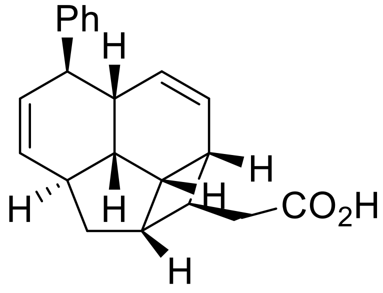
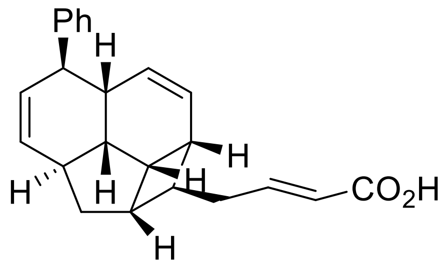
# Endiandric Acids A-D

Ch. 17

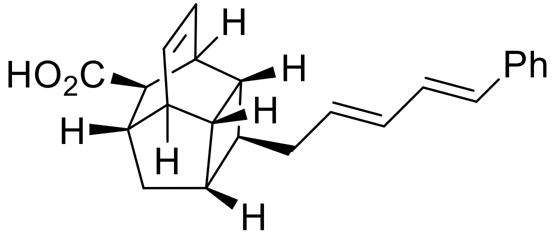
Shannon Cartwright



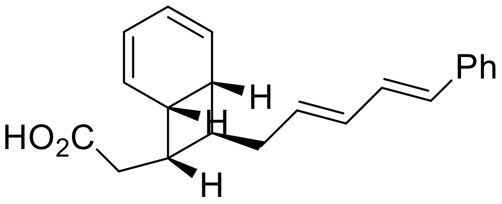

Endiandric acid A




Endiandric acid B




Endiandric acid C




Endiandric acid D

10.1039/C39800000902

# Background

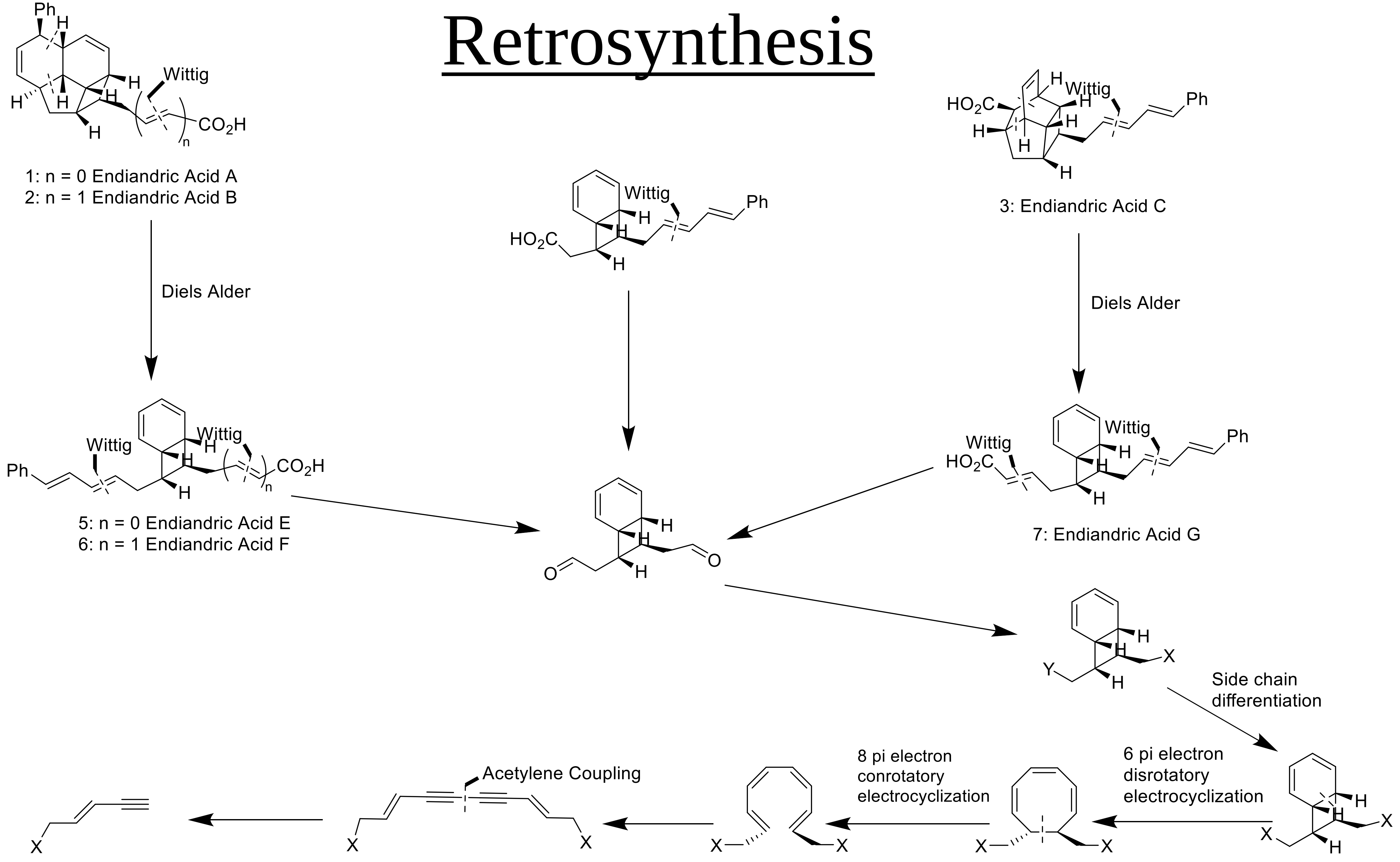
- Endiandric acids are polycyclic compounds isolated in the 1980s from the leaves of a tree that grows in the Australian rain forest.
  - Isolated by D. St. C. Black's group.
- The racemic forms appear in nature, not the enantiomeric forms.
  - Unusual for chiral compounds.
- Black proposed that this is due to their synthesis in nature being from a cascade of reactions.
- These compounds are interesting because of their unusual structures.

