**3 Membered Rings**

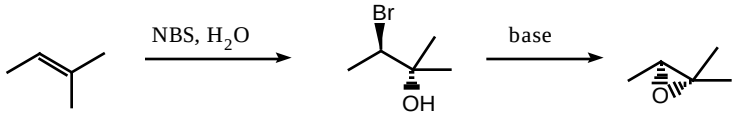
1. epoxides
    a. peracids, hydroperoxides and dioxiranes
    b. transition metal catalyzed epoxidations
    c. halohydrins
    d. Darzen's condensation
    e. sulfur ylides
2. cyclopropanes
    a. Simmons-Smith reactions
    b. diazo compounds
    c. sulfur ylides
    d. $S_N2$ displacements
3. aziridines
    a. nitrenes
    b. $S_N2$ displacements

*Epoxides*

- peracid, hydroperoxide and dioxirane oxidation of alkenes

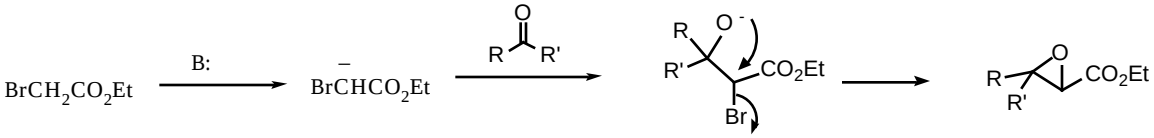
- transition metal catalyzed epoxidation of alkenes
    - Sharpless epoxidation
    - Metal oxo reagents (Jacobsen's reagent)

- from halohydrins

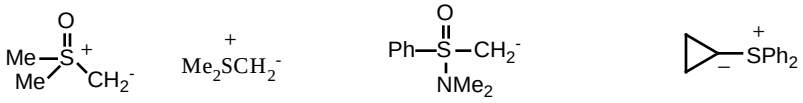



bromohydrin

- Darzen's Condensation




- sulfur ylides *Chem. Rev.* **1997**,*97*, 2421.

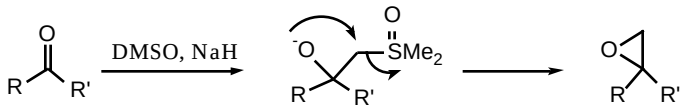



Corey

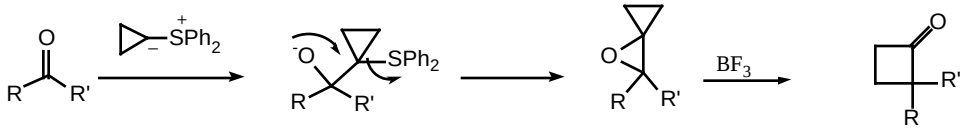
Johnson sulfoximine

Trost

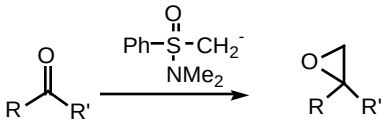
- dimethylsulfoxonium methylide and dimethylsulfonium methylide (Corey's reagent) review: *Tetrahedron* **1987**, *43* , 2609.




- cyclopropyldiphenylsulfonium ylide (Trost's reagent) *ACR* **1974**, *7*, 85.

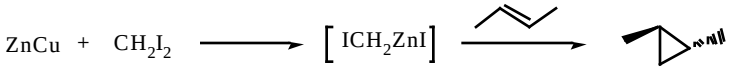



- sulfoximine ylides (Johnson's reagent) *ACR* **1973**, *6* , 341

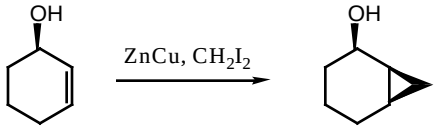



*Cyclopropanes*

- Simmons-Smith Reaction *Org. Reactions* **1973**, *20*, 1.

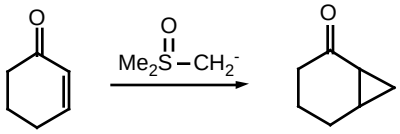



- polar groups (-OH, -$NR_2$- $CO_2R$) can direct the cyclopropanation

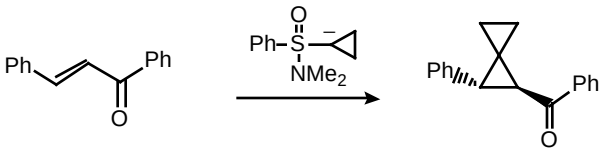



*JACS* **1979**, *101* , 2139

- sulfur ylides



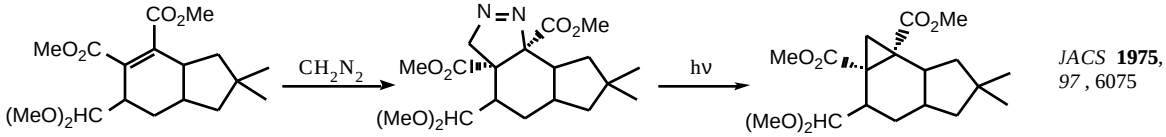

*Tetrahedron* **1987**, *43* , 2609




*ACR* **1973**, *6* , 341

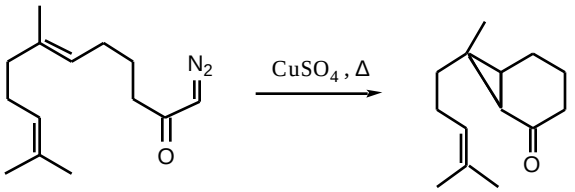
- diazo alkanes and diazo carbonyls *Synthesis* **1972**, 351; **1985**, 569

- cyclopropanation with diazoalkanes; olefin requires at least on electron withdrawing group.

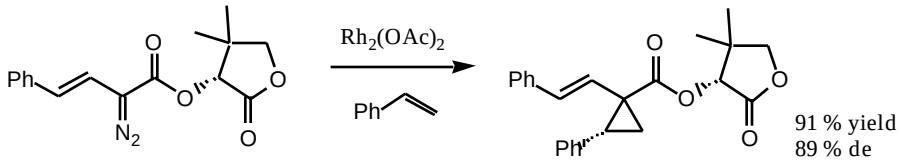



*JACS* **1975**, *97* , 6075

- diazoketones; photochemical or metal catalyzed decomposition of diazoketones to carbenes followed by cyclopropanation of olefins. *Org. Rxns.* **1979**, *26*, 361; *Tetrahedron* **1981**, *37*, 2407



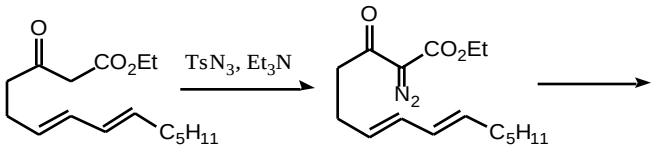

*JACS* **1970**, *92* , 3429
*JACS* **1969**, *91* , 4318

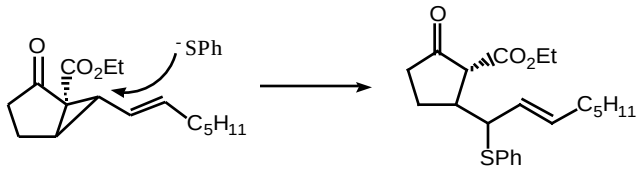



91 % yield
89 % de

*JACS* **1993**, *115*, 9468

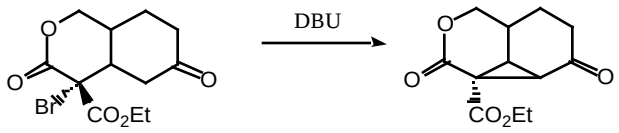
Asymmetric cyclopropanation: Doyle, *Chem Rev*. **1998**, *98*, 911
*Aldrichimica Acta* **1997**, *30*, 107




*JACS* **1977**, *99*, 1940

- $S_N2$ Reactions

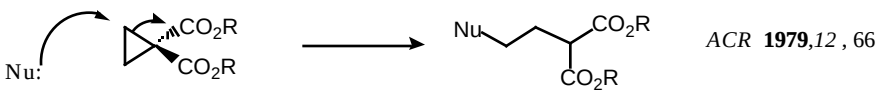



*JACS* **1978**, *99* , 1940

- Electrophillic Cyclopropanes review: *ACR* **1979**, *12* , 66

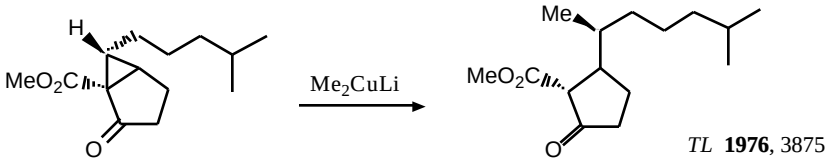
in many ways, cyclopropanes react silmilarly to double bonds

- homo-1,4-addition



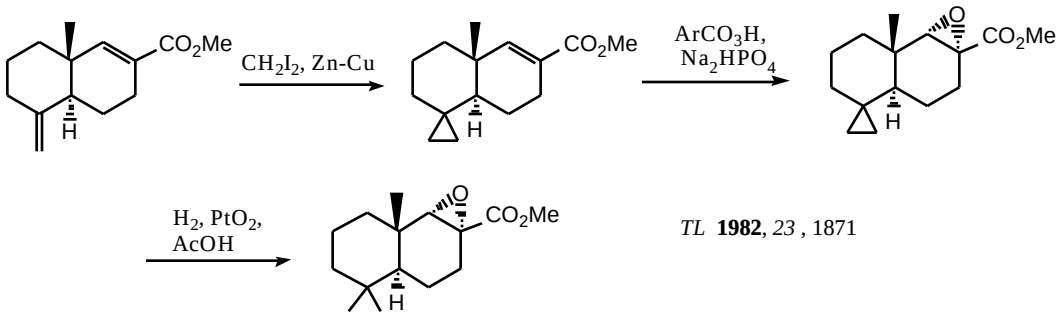

*ACR* **1979**,*12* , 66

Nu:= malonate anion, amines, thiolate anion, enamines, cuprates
(usually requires double activation of cyclopropane)



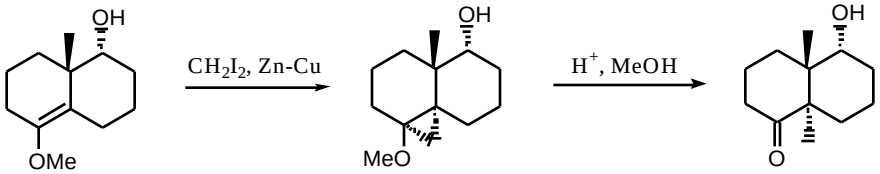

*TL* **1976**, 3875

- hydrogenation



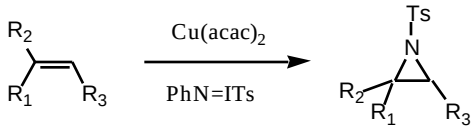

*TL* **1982**, *23* , 1871

- hydrolysis




*JACS* **1967**
*89* , 2507

*Aziridines*




*J. Org. Chem.* .**1991**, *56*, 6744