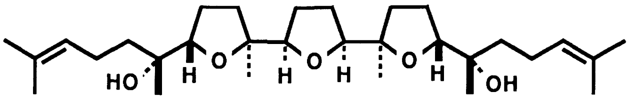
CHEMISTRY LETTERS, pp. 645-646, 1988.

Total Synthesis of *meso*-Triterpene Ether, Teurilene

Masaru HASHIMOTO, Mitsutoshi YANAGIYA, and Haruhisa SHIRAHAMA*
Department of Chemistry, Faculty of Science, Hokkaido University,
Sapporo 060

A marine triterpene, teurilene, whose molecule has *meso* form, was totally synthesized employing chiral assemblies.

Teurilene (**1**) is a marine triterpene isolated from the red alga *Laurencia obtusa*.[1] The molecule of this compound is characterized by beautiful arrangement of eight asymmetric carbons for **Cs** symmetry, and it arouses special interest in its synthesis and conformational properties.[2] We would like to report an total synthesis of teurilene.



teurilene (**1**)

The synthesis is outlined in Fig. 1. Both of distal and chiral fragments, **2** and **3** were furnished from geraniol by Sharpless oxidation assisted by D-(-)- and L-(+)-diisopropyl tartarate.[3] Addition of **4** to **2** gave **5**[4] which was directly converted to tetrahydrofuran **7** through epoxide **6** by vanadium (IV) catalyzed oxidation[5] with 75% stereoselectivity. After protection of hydroxyl group, the benzyloxymethylene of **7** was converted to an aldehyde and elongation by means of Wittig reaction was carried out to afford ester **8**. The sulfide **9**, obtained from **8** *via* an alcohol and a chloride, underwent coupling with **3** to give **10** whose thiophenyl group was removed and hydroxyl group was protected by MOM group and then desilylated to afford bishomoallyl alcohol **11**. Vanadium (IV) assisted epoxidation of **11**[5] gave stereoselectively bistetrahydrofuran **13** ($[\alpha]^{18}_{D}$ -4.2° (c 0.9, $CHCl_3$), no stereoisomer was detected.) through epoxide **12** *via* stereochemically different course from previous oxidation, **5**→**6**→**7**. All of protection on hydroxyl groups were removed and only secondary hydroxyl group was mesylated. Treatment of the mesylate with potassium carbonate and then HCl (2 mol dm^{-3}) gave tristetrahydrofuran which was completely identical with teurilene (**1**) by direct comparison of HPLC retention time and 400 MHz ^1H NMR spectrum. (mp 85.0-85.5 °C, $[\alpha]^{18}_{D}$ 0° (c 0.43, $CHCl_3$); lit.[1] 84-85 °C, $[\alpha]^{22}_{D}$ 0° (c 0.37, $CHCl_3$))

