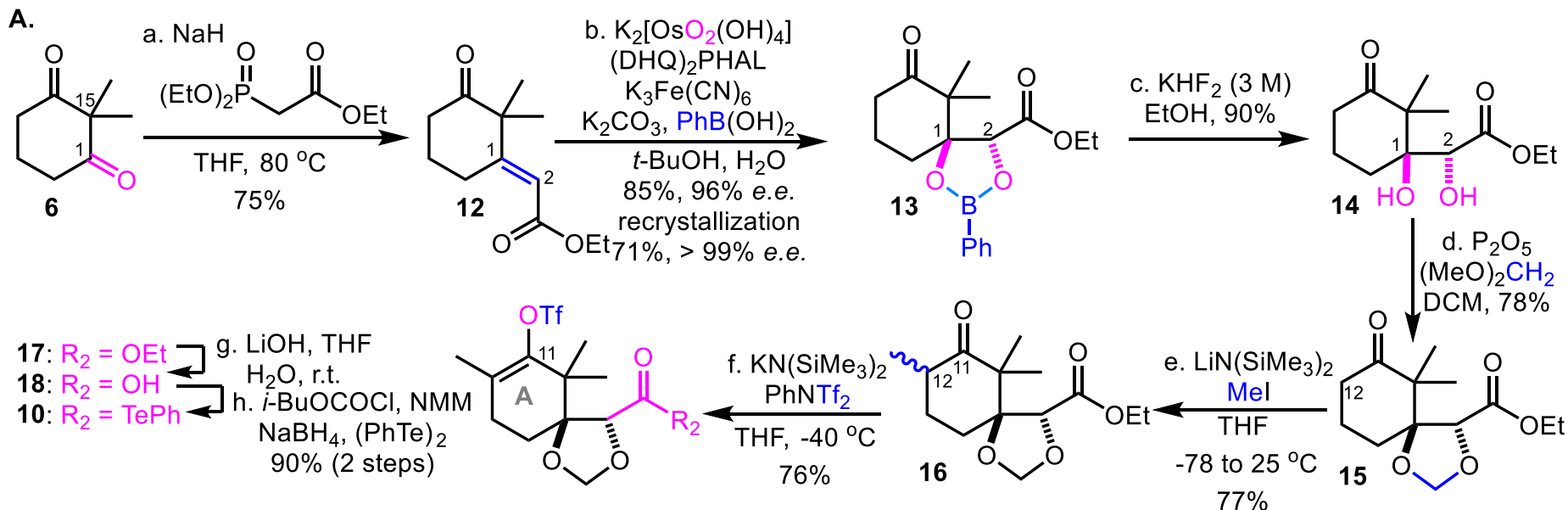
# Total Synthesis of Taxol Enabled by Intermolecular Radical Coupling and Pd-Catalyzed Cyclization

Takahiro Watanabe, Kyohei Oga, Hiroaki Matoba, Masanori Nagatomo, and Masayuki Inoue



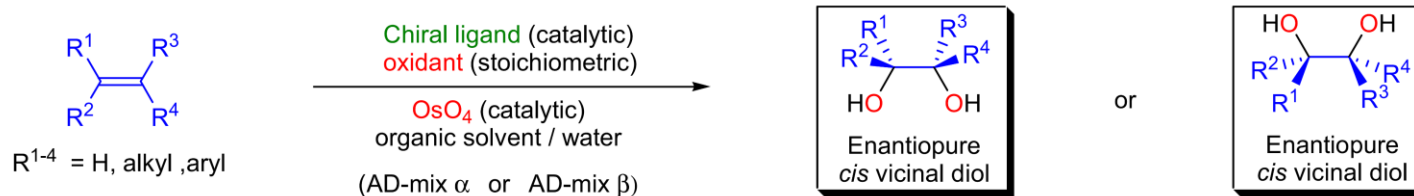
- Synthetic challenge:**
- strained [6-8-6-4]core
  - highly oxygenated
  - bicyclo [5.3.1] skeleton with bridgehead alkene
  - 11 stereocenters  
3 quaternary



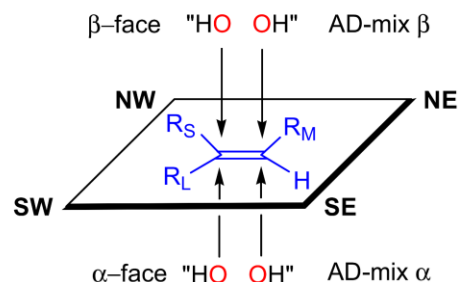
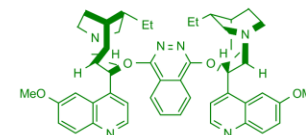
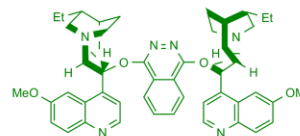


## SHARPLESS ASYMMETRIC DIHYDROXYLATION

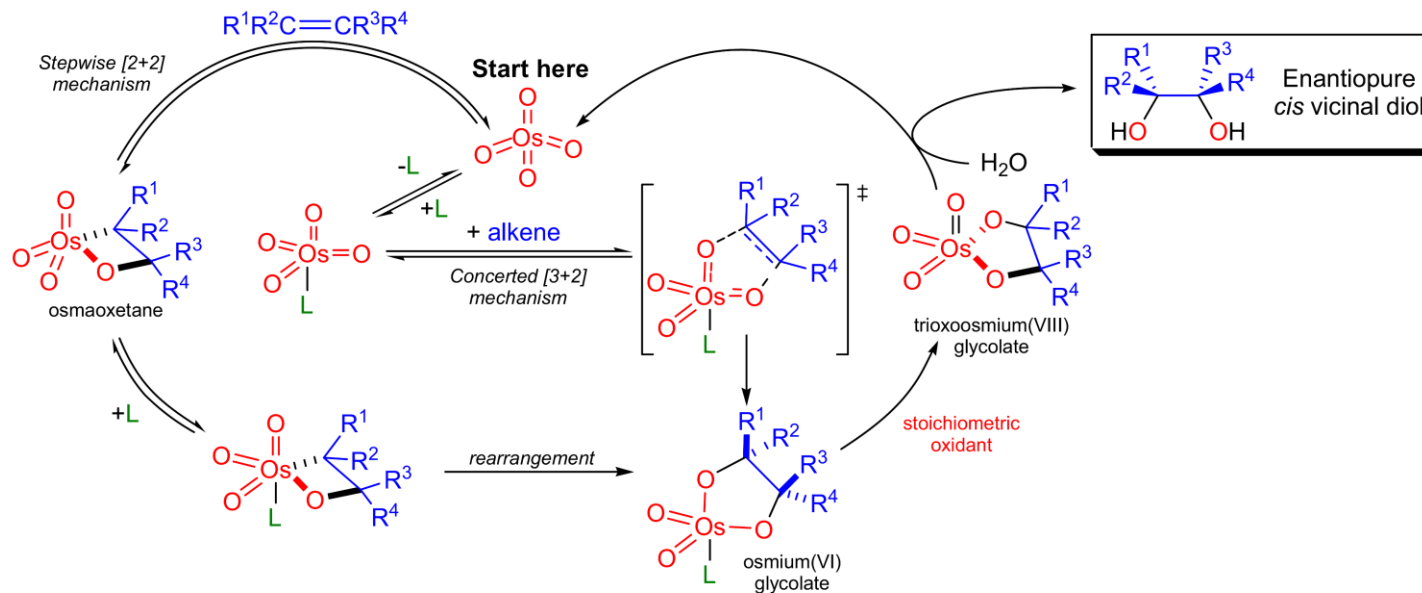
(References are on page 673)