Bandaranayake, W. M., Banfield, J. E., Black, D. S. C., Fallon, G. D., & Gatehouse, B. M. Endiandric acid, a Novel Carboxylic Acid from Endiandra introrsa(Lauraceae): X-ray Structure Determination. *Journal of the Chemical Society, Chemical Communications* **1980** *4*, 162–163. DOI: 10.1039/C39800000162

Bandaranayake, W. M., Banfield, J. E., & Black, D. S. C. Postulated Electrocyclic Reactions leading to Endiandric Acid and Related Natural Products. *Journal of the Chemical Society, Chemical Communications* **1980,** *19*, 902–903. DOI: 10.1039/C39800000902

Nicolaou, K. C.; Sorensen, E. J. Endiandric Acids A –D. In *Classics in Total Synthesis, Targets, Strategies, Methods.* VCH, 1996; pp 265 – 283.

# Retrosynthesis




Nicolaou, K. C.; Sorensen, E. J. Endiandric Acids A –D. In *Classics in Total Synthesis, Targets, Strategies, Methods.* VCH, 1996; pp 265 – 283.

# Electrocyclizations – Thermal Conditions

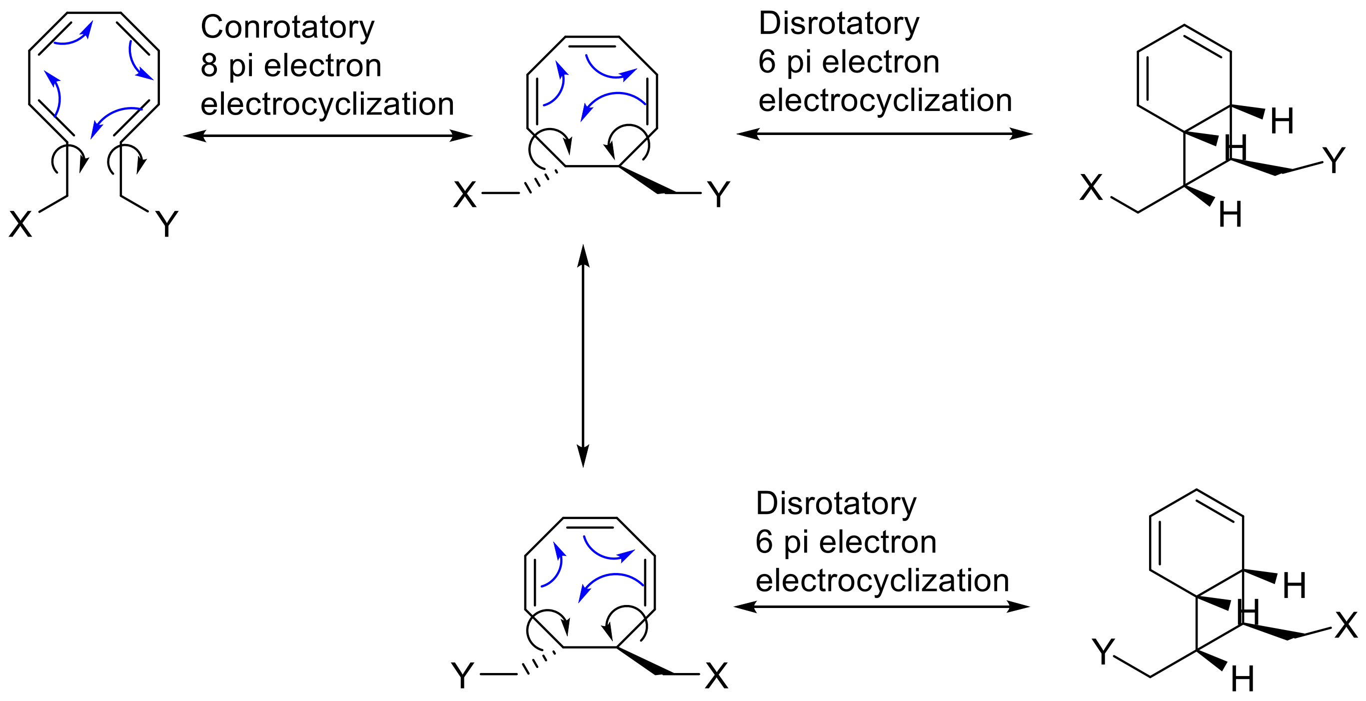
Conditions: Energy source is heat.

**Conrotatory**

- Even number of conjugation in the system
- $C_2$ axis of rotation symmetry maintained

**Disrotatory**

- Odd number of conjugation in the system
- $\sigma_v$ reflection plane symmetry is maintained





Nicolaou, K. C.; Sorensen, E. J. Endiandric Acids A –D. In *Classics in Total Synthesis, Targets, Strategies, Methods.* VCH, 1996; pp 265 – 283.
Ashenhurst, J. *Electrocyclic Reactions*. **2020**. https://www.masterorganicchemistry.com/2020/03/16/electrocyclic-reactions/