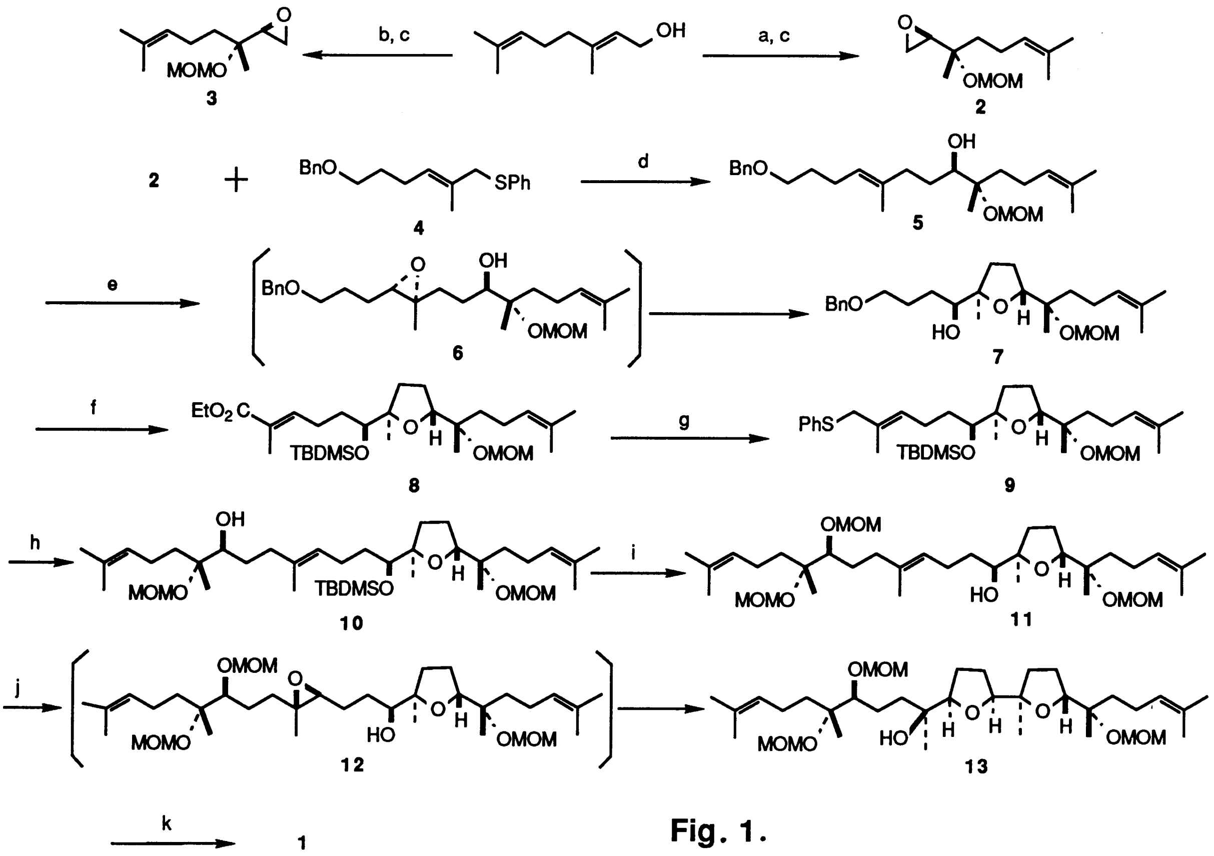


Fig. 1.

Conditions, **a**; D-(-)-DIPT, Ti(Oi-Pr)$_4$, TBHP, CH$_2$Cl$_2$, -20 °C, (98%, 87.8% ee), **b**; L-(+)-DIPT, Ti(Oi-Pr)$_4$, TBHP, CH$_2$Cl$_2$, -20 °C, (97%, 90% ee), **c**; i) TsCl, Py, CH$_2$Cl$_2$, 0 °C, ii) TsOH, aq. CH$_3$CN, 50 °C, (60%, 2 steps), iii) K$_2$CO$_3$, MeOH, -10 °C, iv) MOMCl, i-Pr$_2$NEt, CH$_2$Cl$_2$, r.t., (80% 2 steps), **d**; i) BuLi, DABCO, THF, -50 °C, ii) Na, i-PrOH, THF, reflux, (59% 2 steps), **e**; TBHP, VO(acac)$_2$, CH$_2$Cl$_2$, r.t., (77%), **f**; i) TBDMSOTf, 2,6-lutidine, CH$_2$Cl$_2$, r.t., (88%), , ii) Li, NH$_3$, -78 °C, (90%), iii) (COCl)$_2$, DMSO, Et$_3$N, CH$_2$Cl$_2$, -10 °C, iv) CH$_3$C(PPh$_3$)CO$_2$Et, CH$_2$Cl$_2$, reflux, (61% 2 steps), **g**; i) DIBAH, hexane, -78 °C, (93%), ii) CCl$_4$, PPh$_3$, benzene, reflux, (93%), iii) NaSPh, DMF, 0 °C, (84%), **h**; i) epoxide **3**, BuLi, TMEDA, 0 °C, (63%), ii) Na, i-PrOH, THF, reflux, (quant.), **I**; i) MOMCl, i-Pr$_2$NEt, CH$_2$Cl$_2$, r.t., (quant.), ii) TBAF, THF, reflux, (81%), **j**) TBHP, VO(acac)$_2$, benzene, 50 °C, (53%), **k**; i) cat. HCl, MeOH, r.t.,(98%), ii) MsCl, Et$_3$N, CH$_2$Cl$_2$, -40 °C, iii) K$_2$CO$_3$, MeOH, r.t., iv) 2 mol dm^{-3} HCl (32% 3 steps)

We thank Prof. Etsuro Kurosawa (Hokkaido University) for a generous gift of natural teurilene.

References

1) T. Suzuki, M. Suzuki, A. Furusaki, T. Matsumoto, A. Kato, Y. Imanaka, and E. Kurosawa, Tetrahedron Lett., 26, 1329 (1985).
2) T. R. Hoye and S. A. Jenkins, J. Am. Chem. Soc., 109, 6196 (1987); T. R. Hoye and J. C. Suhadolnik, Tetrahedron, 42, 2855 (1986); S. L. Schreiber, private communication to Prof. E. Kurosawa.
3) C. H. Behrens and K. B. Sharpless, J. Org. Chem., 51, 1922 (1986).
4) M. Hashimoto, T. Kan, M. Yanagiya, H. Shirahama, and T. Matsumoto, Tetrahedron Lett., 28, 5665 (1987).
5) T. Fukuyama, B. Branesic, D. P. Negri, and Y. Kishi, Tetrahedron Lett., 1978, 2741.

(Received January 13, 1988)