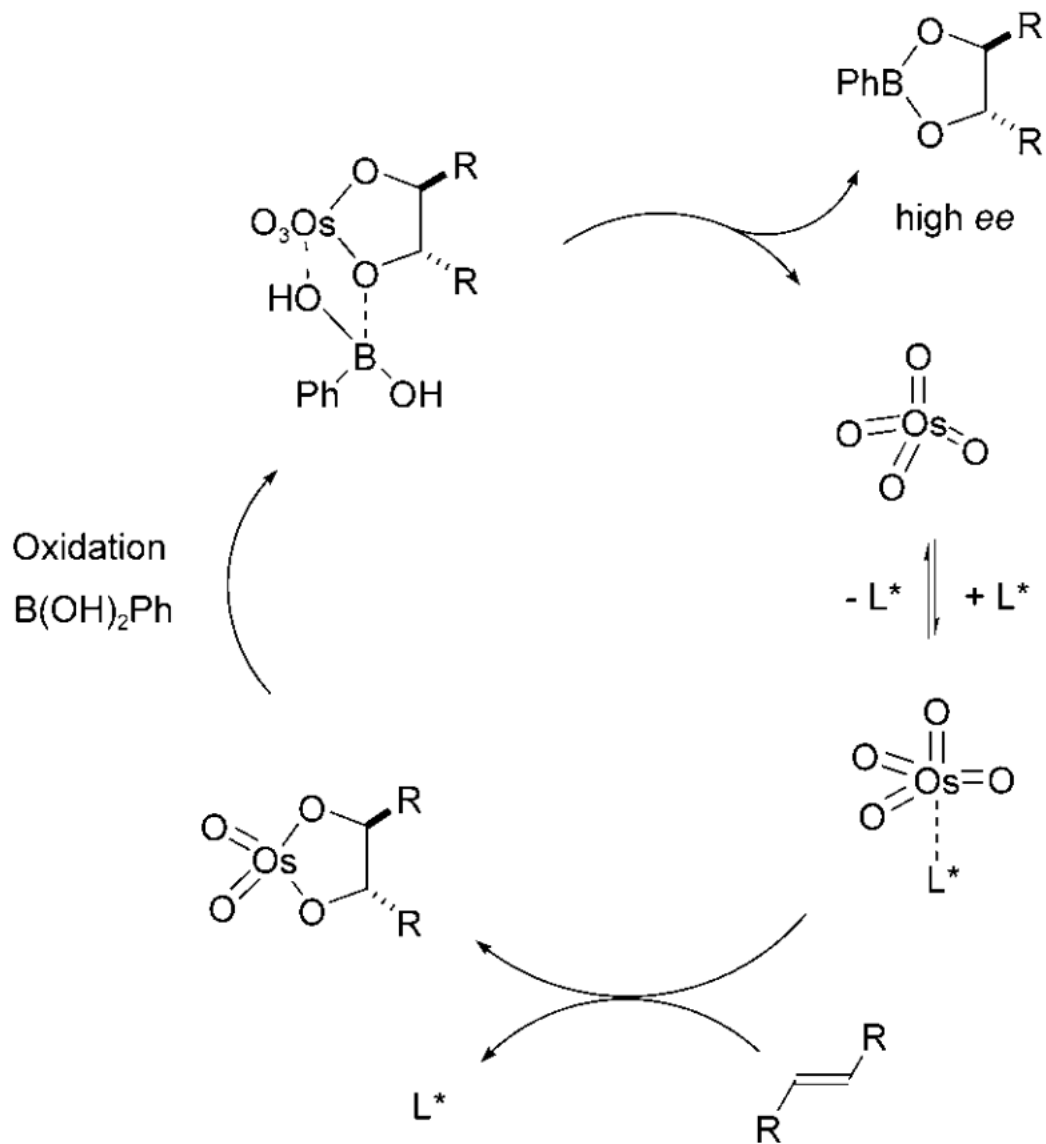


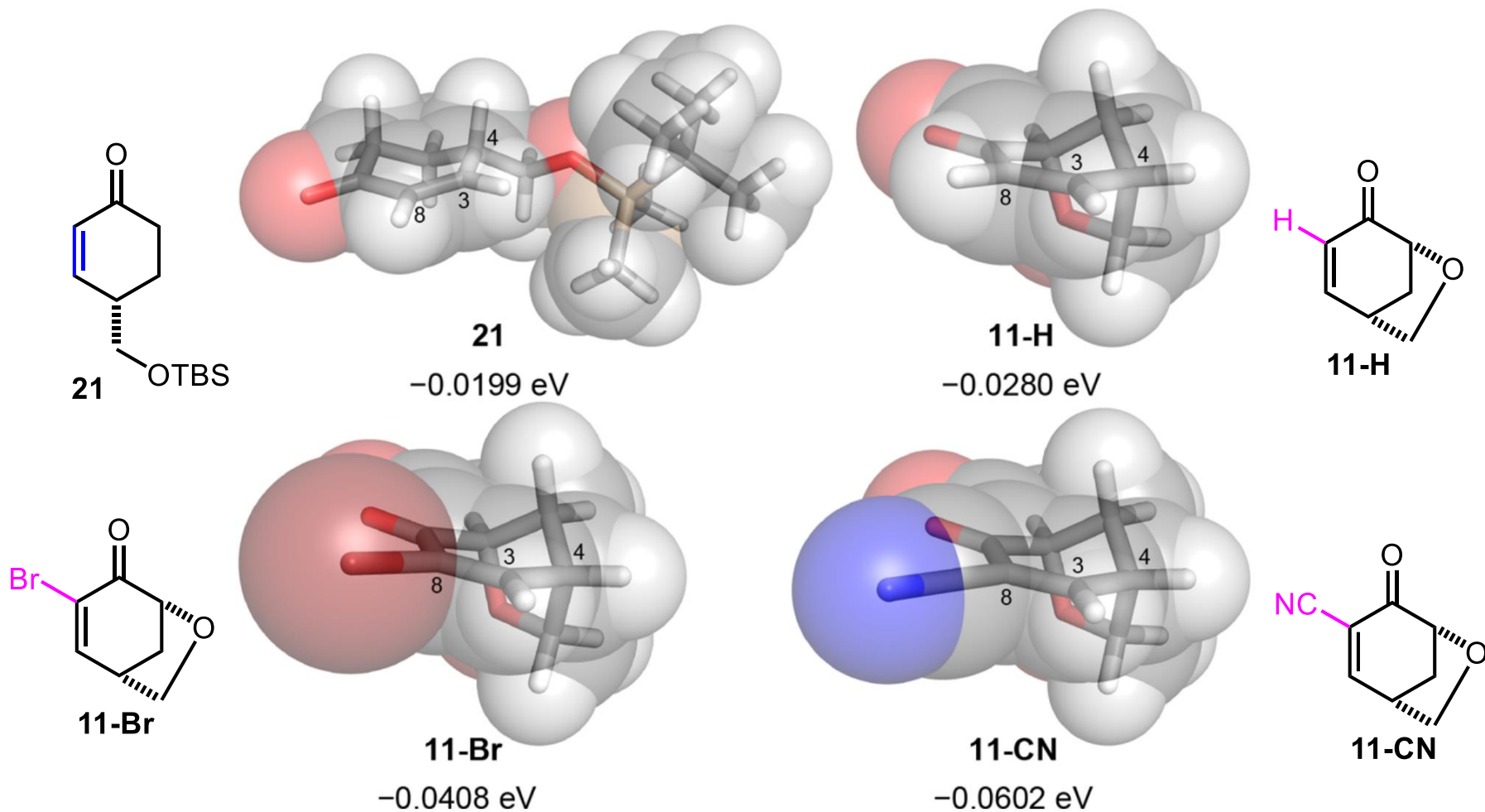
Empirical model (mnemonic device):

AD-mix  $\alpha$ : (DHQD)<sub>2</sub>PHAL + K<sub>2</sub>OsO<sub>2</sub>(OH)<sub>4</sub> + K<sub>3</sub>Fe(CN)<sub>6</sub>AD-mix  $\beta$ : (DHQD)<sub>2</sub>PHAL + K<sub>2</sub>OsO<sub>2</sub>(OH)<sub>4</sub> + K<sub>3</sub>Fe(CN)<sub>6</sub>**Mechanism:**

53-77

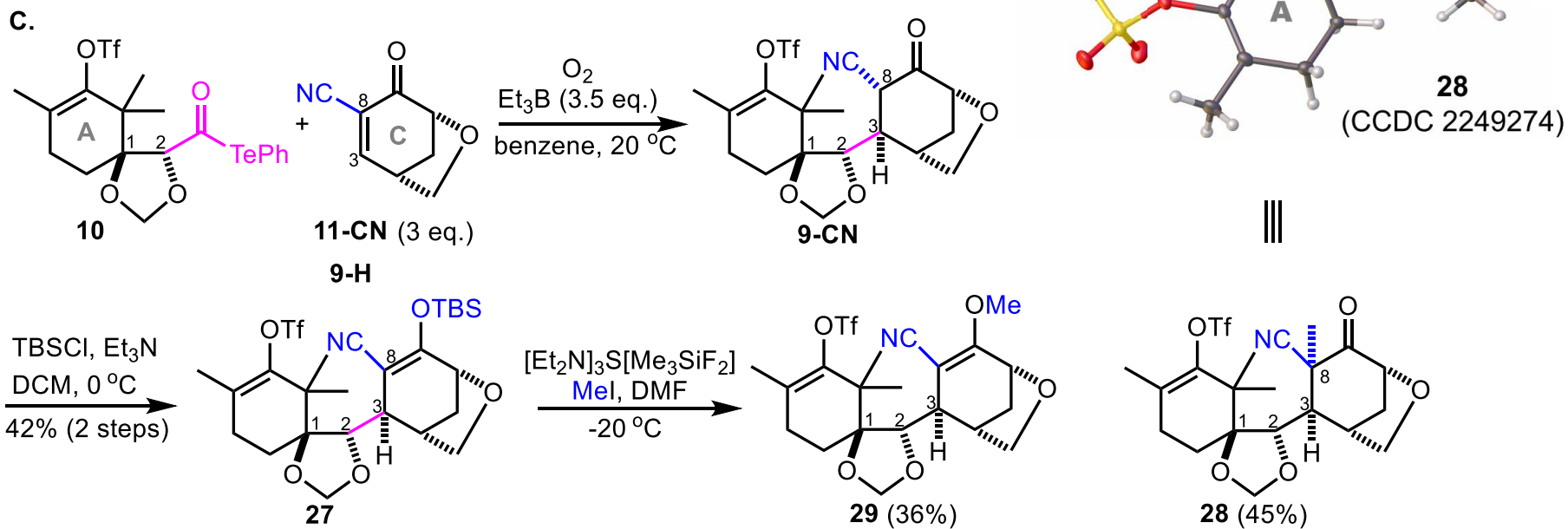
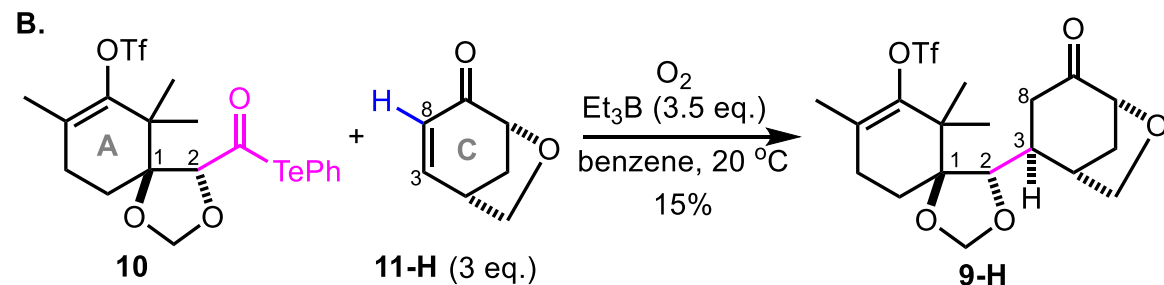
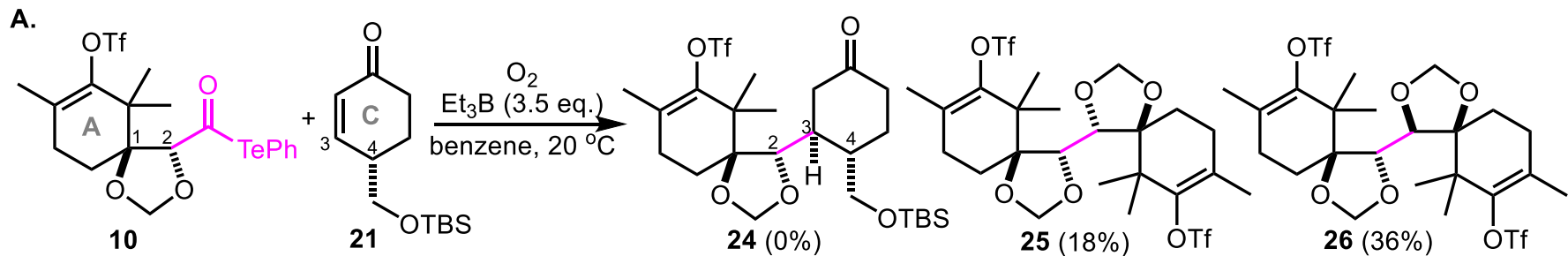


