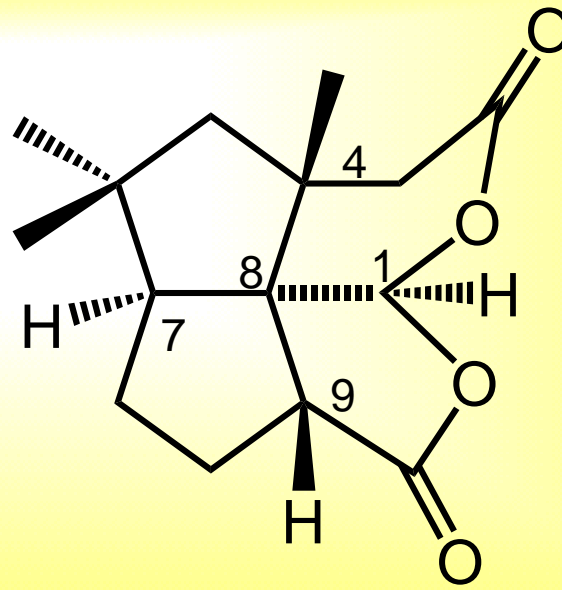


Literature Report 2009-10-27

陈庆安 检查: 高凯

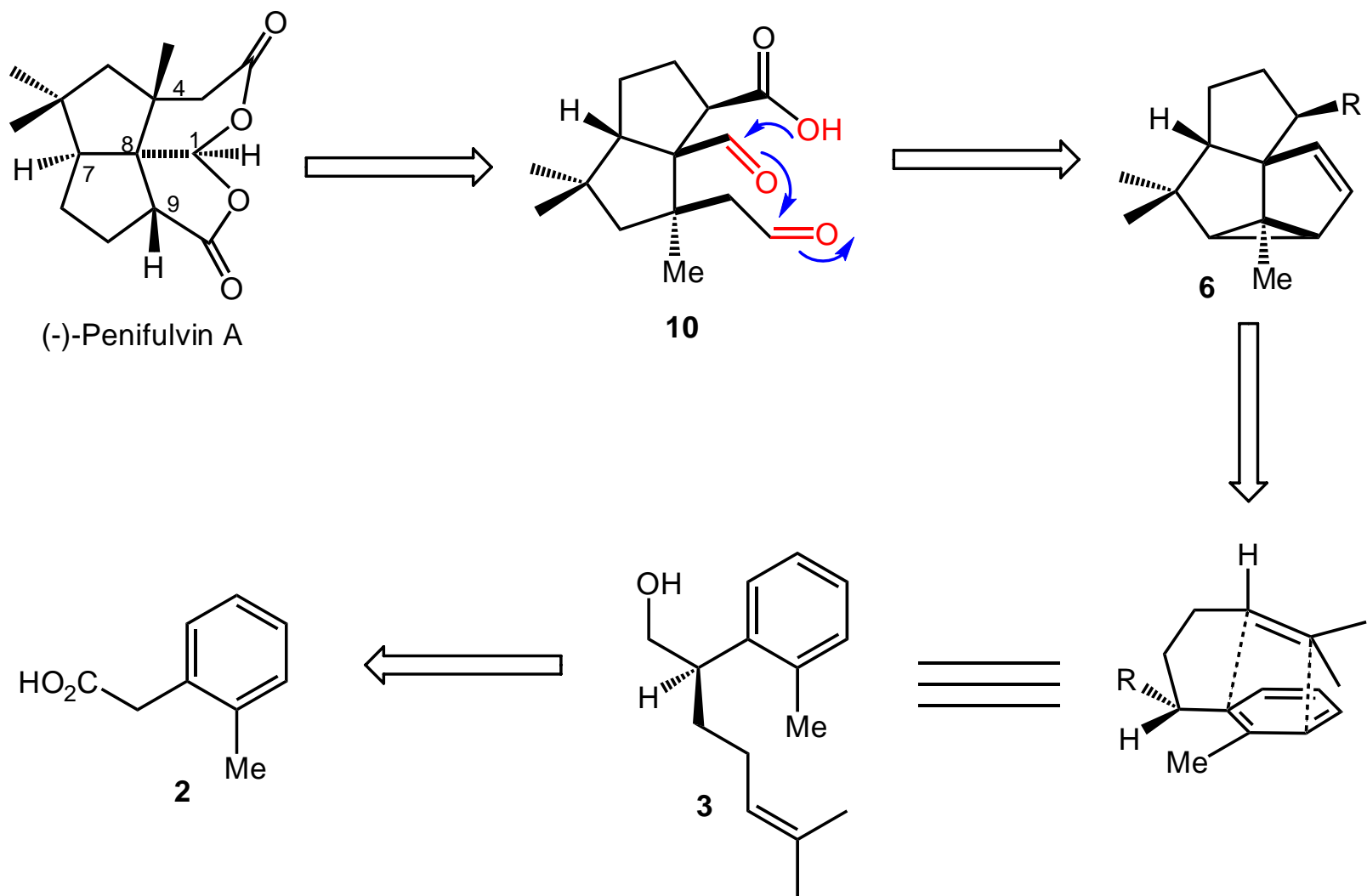
Total Synthesis of (-)-Penifulvin A, an Insecticide with a Dioxafenestrane Skeleton

Johann Mulzer* *et al*
J. Am. Chem. Soc. **2009**, 131, 452-453.

