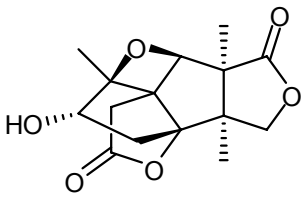
Total Synthesis of (±)-Merrilactone A

Merrilactone A (**1)** is a structurally unique pentacyclic sesquiterpene dilactone isolated in 2000 by Fukuyama and coworkers from the *Illicium merrillianum*. It was identified as a potent nonpeptidal neurotrophic factor that promotes neurite outgrowth in the culture of fetal rat cortical neurons at a remarkably low concentration of 0.1 µmol/L. In addition to its promising bioactivity, the merrilactone A pentacycle is riddled with synthetic challenges. The molecule sports seven contiguous chiral centers, of which three are quaternary, and bears a highly substituted cyclopentane ring at its core.



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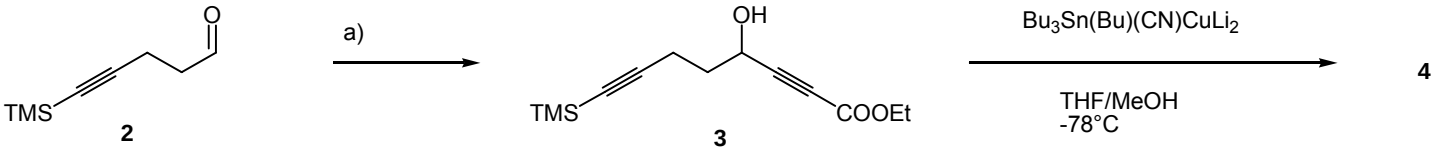
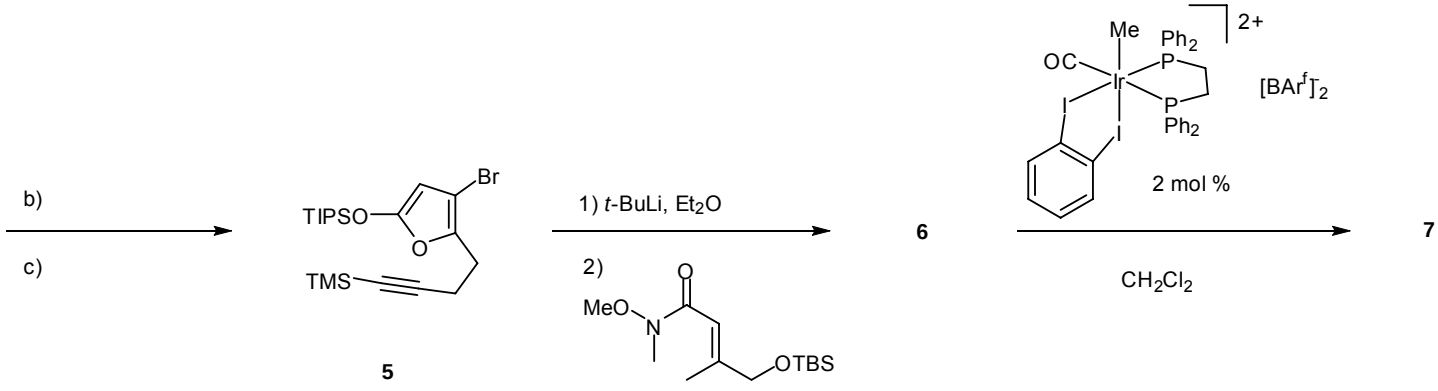


1.) Give reagents for step a).

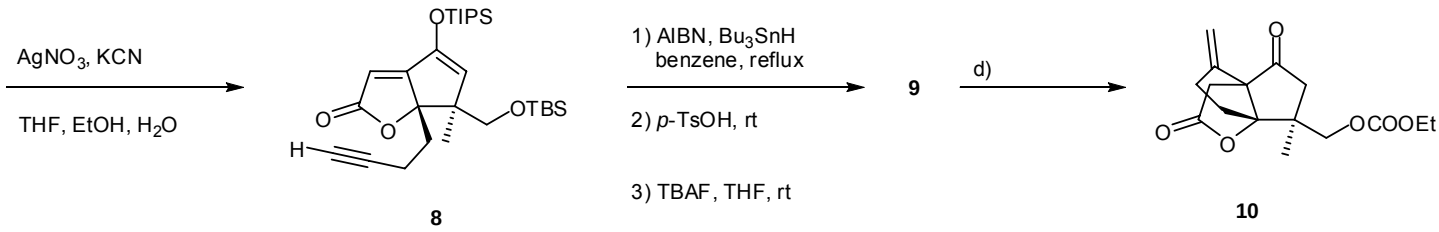
2.) What is the structure of **4**? Draw a reaction mechanism for the formation of **4**.