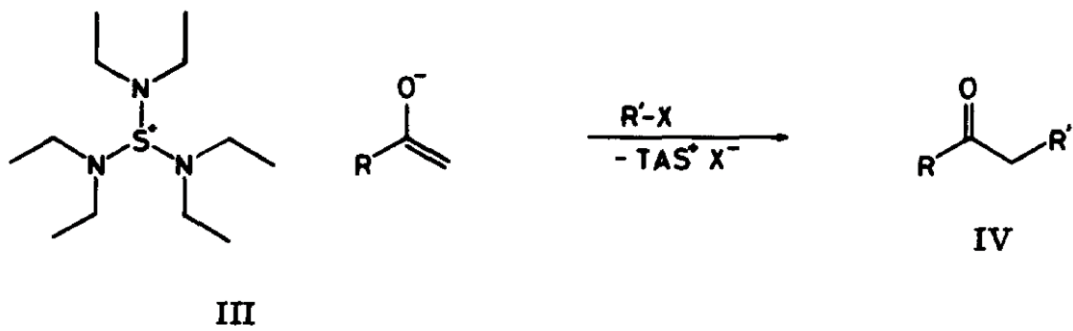
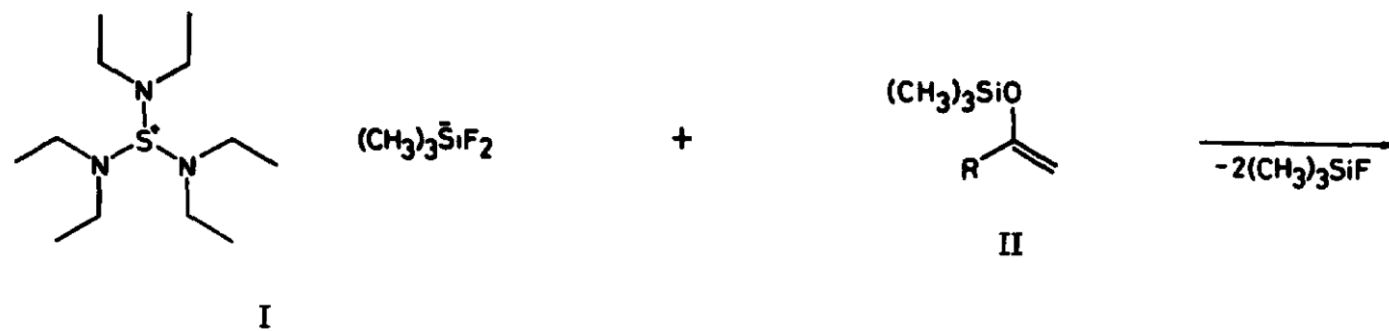




**Figure 1.** Calculated 3D structures and LUMO energy levels (eV) of radical acceptors **21**, **11-H**, **11-CN**, and **11-Br**. Density functional theory (DFT)-optimized structures of compounds **21**, **11-H**, **11-CN**, and **11-Br** (M06-2X/GenECP, 298 K, and 1 atm).