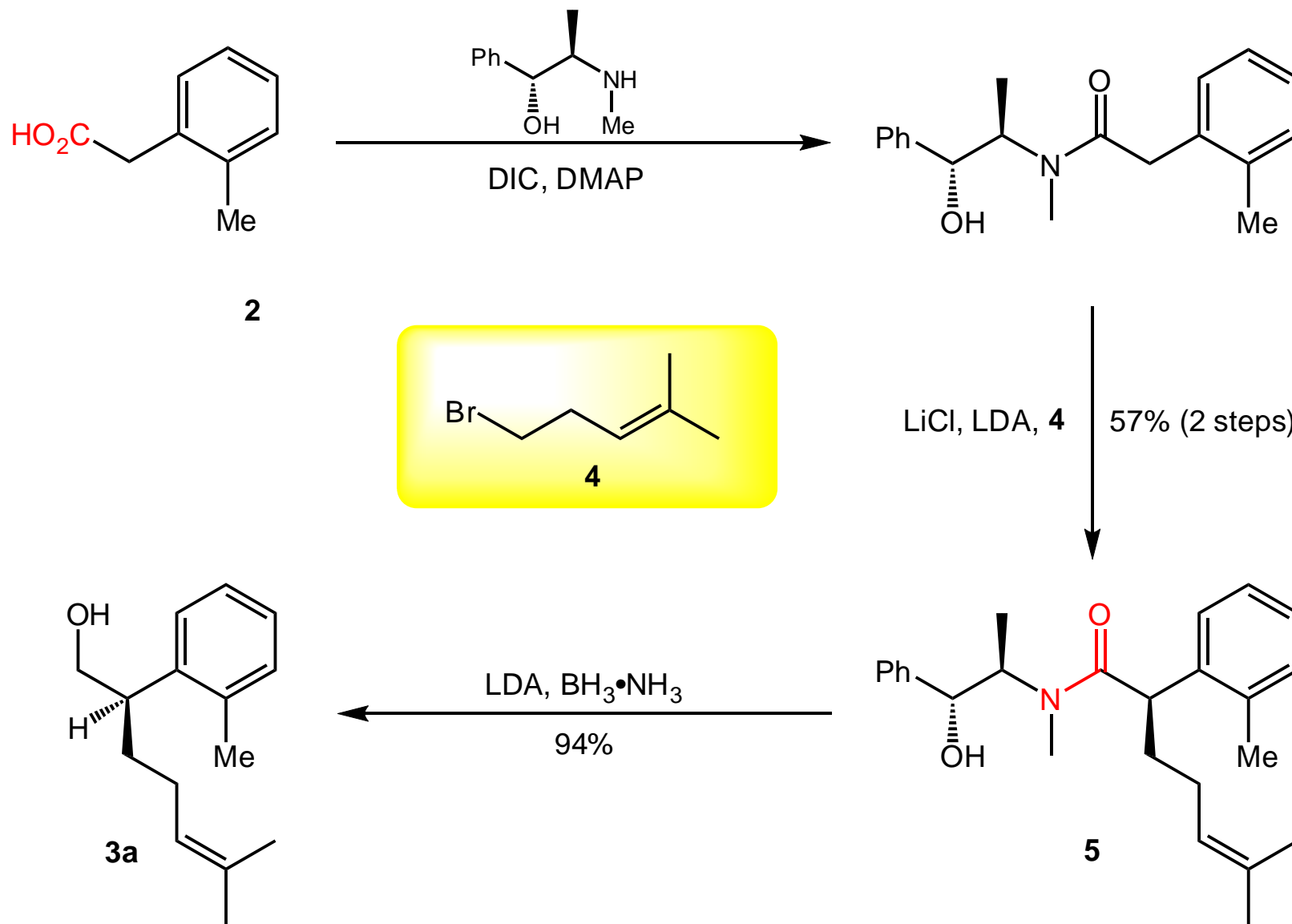


(-)-Penifulvin A

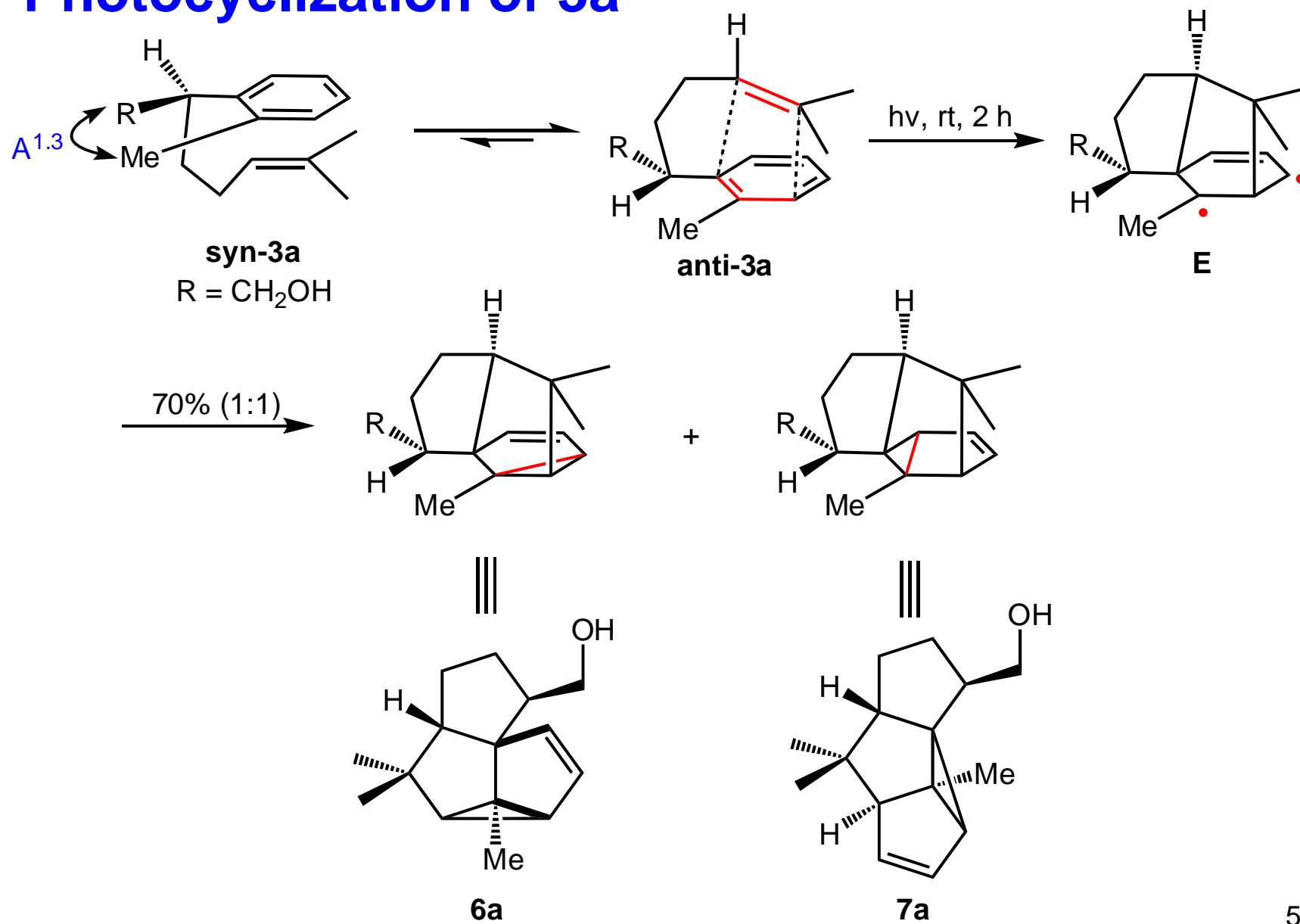