# Electrocyclizations – Photochemical Conditions

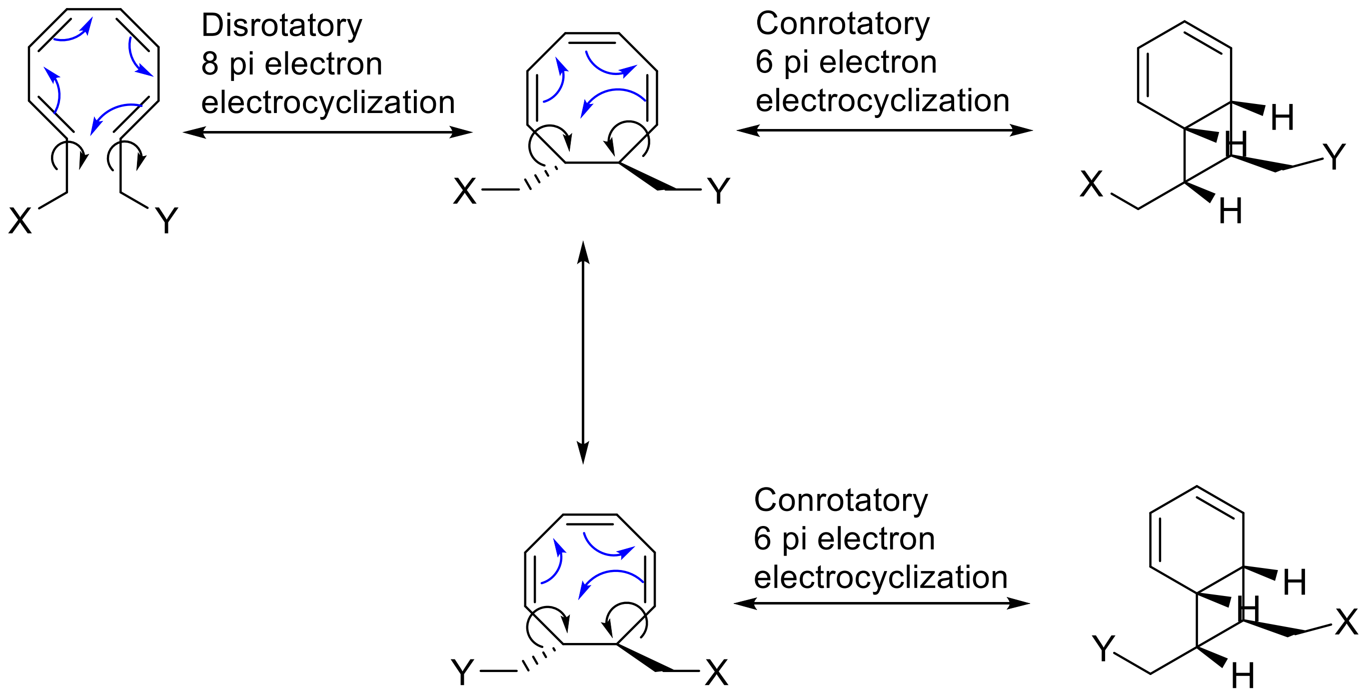
Conditions: Energy source is light

**Conrotatory**

- Odd number of conjugation in the system
