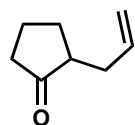


# Total Synthesis of Ginkgolide C and Formal Syntheses of Ginkgolides A and B

*J. Am. Chem. Soc.* 2022, 144, 17792-17796



CH(OMe)<sub>3</sub>, Amberlyst 15,  
MeOH  
2) propionic acid, 1, neat

**A**

3) Grubbs II, DCM, reflux  
4) DBU, PhMe, Δ

**B**

spiro compound

5) LiHMDS, PhNTf<sub>2</sub>, THF  
6) **2**, Pd(PPh<sub>3</sub>)<sub>2</sub>Cl<sub>2</sub>,  
CuI, Et<sub>3</sub>N

**C**

7) 18-crown-6,  
KHMDS, THF,  
then **3**

**D**

8) *m*CPBA,  
DCM

**I**

12) DIBAL-H,  
THF

**H**

11) DMP, DCM,  
then CH(OMe)<sub>3</sub>,  
Amberlyst 15,  
DCM/MeOH

**G**

9) KOAc, DMSO

**F**

tricyclic epoxide

+

**E**

tricyclic lactone

10) Ac<sub>2</sub>O, Et<sub>3</sub>N, DMAP, DCM, then TBAF

**J**

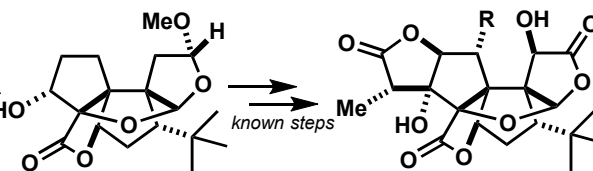
14) SeO<sub>2</sub>, dioxane  
then DMP, DCM  
15) *t*BuLi, CuCN,  
TMSI, THF,  
then TBAF

**L**

16) LiBH<sub>4</sub>, THF,  
then NaOH,  
THF/MeOH/H<sub>2</sub>O

**M**

17) O<sub>3</sub>, DCM, -78°C,  
then DMS



R = H: Ginkgolide A  
R = OH: Ginkgolide B

(*R*)-acetal

+

**K**

(*S*)-acetal

14') SeO<sub>2</sub>, dioxane  
then DMP, dioxane/DCM  
15') *t*BuLi, CuCN,  
TMSI, THF, then TBAF,  
then NaOH,  
THF/MeOH/H<sub>2</sub>O

**N**

16') KHMDS, THF,  
Davis' oxaziridine  
17') MOMBr, TBAI,  
DIPEA, DCM

**O**

18') RuCl<sub>3</sub> · xH<sub>2</sub>O, NaIO<sub>4</sub>,  
CCl<sub>4</sub>/MeCN/H<sub>2</sub>O

**P**

pentacyclic compound

19') I<sub>2</sub>, K<sub>2</sub>CO<sub>3</sub>,  
DCM

+

**Q**

20') NaBH<sub>4</sub>, THF/H<sub>2</sub>O,  
then NaOH, then AcOH

**T**

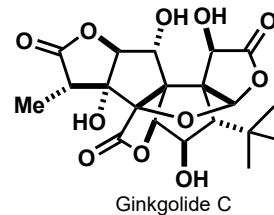
24') PPTS, py, Ac<sub>2</sub>O,  
PhCl, 135°C

**S**

21') DMP, DCM  
22') PhSeCl, HCl, EtOAc/THF  
23') H<sub>2</sub>O<sub>2</sub>, py, DCM/H<sub>2</sub>O

**R**

C<sub>20</sub>H<sub>30</sub>O<sub>8</sub>



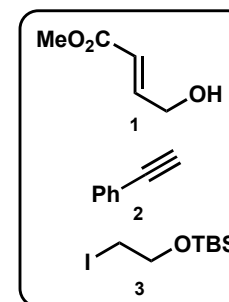
28') DMDO,  
acetone/H<sub>2</sub>O  
29') Br<sub>2</sub>, NaOAc,  
AcOH/H<sub>2</sub>O  
30') K<sub>2</sub>CO<sub>3</sub>, MeOH

**V**

26') EtCO<sub>2</sub>*t*Bu, LDA,  
THF/HMPA  
27') CSA, DCM

**U**

25') Ph<sub>3</sub>COOH,  
DBU, DCM



hints:  
step 7: a second quaternary  
carbon atom is formed

step 16 & 15': cyclization  
takes place