Retrosynthetic analysis of Penifulvin A



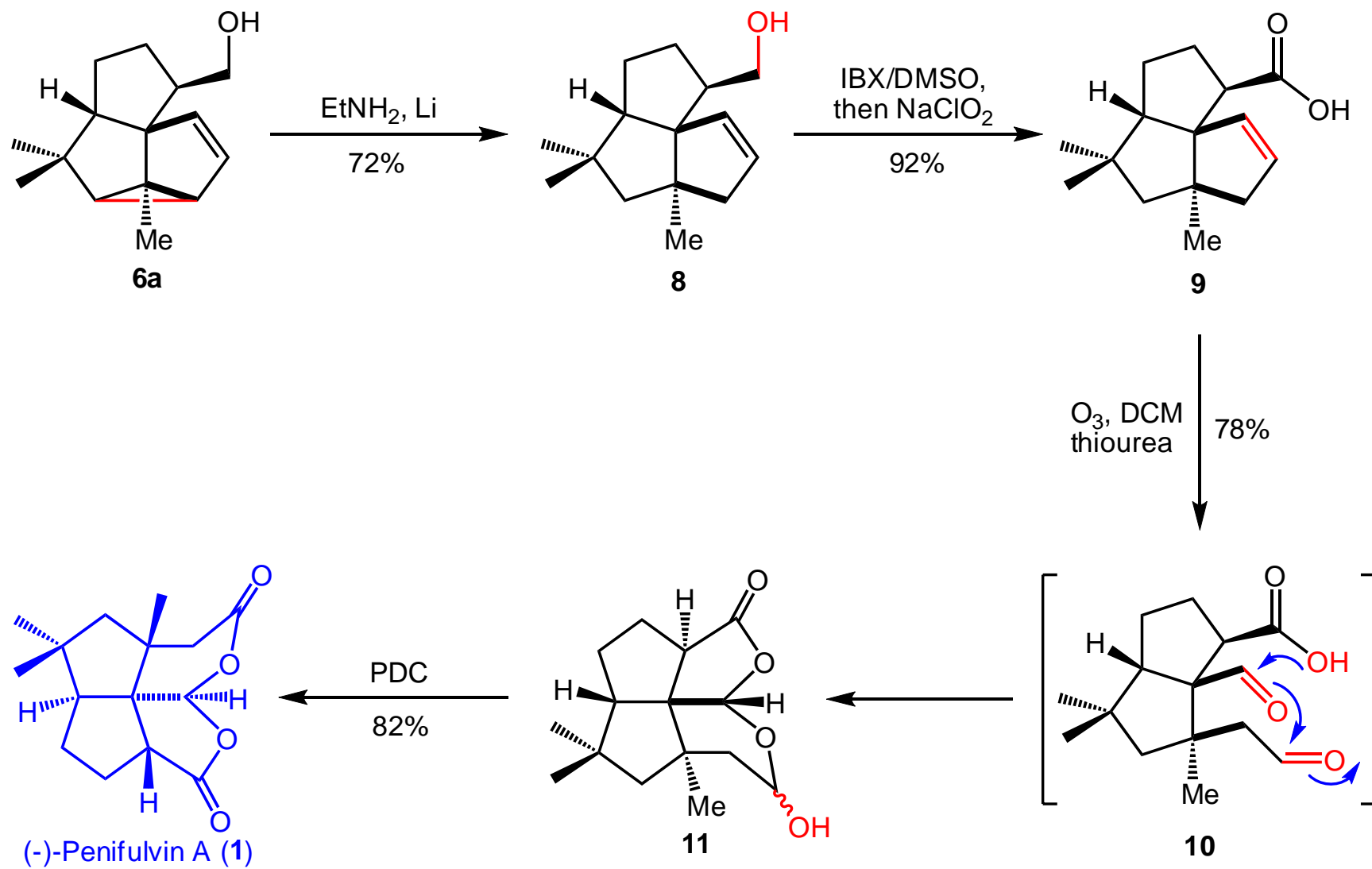
Preparation of Photocyclization Precursors 3a