- $C_2$ axis of rotation symmetry maintained

**Disrotatory**

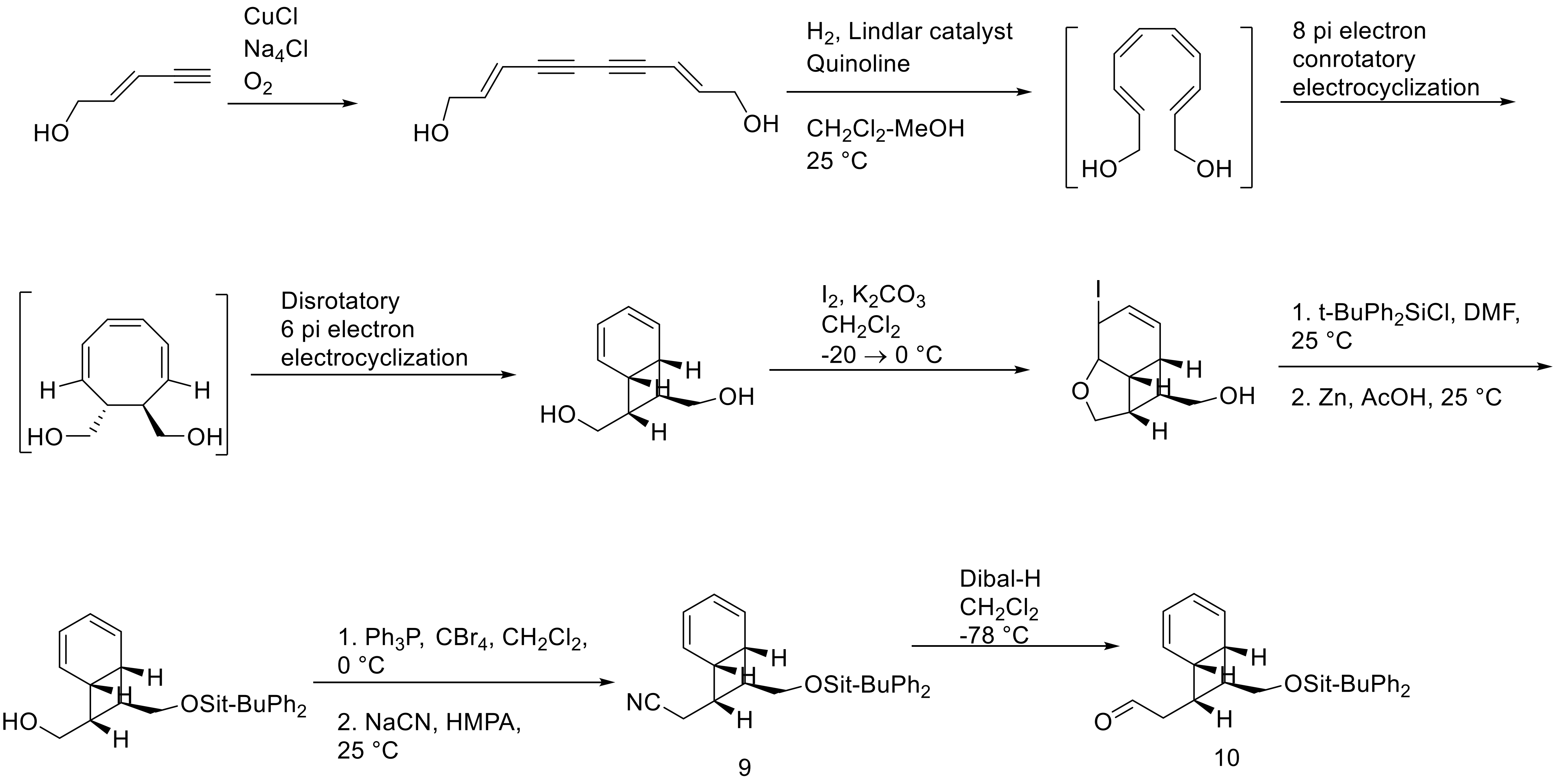
- Even number of conjugation in the system
- $\sigma_v$ reflection plane symmetry is maintained