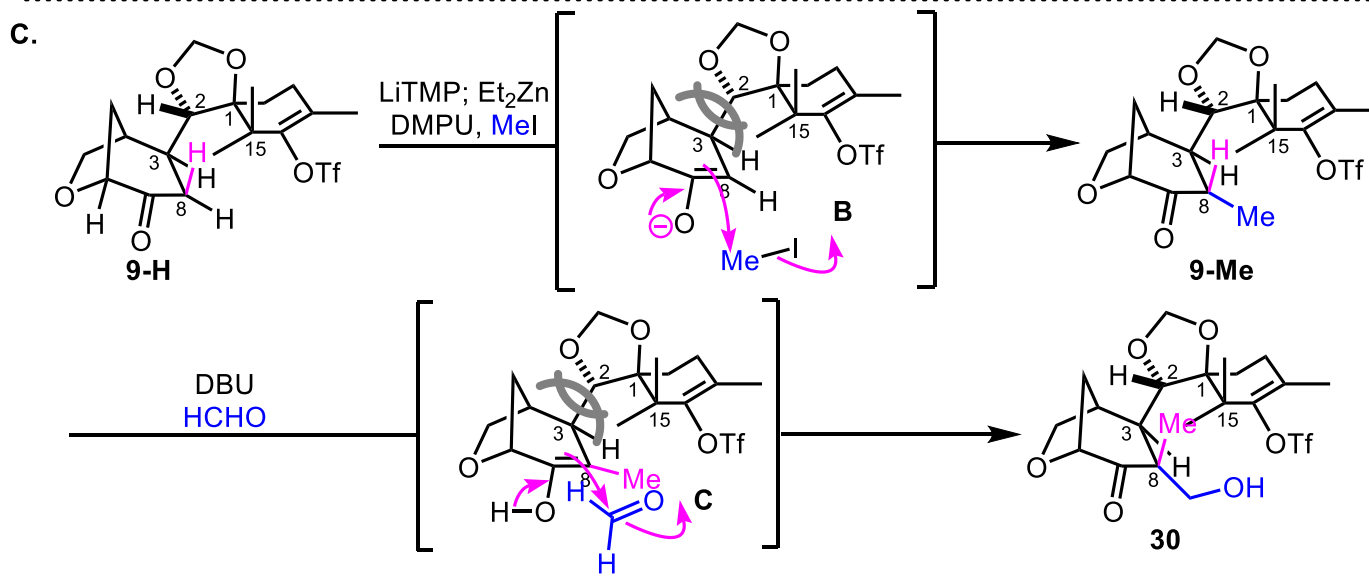
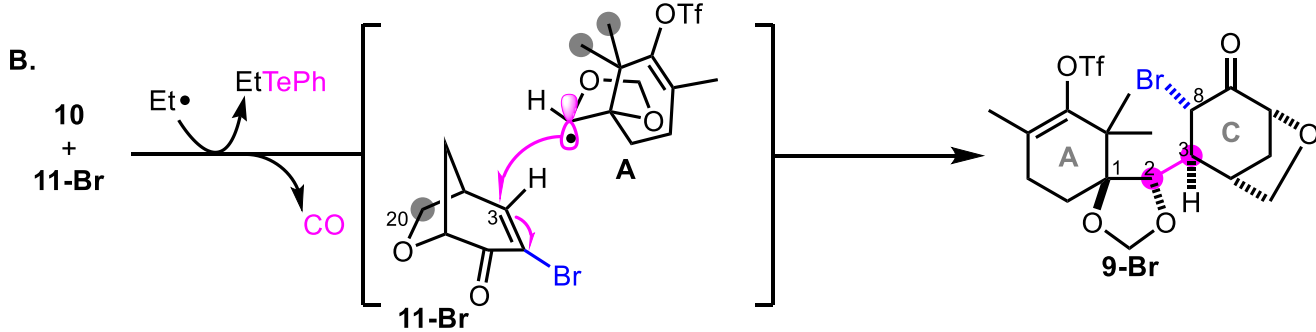
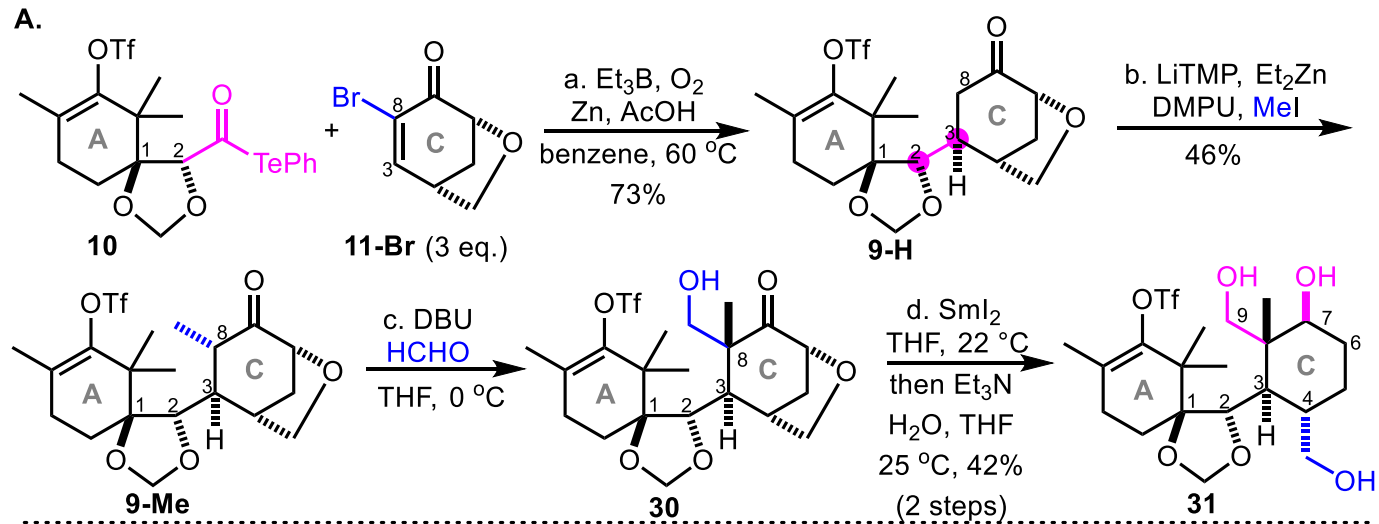
**Activity of the reaction: 11-CN > 11-Br > 11-H > 21**