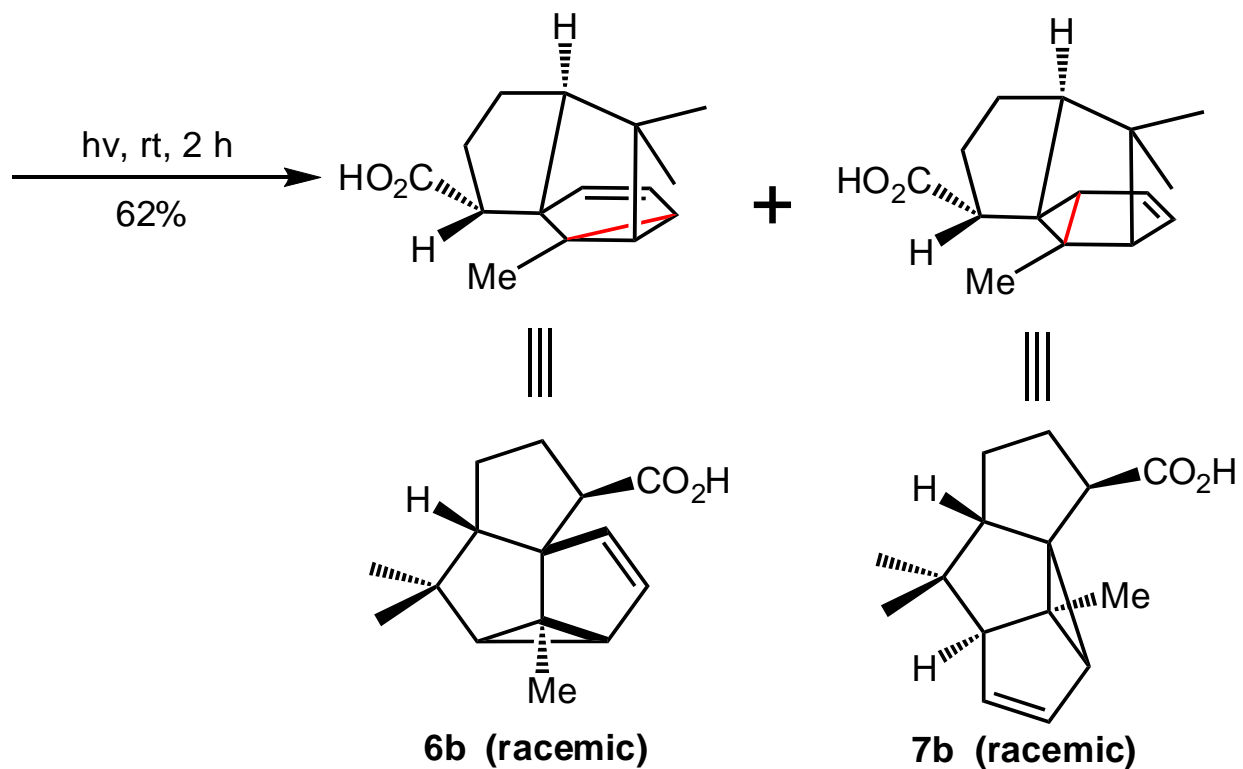
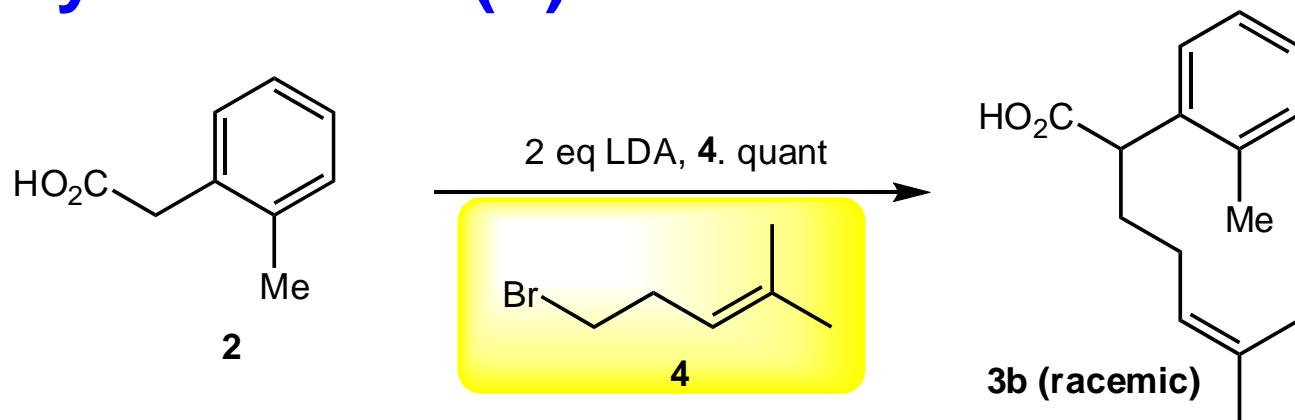
Photocyclization of 3a