Nicolaou, K. C.; Sorensen, E. J. Endiandric Acids A –D. In *Classics in Total Synthesis, Targets, Strategies, Methods.* VCH, 1996; pp 265 – 283.
Ashenhurst, J. *Electrocyclic Reactions*. **2020**. https://www.masterorganicchemistry.com/2020/03/16/electrocyclic-reactions/

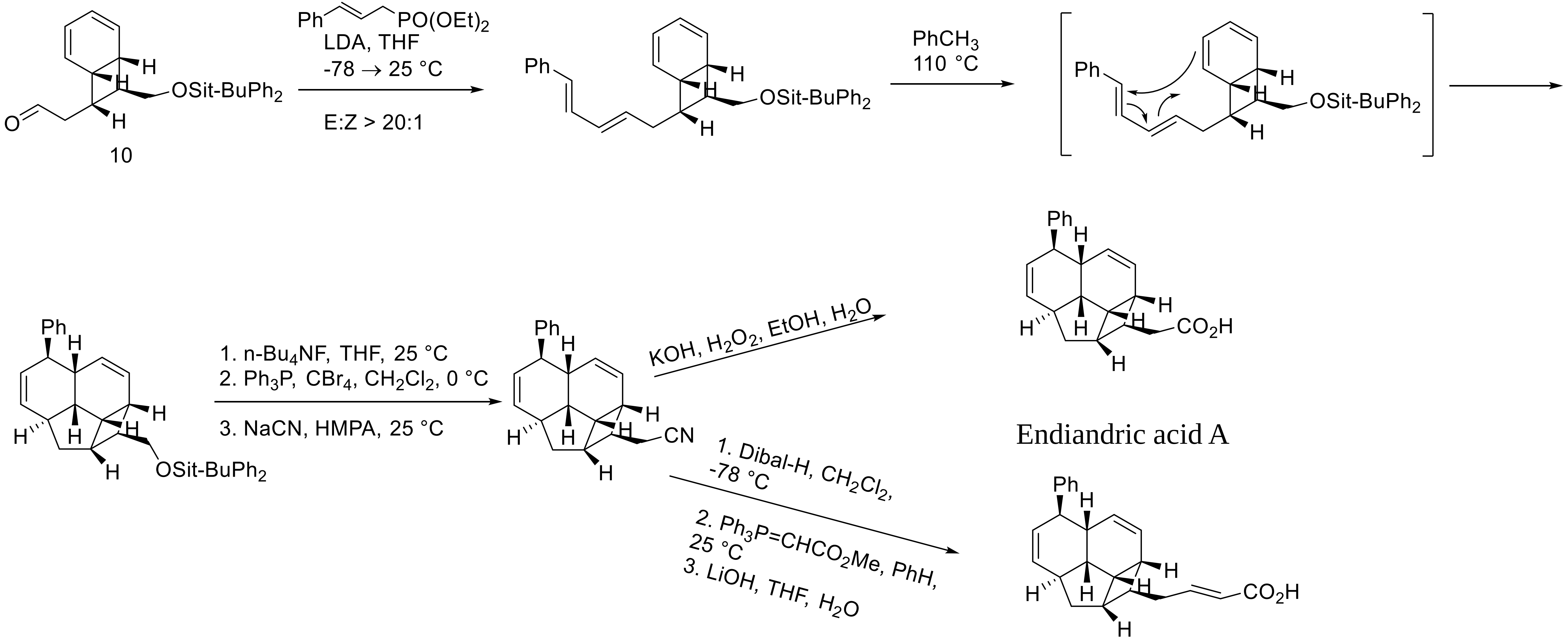
# Synthesis of 9 and 10




K. C. Nicolaou, N. A. Petasis, R. E. Zipkin, and J. Uenishi. *Journal of the American