3.) Give the reagents for step b) and c).

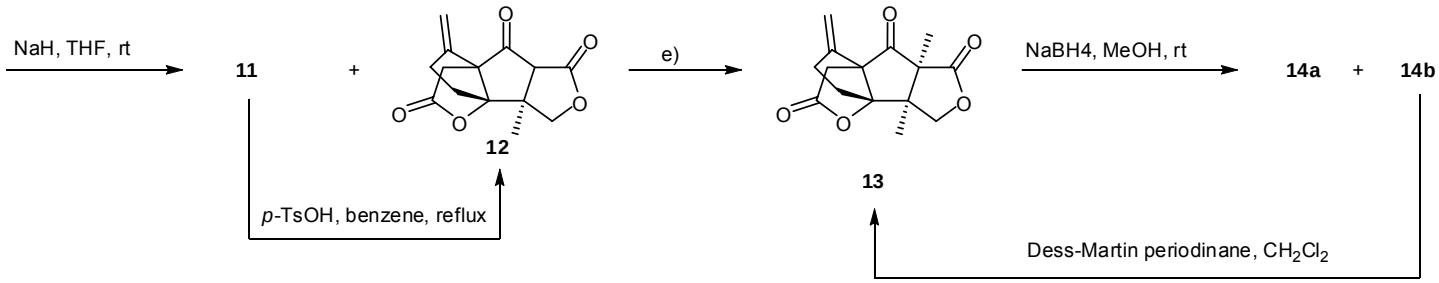
4.) Draw the structures of **6** and **7**.

5.) What is the name of the reaction from **6** to **7**? Propose a reaction mechanism. Comment on the stereochemistry.



6.) Draw the structure of **9** and the reaction mechanism of step 1).

7.) Give the reagents for step d).

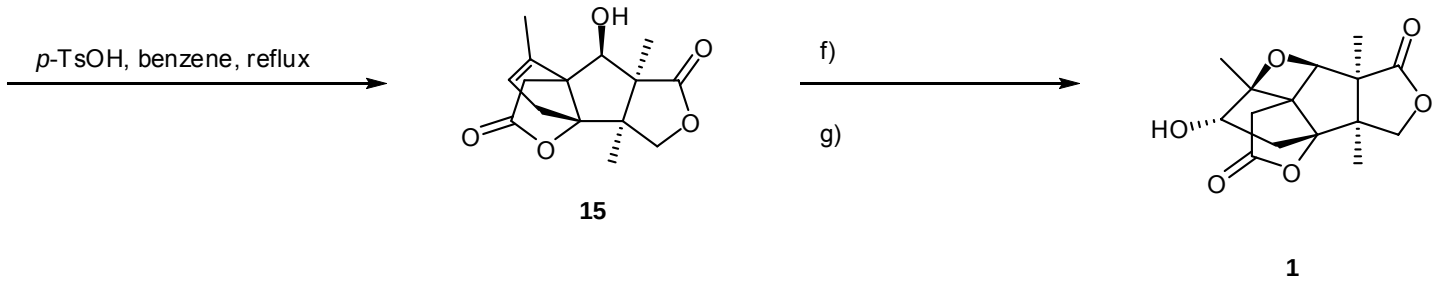


8.) Draw the structure of **11**. Give a mechanism for the formation of **12**, both from **10** and from **11**.

9.) Give the reagents for step e).

10.) What is the structure of **14a** and **b**? What ratio do you expect?

11.) Give the structure of Dess-Martin periodinane. Draw the reaction mechanism for the formation of **13** out of **14b**.



12.) Give reagents and mechanisms for steps f) and g).