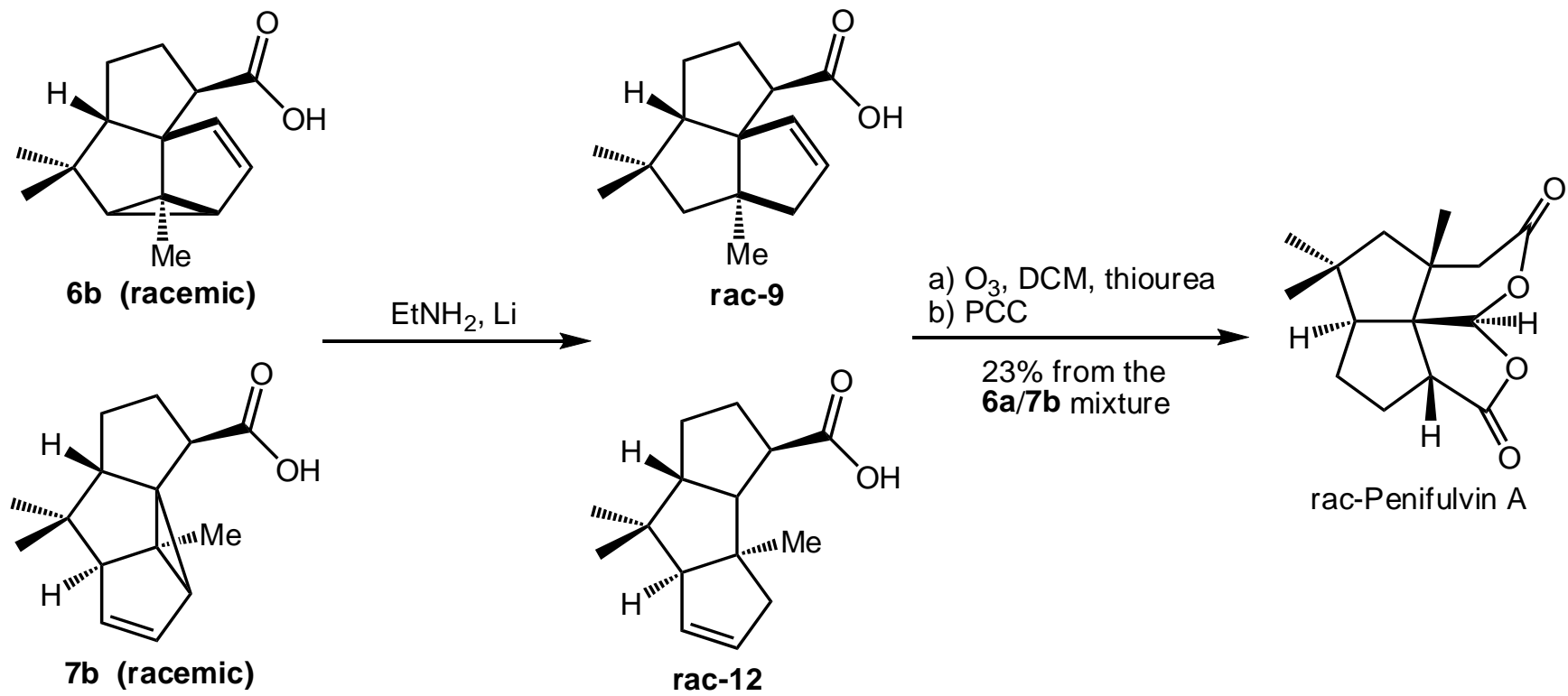


Completion of the Synthesis of (-)-Penifulvin A

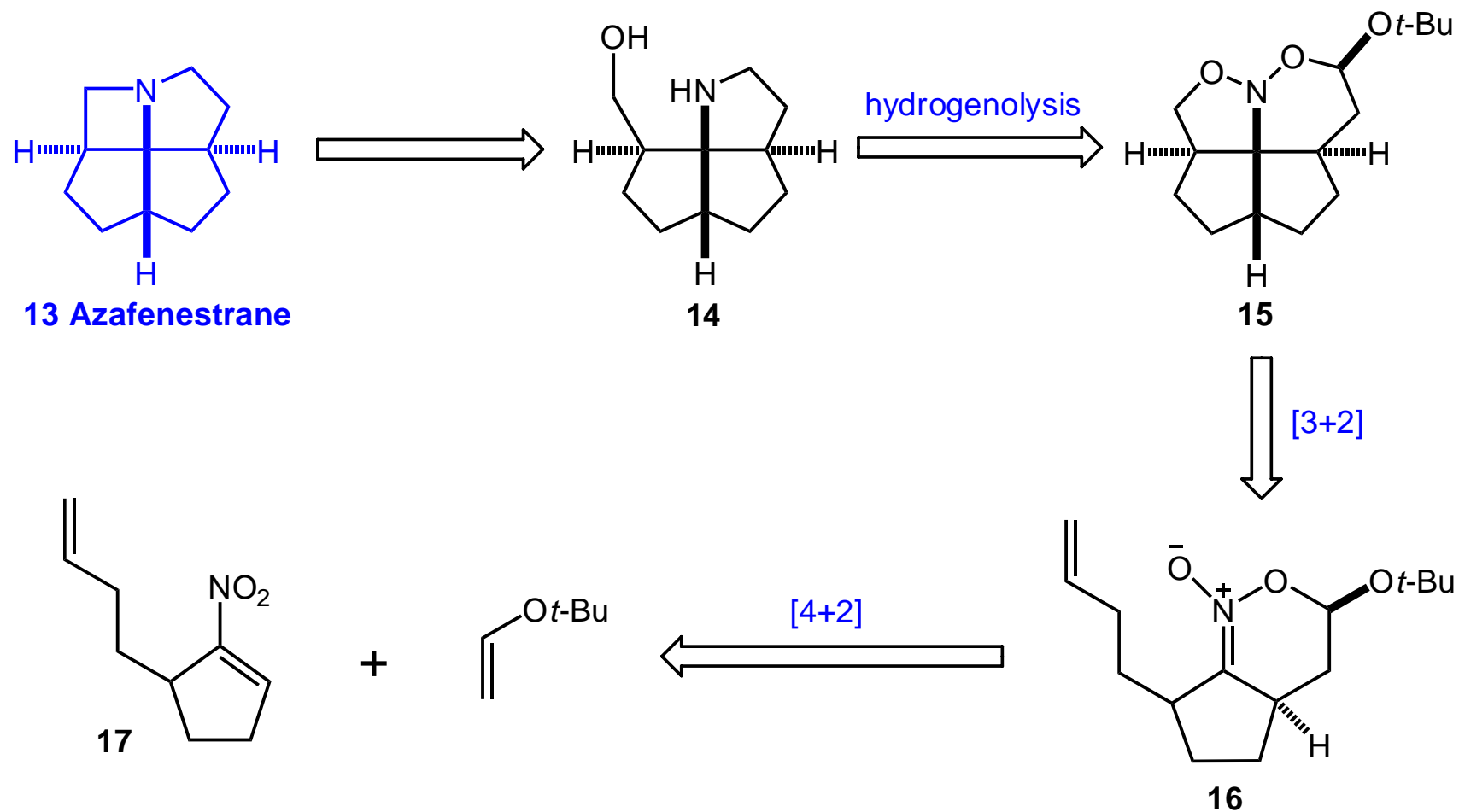


The Synthesis of (\pm)-Penifulvin A



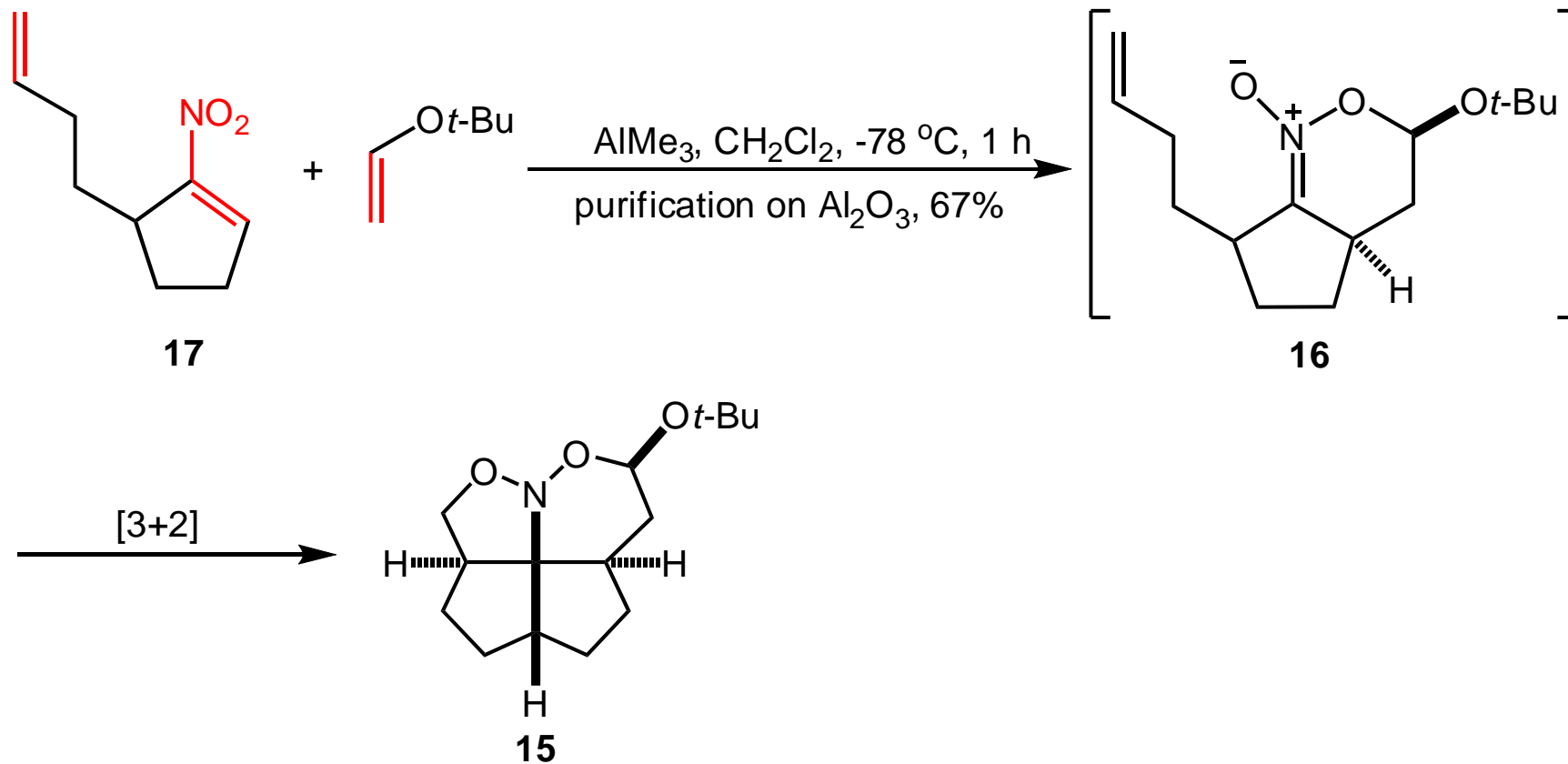


Denmark's work: Synthesis of Azafenestrane 13

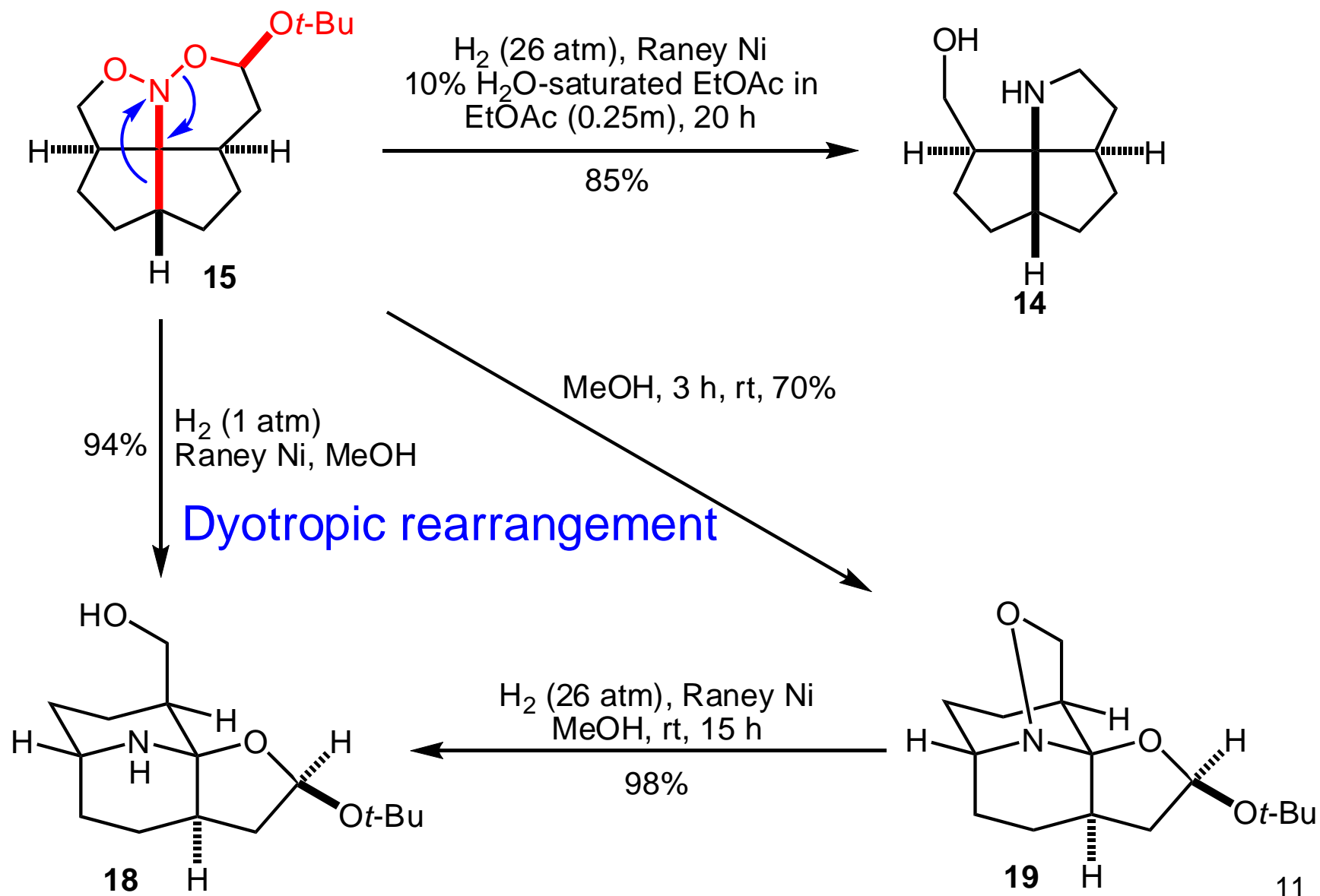


Denmark, S. E. *et al* *Angew. Chem. Int. Ed.* **2005**, *44*, 3732-3736

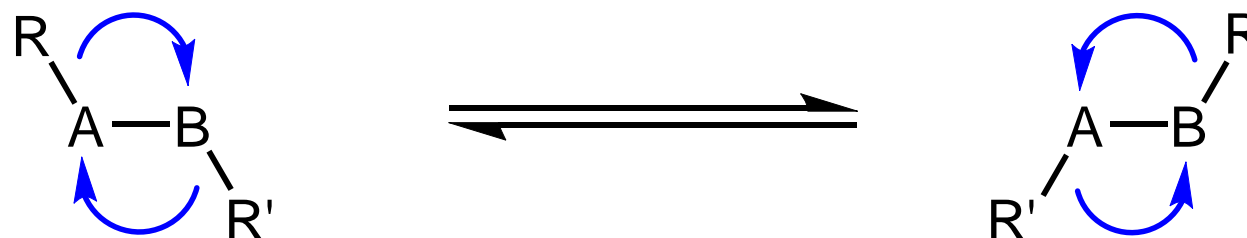
Tandem [4+2]/[3+2] cycloaddition



Hydrogenolysis of nitroso acetal 15