Chemical Society* **1982** *104* (20), 5555-5557. DOI: 10.1021/ja00384a077

Nicolaou, K. C.; Sorensen, E. J. Endiandric Acids A –D. In *Classics in Total Synthesis, Targets, Strategies, Methods.* VCH, 1996; pp 265 – 283.

# Synthesis of Endiandric Acids A and B




Endiandric acid A

Endiandric acid B

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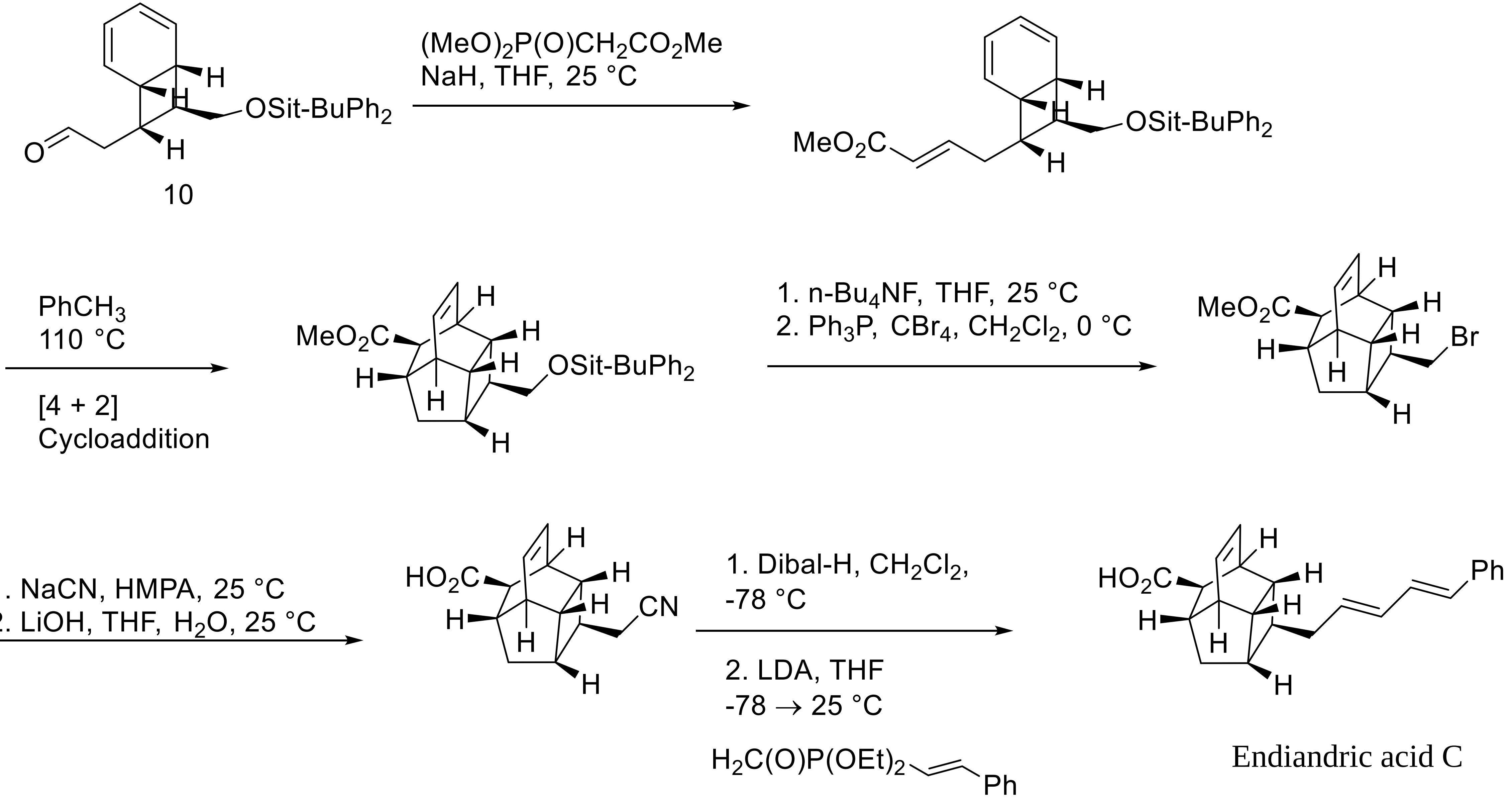
# Synthesis of Endiandric Acid C