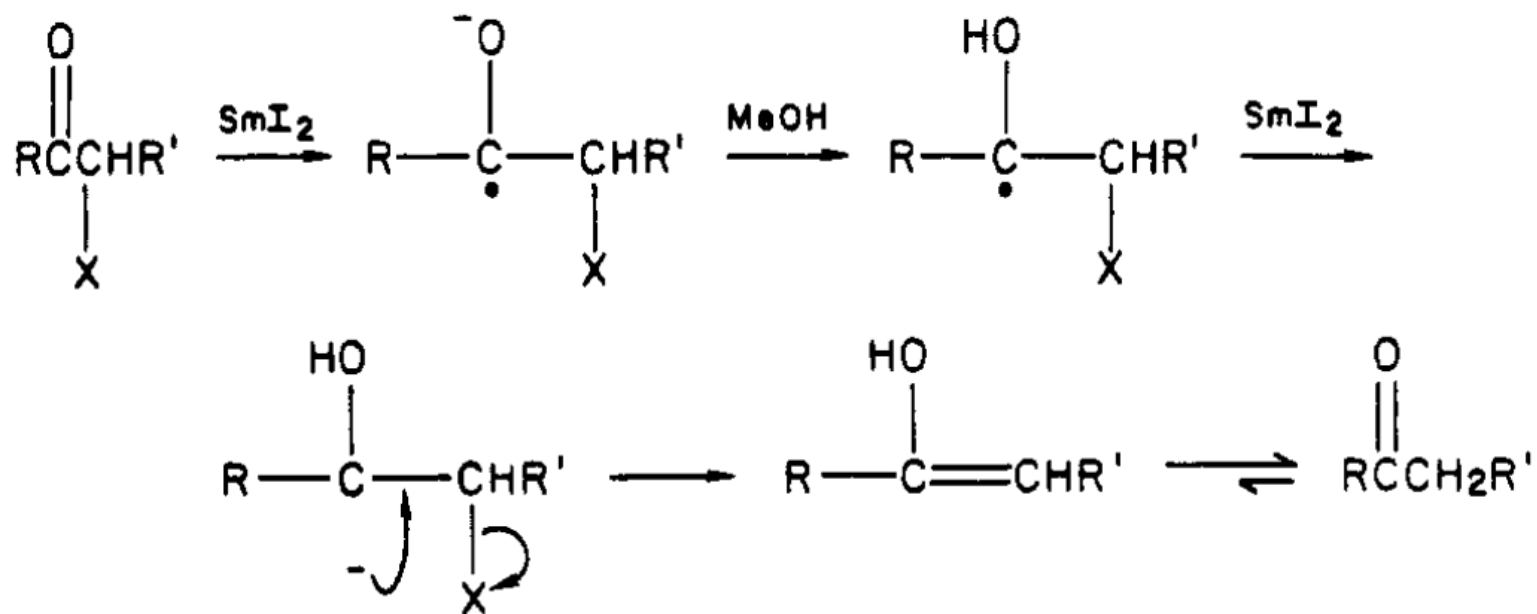




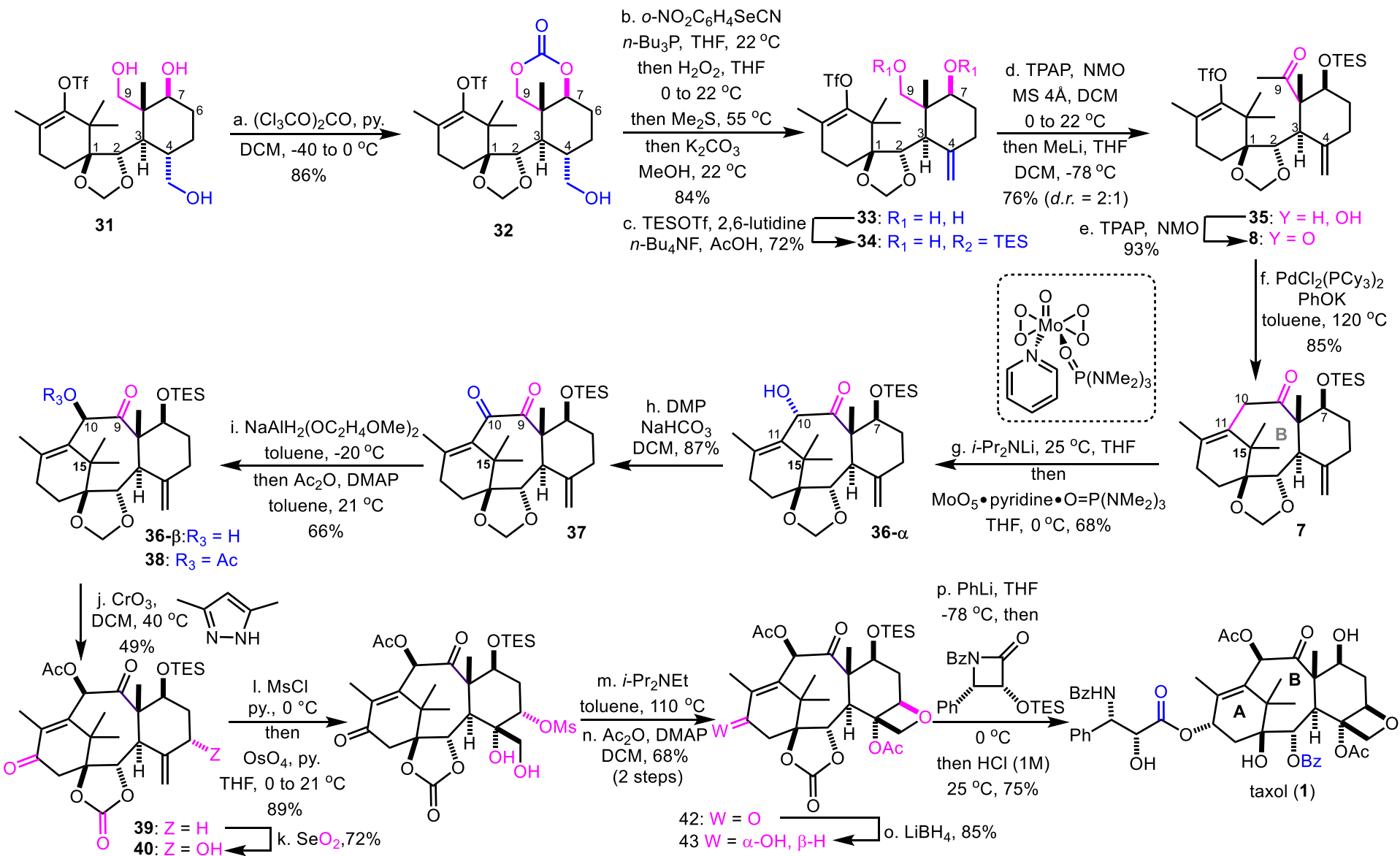
*Tetrahedron Lett.*, **1980**, 21, 2085.

