Tetrahedron Letters,Vol.29,No.46,pp 5947-5948,1988 0040-4039/88 $3.00 + .00
Printed in Great Britain Pergamon Press plc

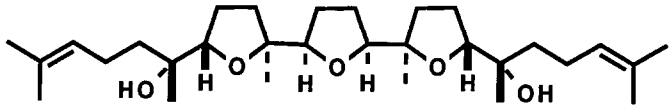
# A SHORT STEP SYNTHESIS OF TEURILENE. STEREOCONTROLLED SEQUENTIAL DOUBLE CYCLIZATION OF THE $C_{30}$-TETRAENETETRAOL TO THE TANDEM TETRAHYDROFURAN SYSTEM

Masaru Hashimoto, Hiroko Harigaya, Mitsutoshi Yanagiya,
and Haruhisa Shirahama*

Department of Chemistry, Faculty of Science, Hokkaido University,
Sapporo 060, Japan

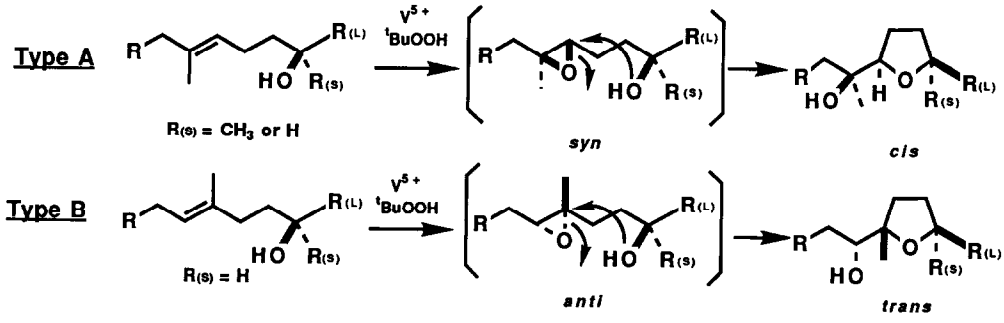
A meso-triterpene ether, teurilene was stereoselectively synthesized through one step formation of a link of two tetrahydrofurans by $V^{5+}$ catalyzed oxidation of a $C_{30}$-tetraenetetraol derivative.

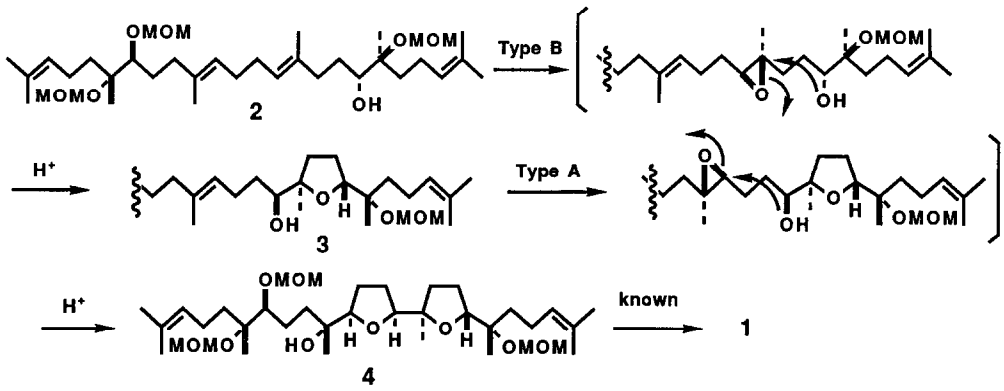
A marine triterpene, teurilene (**1**)[1] is characterized by beautiful arrangement of eight asymmetric carbons and a link of three tetrahydrofurans in the center of its molecule. The decorous molecule arouses special interest in its synthesis and conformational properties.[2] We should like to report a short step synthesis of teurilene (**1**) by stereocontrolled sequential double cyclization of a $C_{30}$-tetraenetetraol derivative **2**.




teurilene (1)

In the course of the studies on total synthesis of thyrsiferol,[3] we found a "rule" of $V^{5+}$ catalyzed oxidation-cyclization of bishomoallylalcohol system, i.e. a 5-substituted 4-en-1-ol gave a cis-2,5-disubstituted tetrahydrofuran through a syn-epoxide (Type A), while a 4-substituted 4-en-1-ol gave a trans-2,5,5-trisubstituted tetrahydrofuran through anti-epoxide (Type B)[4]. This "rule" was extremely valuable to assemble stereoselectively 2,5-disubstituted tetrahydrofuran moieties and its usefulness was successfully demonstrated by application to the present synthesis.



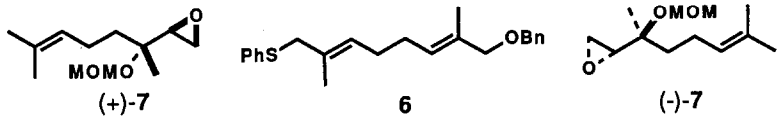



The synthesis was outlined above. A $C_{30}$-tetraenetetraol derivative **2**[5] was treated with $VO(acac)_2$ (0.01 eq.) and t-butylhydroperoxide (3 eq.) in the presence of AcOH (0.1 eq.) in benzene at 47 °C for 7 hr. The sequential epoxidation-cyclization of Type A and B proceeded smoothly and stereoselectively afforded a tandem tetrahydrofuran system **4** in a single step.[6] Assembling the third tetrahydrofuran ring through the known procedure[2a] furnished teurilene (**1**) which was completely identical with natural product by direct comparison of HPLC retention time, m.p., $[\alpha]_D$, 400 MHz $^1$H-NMR and IR.

**Acknowledgement** We are most grateful to Prof. Etsuro Kurosawa (Hokkaido University) for a generous gift of a sample of natural teurilene (**1**).

**References and Notes**

1) T. Suzuki, M. Suzuki, A. Furusaki, T. Matsumoto, A. Kato, Y. Imanaka, and E. Kurosawa, Tetrahedron Lett., **26**, 1329 (1985).
2) a) M. Hashimoto, M. Yanagiya, and H. Shirahama, Chem. Lett., **1988**, 645;
b) T. R. Hoye and S. A. Jenkins, J. Am. Chem. Soc., **109**, 6196 (1987);
c) T. R. Hoye and J. C. Suhadolink, Tetrahedron, **42**, 2855 (1986);
d) S. L. Schreiber, private communication to Prof. E. Kurosawa.
3) M. Hashimoto, T. Kan, M. Yanagiya, H. Shirahama, and T. Matsumoto, Tetrahedron Lett., **28**, 5665 (1987); M. Hashimoto, T. Kan, K. Nozaki, M. Yanagiya, H. Shirahama, and T. Matsumoto, ibid., **29**, 1143 (1988).
4) Selectivity of "Type B" has been known: T. Fukuyama, B. Vranesic, D. P. Negri, and Y. Kishi, Tetrahedron Lett., 2741 (1978).
5) Compound **2** was prepared from **6** by the following treatment, i) n-BuLi/TMEDA/(+)-**7**,[2a] ii) MOMCl/i-$Pr_2$NEt, iii) Na/i-PrOH/Δ, iv) Li/$NH_3$, v) $PPh_3/CCl_4$, vi) NaSPh, vii) n-BuLi/TMEDA/(-)-**7**,[2a] viii) Na/i-PrOH/Δ.




6) Bicyclic compound **4** was obtained in 25% yield with monocyclic compound **3** (30%) and polar materials. Longer time oxidation of **2** at higher temperature or employing larger amount of catalyst reduced considerably the yield of desired compound **4** (<10%).

(Received in Japan 2 July 1988; accepted 1 September 1988)