K. C. Nicolaou, N. A. Petasis, J. Uenishi, and R. E. Zipkin. *Journal of the American Chemical Society* **1982** *104* (20), 5557-5558. DOI: 10.1021/ja00384a078

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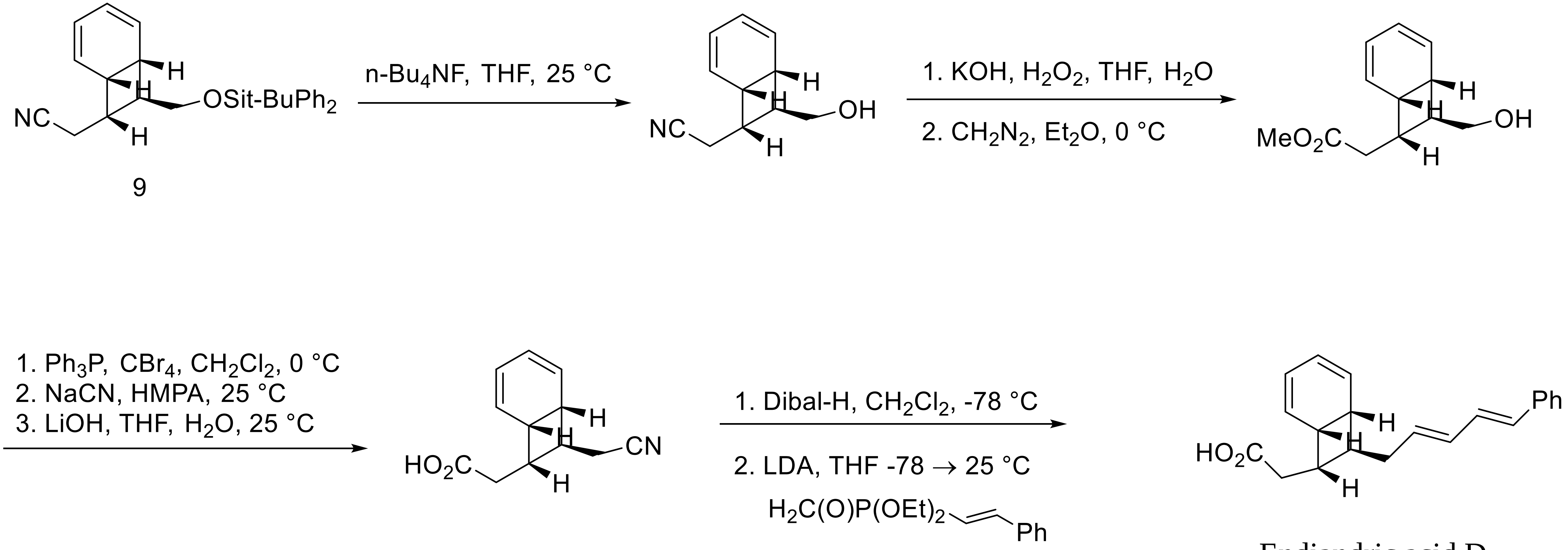
# Synthesis of Endiandric Acid D




Endiandric acid D


K. C. Nicolaou, N. A. Petasis, J. Uenishi, and R. E. Zipkin. *Journal of the American Chemical Society* **1982** *104* (20), 5557-5558. DOI: 10.1021/ja00384a078