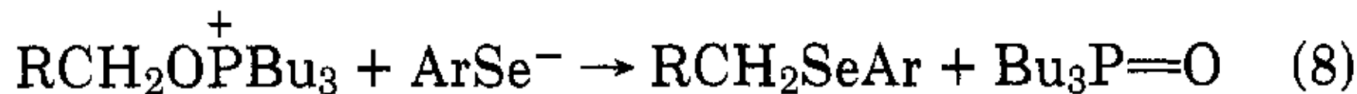
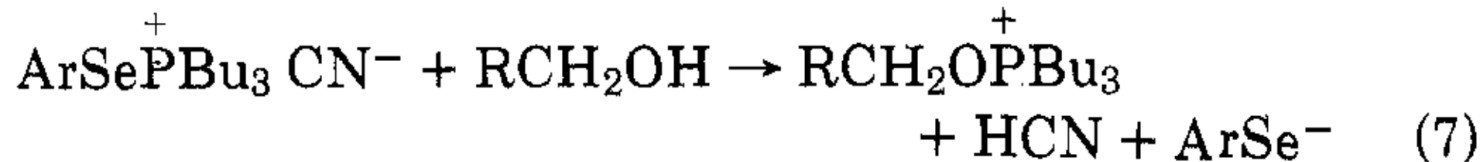


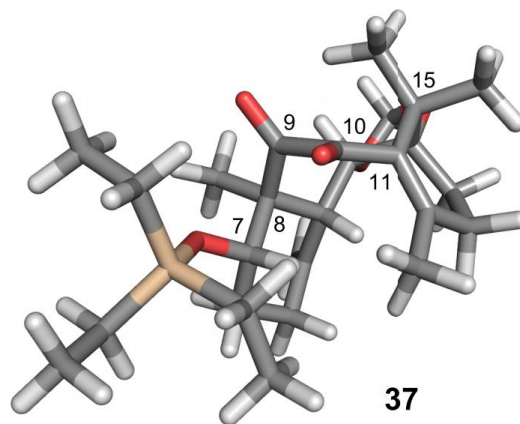
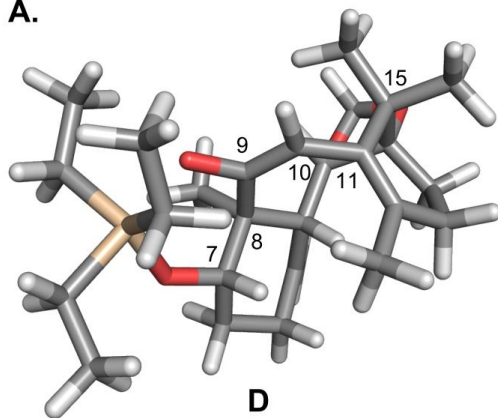
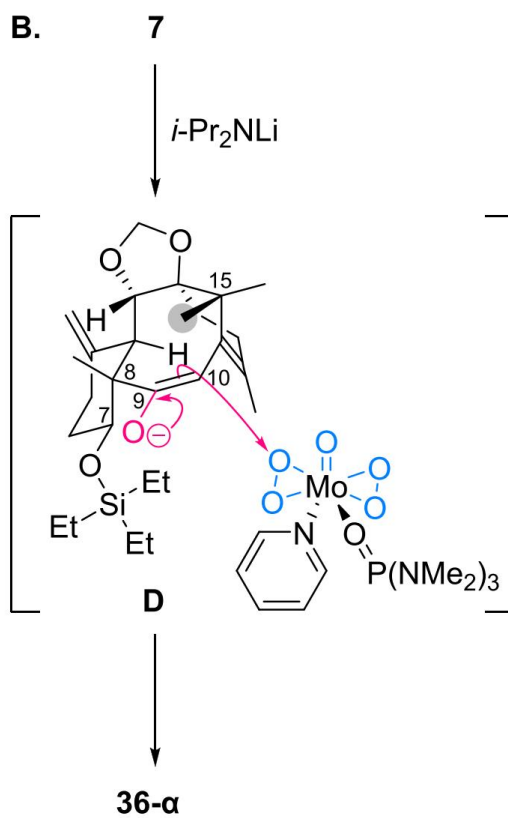
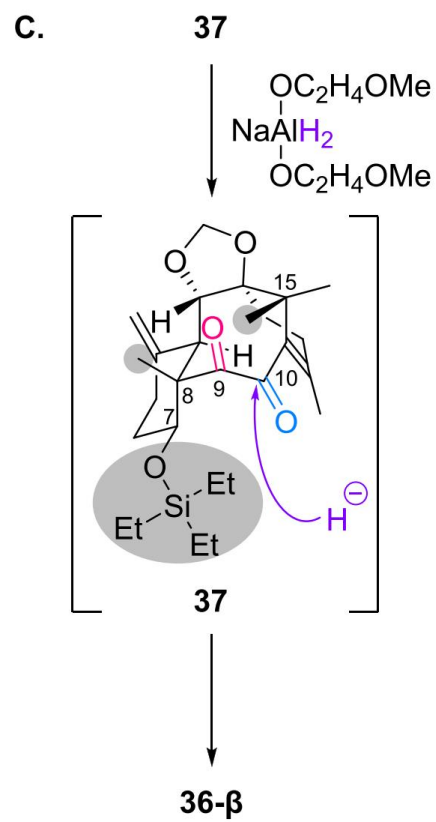