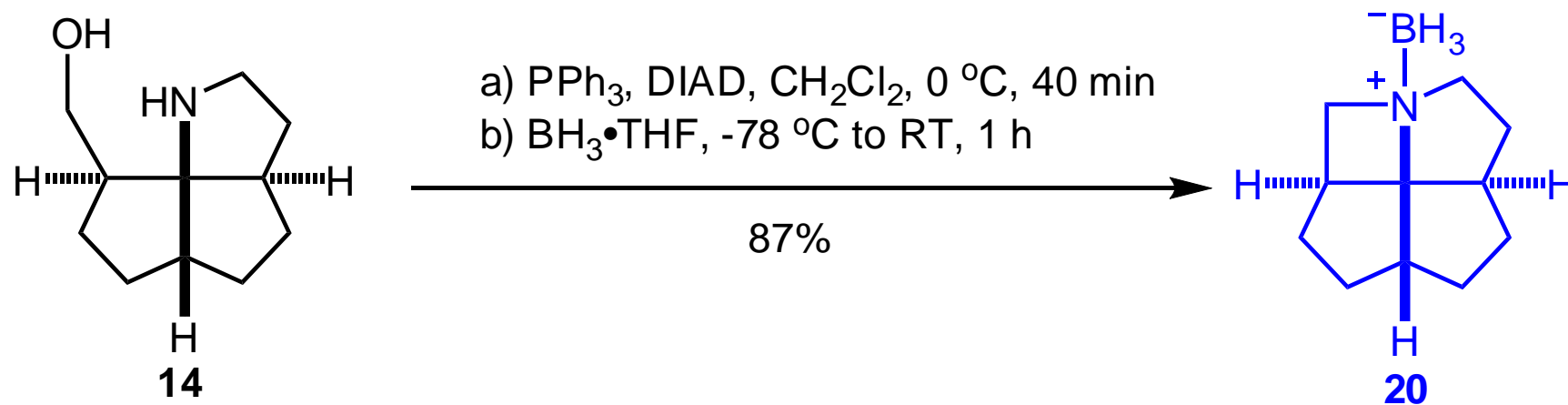


Dyotropic rearrangement

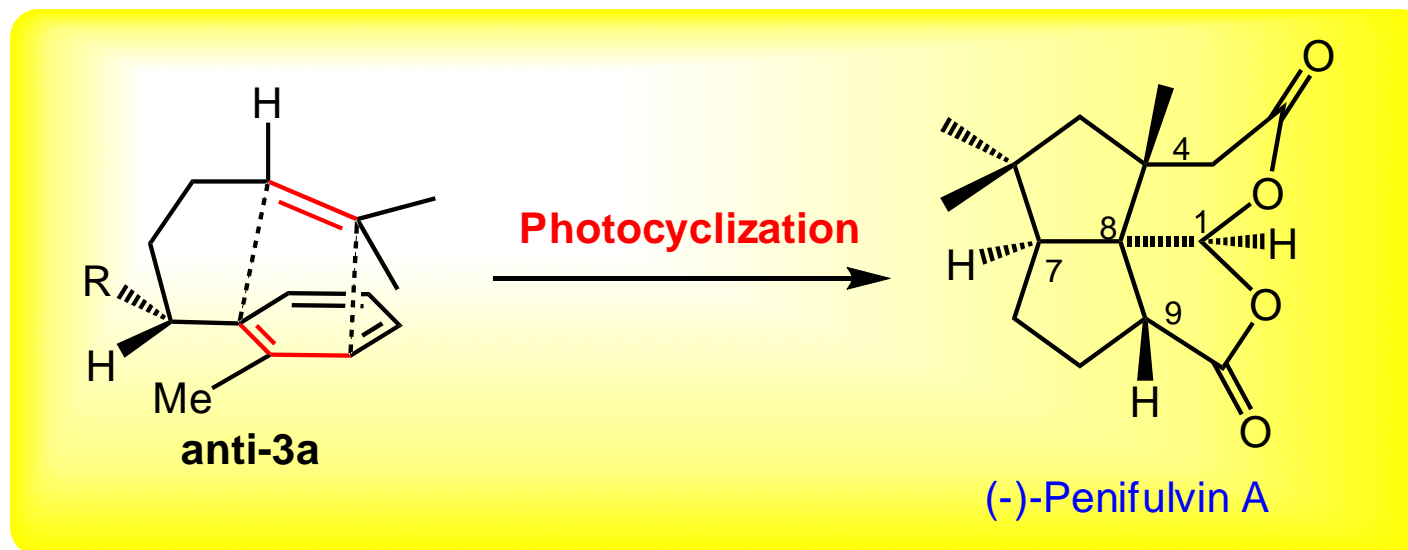


In 1972, M. T. Reetz defined dyotropic rearrangements as a new class of pericyclic valence isomerizations in which two σ -bonds simultaneously migrate intramolecularly.

Completion of the Synthesis of Azafenestrane



Summary



- a) No protecting groups.
- b) Marvelous photoinduced cyclization.
- c) (-)-Penifulvin A overall yield 8%, 8 steps.
- d) (\pm)Penifulvin A overall yield 14%, 5 steps.

The overall structure of **1**, which has been secured by X-ray crystallographic analysis, reveals a complex oxa-fenestrane structure in which four rings share a central quaternary carbon. Additionally there are two more quaternary carbons, a γ - and a δ -lactone sharing the acylal center, and a total of five stereogenic centers congested on a 15 carbon skeleton. This ring system, whose absolute configuration is unknown, has not been described previously in literature. Herein we report the first total synthesis of racemic and optically active **1** from inexpensive *o*-tolylacetic acid (**2**).

In conclusion we have disclosed a concise synthesis of penifulvin A in racemic and optically active form from *o*-tolylacetic acid in altogether 5 steps (14% overall yield) and 8 steps (8% overall yield), respectively. Apart from the photocyclization which leads to readily separable regioisomers, the synthesis is stereo- and regiocontrolled, does not require protecting groups or purification of intermediates, and is scalable.