
Sir:

Although a number of elegant rearrangements generally classified as [2,3] sigmatropic processes have recently been reported, the incorporation of this class of reactions into synthetic methodology has been quite limited. The purpose of this communication is to define the complementary nature of certain (4 + 2) cycloaddition and [2,3] sigmatropic reactions. As illustrated in Scheme I, the merging of these two processes leads to substituted cyclohexene derivatives such as 4 which may be readily inaccessible via the direct cycloaddition route.

In the course of our current work directed toward the synthesis of both the hasubanan and morphine bases, an annelation sequence like that depicted in Scheme I appeared to offer an attractive solution to the construction of substituted cyclohexene derivatives such as 4, leads to substituted cyclohexene derivatives such as 4 which may be readily inaccessible via the direct cycloaddition route.


Sir:

Although a number of elegant rearrangements generally classified as [2,3] sigmatropic processes have recently been reported, the incorporation of this class of reactions into synthetic methodology has been quite limited. The purpose of this communication is to define the complementary nature of certain (4 + 2) cycloaddition and [2,3] sigmatropic reactions. As illustrated in Scheme I, the merging of these two processes leads to substituted cyclohexene derivatives such as 4 which may be readily inaccessible via the direct cycloaddition route.

In the course of our current work directed toward the synthesis of both the hasubanan and morphine bases, an annelation sequence like that depicted in Scheme I appeared to offer an attractive solution to the construction of substituted cyclohexene derivatives such as 4, leads to substituted cyclohexene derivatives such as 4 which may be readily inaccessible via the direct cycloaddition route.
formed the β-resorcylic acid salt, mp 180–181°C. The evidence that 8b is a single isomer rather than an
epimeric alcohol mixture was derived from its behavior on tlc, its cleanly resolved nmr spectrum, and the sharp
melting range of the amine salt. The structure of 8b followed unambiguously from the nmr (60 MHz, CDCl3) which clearly revealed all ring-C protons. The C6–C7 vinyl hydrogens appeared as an AB quartet (5.74 ppm, J = 9 Hz) coupled allylically (J = 2.5 Hz) to the C9 H. The C7 H appeared as a broadened triplet (3.75 ppm, J = 7 Hz) coupled with the magnetically equivalent protons at C9 (doublet, 2.2 ppm, J = 7 Hz).9

The syn relationship between hydroxyl and nitrogen functions follows from the observance of intramolecular hydrogen bonding in the ir spectrum (CCl4 at 0.006 M), 3611 (free OH) and 3323 cm–1 (bonded OH). Other examples of intramolecular hydrogen bonding from a similar configuration have also been reported.10 Thus, from the known stereochemical relationships in 8b, the syn relation between sulfoxide and amine functions in 7 may be inferred. This is the geometry that would be predicted from the preferred endo orientation of 5 and 6 during the cycladdition step.11

In a parallel experiment designed to compare the relative reactivity of sulfoxide 5 with more commonly used electron-deficient dienes, enamine 6 was also found to add to methyl pentadienoate12 (12) (CH3CN, 24 hr, 40°C) affording the nicely crystalline tetracyclic ester 11, mp 96–98°C, in 50% yield.6 Qualitatively, it appears that the sulfoxide-substituted diene 5 is slightly less reactive than 12, an observation in agreement with the expected activating abilities of ester and sulfoxide functions in nucleophilic addition reactions with substituted ethylene derivatives.14

In order to extend this annelation sequence to include both electron-deficient as well as electron-rich dienes one may simply change the oxidation state of the sulfur-substituted diene. We have found that dienyl sulfide 10 reacts quite cleanly with both methyl vinyl ketone (neat, 125°C, 11.5 hr) and maleic anhydride (reflux, benzene, 25 hr) affording adducts 13 and 14 in 67 and 84% yields, respectively.5,14

These results indicate that both dienyl sulfoxide 5 and sulfide 10 appear to be effective dienes in Diels–
Alder reactions with electron-rich and electron-deficient dienophiles, respectively. As a result of the fact that such sulfoxides can be efficiently transformed into alcohols with allylic rearrangement, this synthetic sequence should extend the utility of the Diels–Alder reaction.

Acknowledgment. This investigation was supported by the National Institutes of Health, the National Science Foundation, and funds provided by Eli Lilly.

(14) Compound 14 was characterized as the crystalline diacid, mp 154–155°.

(15) Camille and Henry Dreyfus Teacher-Scholar recipient, 1971–
1976.

D. A. Evans,*14 C. A. Bryan, C. L. Sims
Contribution No. 2002, Department of Chemistry
University of California, Los Angeles
Los Angeles, California 90024
Received December 8, 1971

Nucleophilic Participation by Remote Cyclopropane in an Intramolecular Analog to the SN2 Reaction

Sir:

Previous work in this laboratory1 has provided non-
enzymic precedent for the previously suggested2 possi-

(See, for example: J. H. Law, Accounts Chem. Res., 4, 199 (1971).)


(7) G. D. Sargent, R. L. Taylor, and W. F. Demisch, Tetrahedron Lett., 2275 (1968); G. D. Sargent, M. J. Harrison, and G. Khoury,