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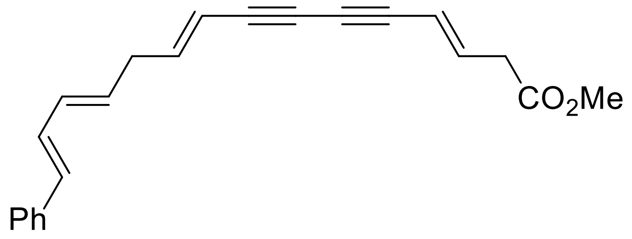
# Interesting "One Step" Synthesis

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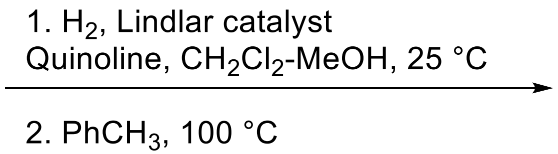
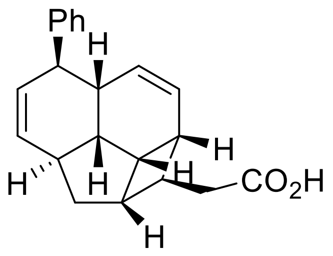
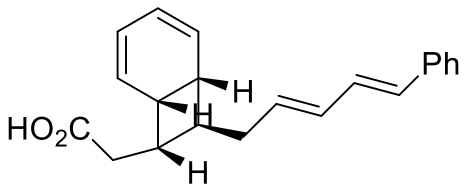
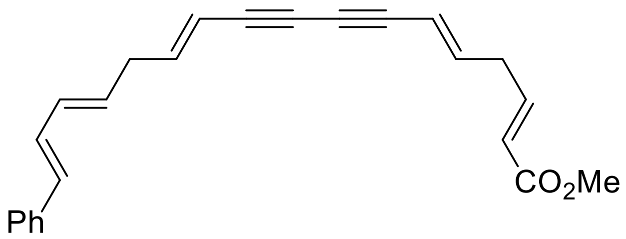


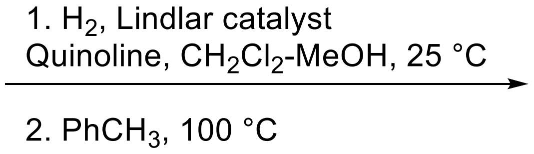

Endiandric acid A
Methyl Ester

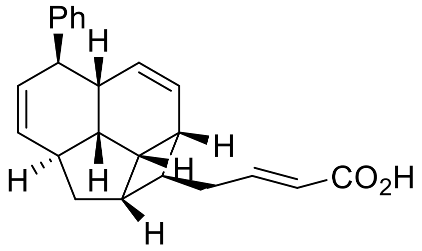



Endiandric acid D
Methyl Ester

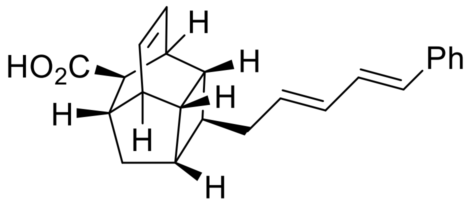



12




Endiandric acid B
Methyl Ester




Endiandric acid C
Methyl Ester

Nicolaou, K. C.; Sorensen, E. J. Endiandric Acids A –D. In *Classics in Total Synthesis, Targets, Strategies, Methods.* VCH, 1996; pp 265 – 283.

# Conclusion

- Endiandric acids A-D were isolated in the 1980s from nature
- They exist in racemic mixture in nature
- Black's group hypothesized that they were created via a cascade of reactions
- The "one step" synthesis shows the products obtained through electrocyclization cascade reactions
- The multi-step synthesis uses two back-to-back electrocyclization reactions, both conrotatory and disrotatory, along with other steps to get to the products

Bandaranayake, W. M., Banfield, J. E., Black, D. S. C., Fallon, G. D., & Gatehouse, B. M. Endiandric acid, a Novel Carboxylic Acid from Endiandra introrsa(Lauraceae): X-ray Structure Determination. *Journal of the Chemical Society, Chemical Communications* **1980** *4*, 162–163.

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