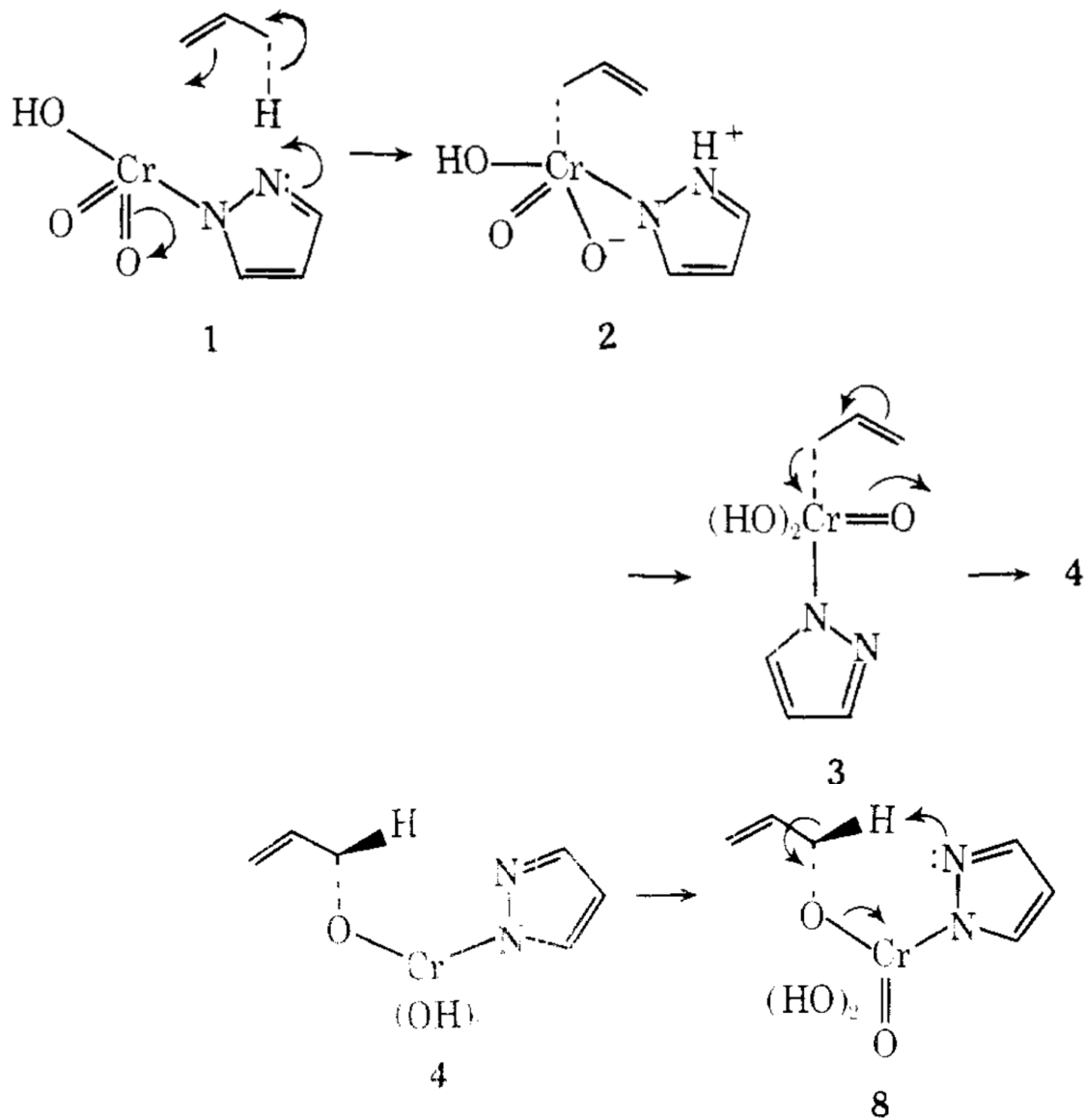
*J. Org. Chem.*, **1986**, *51*, 1135.





**A.****B.****C.**

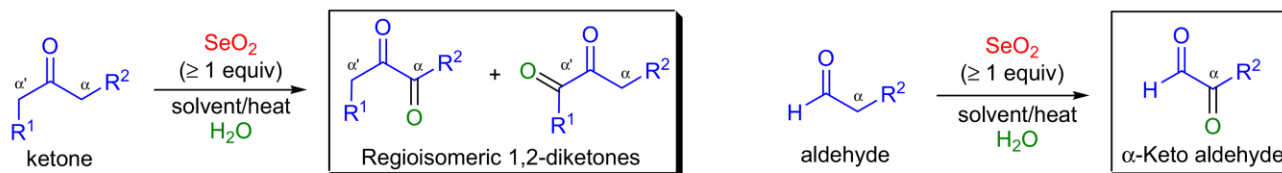
Scheme I



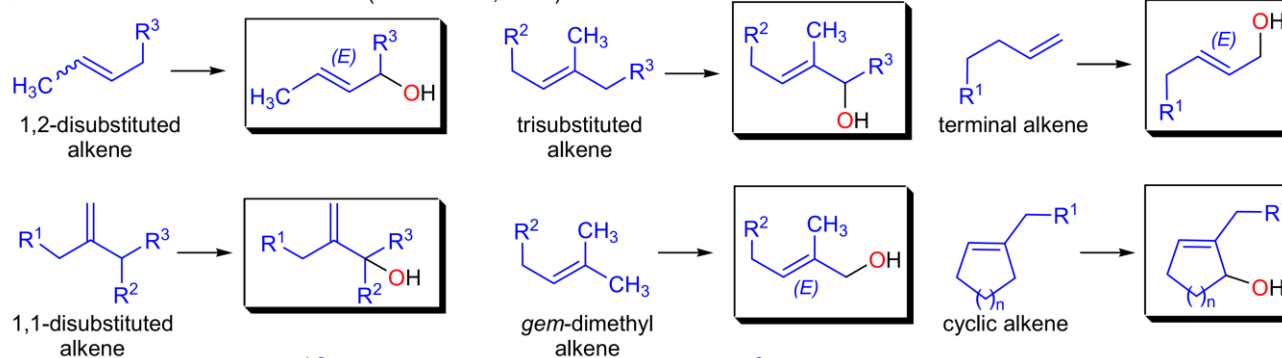
## RILEY SELENIUM DIOXIDE OXIDATION

(References are on page 663)

Selenium dioxide oxidation of ketones and aldehydes (Riley, 1932):



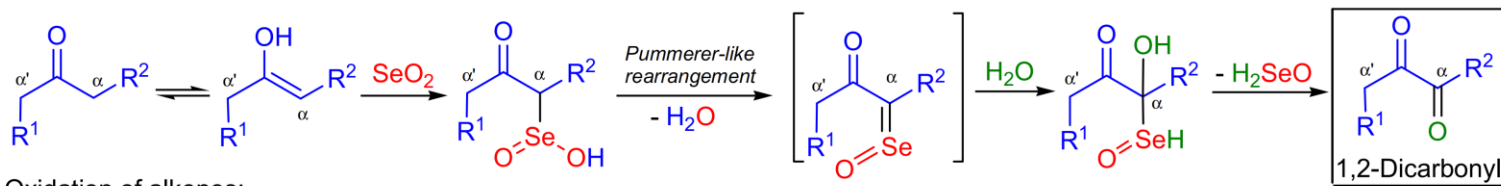
Selenium dioxide oxidation of olefins (Guillemonat, 1939):



$\text{R}^{1-2} = \text{H, aryl, alkyl, substituted alkyl and aryl}; \text{R}^3 = \text{alkyl, aryl}; n = 1-3$

### Mechanism: <sup>24-41</sup>

Oxidation of carbonyl compounds:



Oxidation of alkenes:

