

Supporting Information for ol060115t

Part 1

Synthesis of the 17-Norjatrophone Diterpene (-)-15-Acetyl-3-propionyl-17-norcharaciol

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1. Methods and Materials

Unless otherwise stated, commercially available reagents were used as purchased without further purification. Before use, solvents were refluxed in the presence of the appropriate drying agent and distilled under nitrogen: tetrahydrofuran (THF) from potassium, dichloromethane (CH_2Cl_2), 1,2-dichloroethane and diethylether (Et_2O) from CaH_2 . Diisopropylamine and triethylamine (Et_3N) were distilled from CaH_2 and stored over 3 Å molecular sieves. Ethanol was distilled from sodium and stored over activated 3 Å molecular sieves. Methanol was distilled from magnesium and stored over activated 3 Å molecular sieves. Decane (99+%, ACROS) was used as purchased. *n*-Bu₂BOTf (1 M in CH_2Cl_2) was purchased from FLUKA. Lithium chloride was dried for 12 h at 150 °C and 0.05 mbar. The concentration of *n*-BuLi in hexane was determined employing 4-biphenylmethanol as indicator¹. All moisture-sensitive reactions were performed in flame-dried septum-sealed glassware under an atmosphere of argon. Reagents were transferred by means of syringe or cannula. Glass pressure tubes with a screw-cap were purchased from SIGMA-ALDRICH (Ace pressure tube, 35 ml, PTFE bushing, FETFE O-ring, type A). Analytical TLC was performed using pre-coated silica gel foils 60 F₂₅₄ (Merck, 4 cm). Visualization was achieved using 365 nm ultraviolet irradiation followed by staining with an anisaldehyde reagent (*p*-anisaldehyde 2.53 vol%, acetic acid 0.096 vol%, ethanol 93.06 vol%, conc. H_2SO_4 0.034 vol%) or with a potassium permanganate reagent (3 g KMnO_4 , 20 g K_2CO_3 , 5 mL 5% aqueous NaOH, 300 mL water).

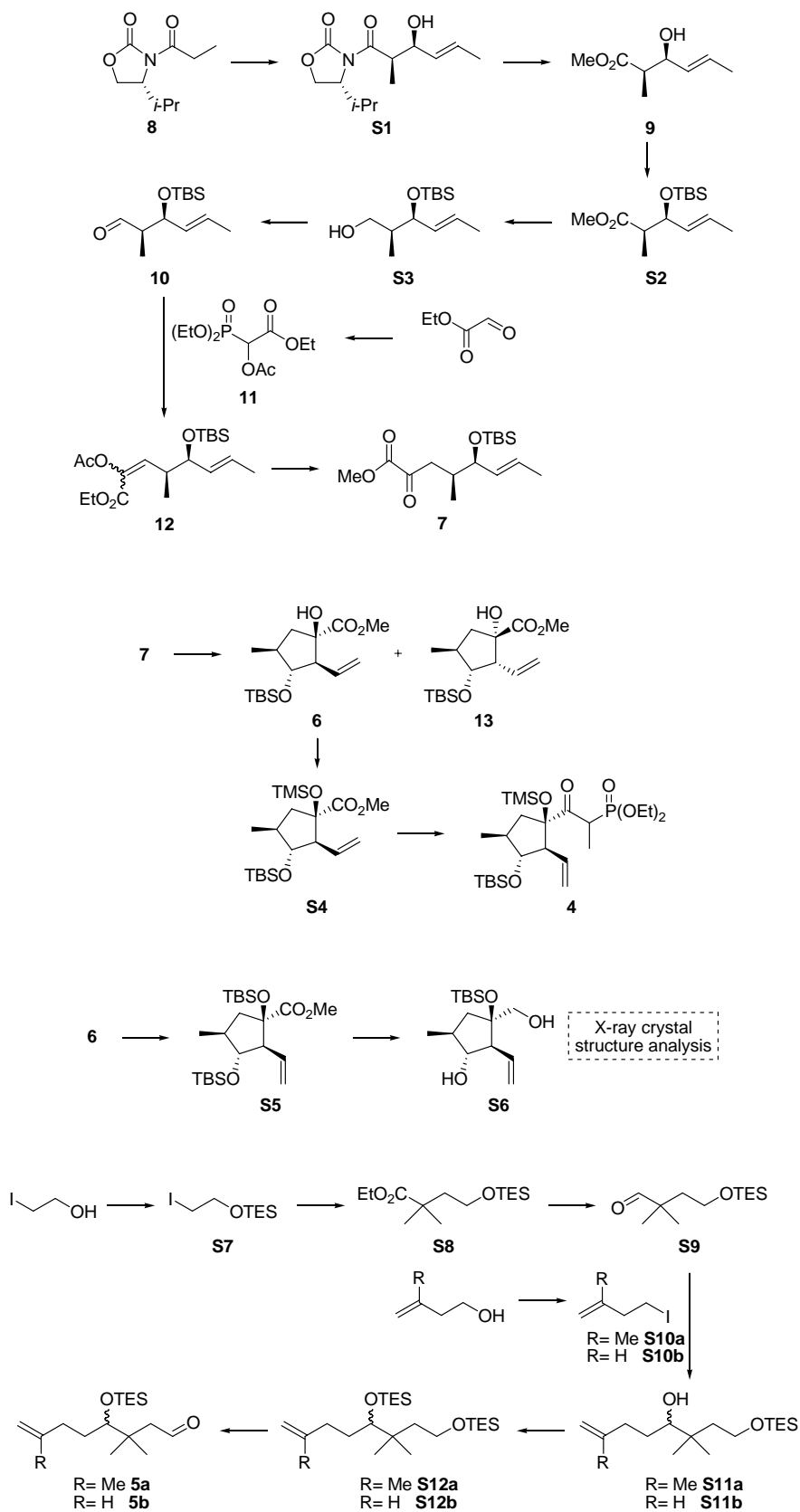
Flash chromatography was performed using silica gel Merck (particle size 0.032-0.063 mm) supplied by Merck and mixtures of heptane and ethyl acetate or hexane and ethyl acetate as eluent.

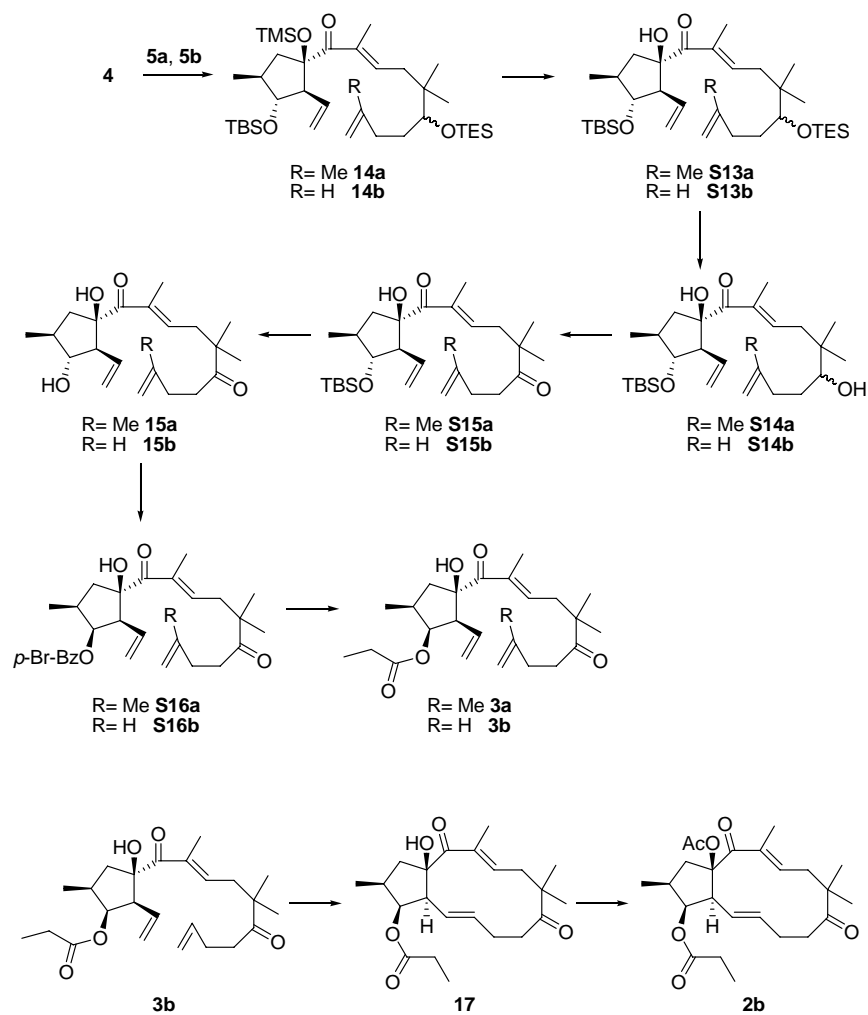
¹H NMR spectra were recorded on an ASP-300 (Bruker) at 300.13 MHz or on a DRX-500 (Bruker) spectrometer at 500.13 MHz. Chemical shifts are reported in ppm relative to tetramethylsilane (δ 0 ppm). Signal splitting patterns are labeled by the following abbreviations: s = singlet, d = doublet, t = triplet, q = quartet, br. s = broad singlet, sept = septet, m = multiplet or overlap of non equivalent resonances. ¹³C NMR spectra were recorded on an ASP-300 (Bruker) at 75.48 MHz or on a DRX-500 (Bruker) spectrometer at 125.77 MHz. Chemical shifts are reported in ppm relative to CDCl_3 (δ 77.0 ppm). The assignment of C, CH, CH₂, CH₃ is based on DEPT (distortionless enhancement by polarization transfer) experiments. The terms “major” and “minor” are used to distinguish between diastereomers. The assignments of atom connectivity and

¹ Juaristi, E.; Martinez-Richa, A.; Garcia-Rivera, A.; Cruz-Sanchez, J. S. *J. Org. Chem.* **1983**, *48*, 2603-2606.

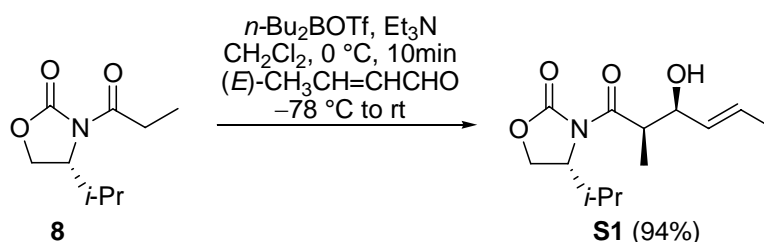
spatial relationships are based on 2D NMR correlation ($^1\text{H}/^1\text{H}$ -NOESY, $^1\text{H}/^1\text{H}$ -ROESY, $^1\text{H}/^1\text{H}$ -COSY, $^1\text{H}/^{13}\text{C}$ -HMBC and $^1\text{H}/^{13}\text{C}$ -HSQC). Infrared spectra were recorded as a thin film on a KBr disk (“in substance”) on a NICOLET 205 spectrometer. Molecular formula assignment was confirmed by combustion elemental analysis using an Elemental Analyzer EA 1108 (CARLO ERBA INSTRUMENTS). Melting points were measured with a 3306C MELT PT-Electrothermal capillary melting point apparatus.

2. Chart of all Synthesized Compounds in Order of their Appearance

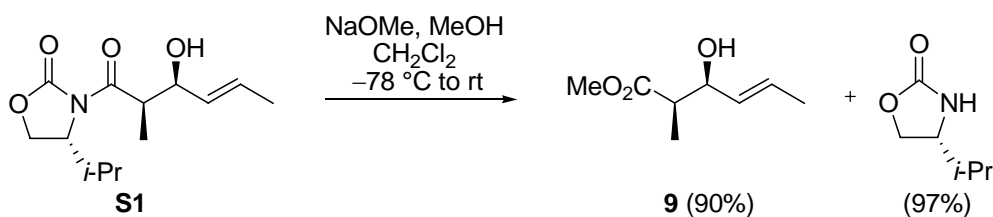




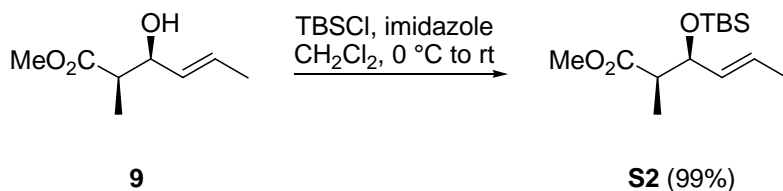
3. Experimental Procedures and Product Characterization Data



Aldol adduct S1: (*R*)-4-Isopropyl-3-propionyl-oxazolidin-2-one **8** (9.26 g, 50 mmol, 1 eq.) was dissolved in CH_2Cl_2 (60 mL, 1.2 mL/mmol **8**) in a septum-sealed 500 mL round bottom flask under an atmosphere of argon. The solution was cooled to 0 °C. *n*-Bu₂BOTf (1 M in CH_2Cl_2 , 55 mL, 55 mmol, 1.1 eq.) was added dropwise followed by the addition of Et₃N (9.41 mL, 67.5 mmol, 1.35 eq.). After 10 min the solution was cooled to –78 °C and a cooled (–78 °C) solution of freshly distilled croton aldehyde (6.25 mL, 75 mmol, 1.5 eq.) in CH_2Cl_2 (0.21 mL/mmol aldehyde) was added. The mixture was stirred for 1 h at –78 °C and 30 min at 0 °C. The reaction was then quenched at 0 °C by slowly adding 55 mL pH 7-buffer, 130 mL MeOH and 55 mL H₂O₂ (exothermic reaction). The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. The crude product was purified by flash chromatography (heptane/ethyl acetate 10/1) to afford **S1** (11.98 g, 94%, dr > 95:5) as a colorless oil: *R_f* 0.2 (heptane/ethyl acetate 1/1); ¹H NMR (300 MHz, CDCl₃) δ 0.86 (d, *J* = 6.9 Hz, 3 H), 0.90 (d, *J* = 7.0 Hz, 3 H), 1.22 (d, *J* = 7.1 Hz, 3 H), 1.69 (ddd, *J*₁ = 6.5 Hz, *J*₂ = 1.6 Hz, *J*₃ = 0.9 Hz, 3 H), 2.25-2.41 (m, 1 H), 2.88 (br. s, 1 H), 3.84 (dq, *J*₁ = 7.2 Hz, *J*₂ = 3.7 Hz, 1 H), 4.17-4.31 (m, 2 H), 4.36-4.48 (m, 2 H), 5.42-5.53 (m, 1 H), 5.73 (dq, *J*₁ = 12.9 Hz, *J*₂ = 6.4 Hz, *J*₃ = 1.1 Hz, 1 H); ¹³C NMR (75.5 MHz, CDCl₃) δ 11.5 (CH₃), 14.7 (CH₃), 17.8 (CH₃), 17.9 (CH₃), 28.4 (CH), 42.8 (CH), 58.3 (CH), 63.4 (CH₂), 72.5 (CH), 128.1 (CH=), 130.1 (CH=), 153.6 (C=O), 177.0 (C=O); IR (in substance) ν 1200, 1700, 1770, 2960, 3500 cm^{–1}; Anal. Calcd. for C₁₃H₂₁NO₄: C, 61.16; H, 8.29; N, 5.49, Found: C, 60.95; H, 8.40; N, 5.45; [α]_D²⁵ –74.1 (c 2.26, CHCl₃).

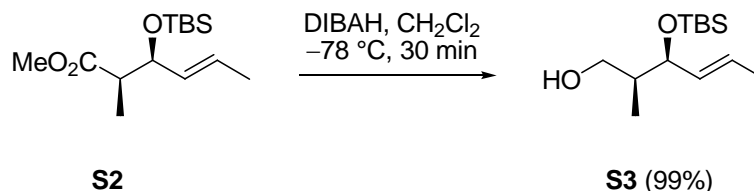


β -Hydroxyester **9:** **S1** (18.18 g, 71.2 mmol, 1 eq.) in CH_2Cl_2 (285 mL, 4 mL/mmol **S1**) was cooled to -78°C . Separately was prepared a solution of sodium (1.64 g, 71.2 mmol, 1 eq.) in methanol (72 mL, 1.5 mL/mmol sodium). The alcoholate was slowly added at -78°C to the solution of **S1**, followed by warming to 0°C . The reaction was quenched with sat. aqueous NH_4Cl and diluted with CH_2Cl_2 . The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. The crude product was dissolved in hexane followed by filtration to remove most of the crystalline oxazolidinone. Concentration under reduced pressure and flash chromatography (hexane/ethyl acetate 10/1 to ethyl acetate) afforded **9** (10.1 g, 90%) as a colorless oil and (*R*)-4-isopropylloxazolidin-2-one (8.88 g, 97%) as white crystals. **9**: R_f 0.55 (hexane/ethyl acetate 1/2); ^1H NMR (300 MHz, CDCl_3) δ 1.08 (d, $J = 7.1$ Hz, 3 H), 1.61 (ddd, $J_1 = 6.5$ Hz, $J_2 = 1.5$ Hz, $J_3 = 0.9$ Hz, 3 H), 2.40 (br. s, 1 H), 2.53 (qd, $J_1 = 7.2$ Hz, $J_2 = 4.4$ Hz, 1 H), 3.61 (s, 3 H), 4.21 (br. s, 1 H), 5.38 (qdd, $J_1 = 15.3$ Hz, $J_2 = 6.8$ Hz, $J_3 = 1.6$ Hz, 1 H), 5.64 (dq, $J_1 = 15.4$ Hz, $J_2 = 6.5$ Hz, $J_3 = 1.0$ Hz, 1 H); ^{13}C NMR (75.5 MHz, CDCl_3) δ 11.5 (CH_3), 17.6 (CH_3), 45.0 (CH or CH_3), 51.6 (CH or CH_3), 73.2 (CH), 128.3 (CH=), 130.4 (CH=), 175.6 (C=O); IR (in substance) ν 1740, 2940-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_8\text{H}_{14}\text{O}_3$: C, 60.74; H, 8.92, Found: C, 60.76; H, 9.05; $[\alpha]_D^{30} -9.5$ (c 1.33, CHCl_3).

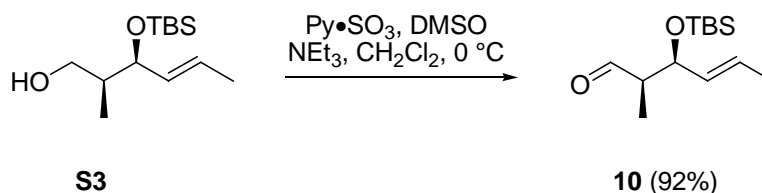


Silyl ether **S2:** To a solution of **9** (5.2 g, 32.9 mmol, 1 eq.) in CH_2Cl_2 (33 mL, 1 mL/mmol **9**) was added imidazole (4.03 g, 59.22 mmol, 1.8 eq.) and TBSCl (5.46 g, 36.2 mmol, 1.1 eq.) at 0°C . The reaction mixture was stirred overnight at room temperature and quenched with sat. aqueous NH_4Cl . The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (heptane/ethyl acetate 20/1) afforded **S2** (8.95 g, 32.9 mmol, 99%) as a colorless oil: R_f 0.7 (heptane/ethyl acetate 3/1); ^1H NMR (300 MHz, CDCl_3) δ -0.02 (s, 3 H), 0.00 (s, 3 H), 0.85 (s, 9 H), 1.13 (d, $J = 6.8$ Hz, 3 H), 1.66 (dd, $J_1 = 5.8$ Hz, $J_2 = 0.9$ Hz, 3 H), 2.48 (qd, $J_1 = 6.8$ Hz, $J_2 = 6.3$ Hz, 1 H), 3.63 (s, 3 H), 4.29 (dd, $J_1 = J_2 = 6.5$ Hz, 1 H), 5.36-5.47 (m, 1 H), 5.51-5.64 (m, 1 H); ^{13}C NMR (75.5 MHz, CDCl_3) δ -5.1 (CH_3), -4.2 (CH_3), 11.7

(CH₃), 17.4 (CH₃), 18.0 (C), 25.7 (3 × CH₃), 47.1 (CH or CH₃), 51.2 (CH or CH₃), 74.9 (CH), 126.7 (CH=), 132.5 (CH=), 174.9 (C=O); IR (in substance) ν 1740, 2860-2960 cm⁻¹; Anal. Calcd. for C₁₄H₂₈O₃Si: C, 61.72; H 10.36, Found: C, 61.97; H, 10.72; $[\alpha]^{25}_D$ -7.3 (c 1.31, CHCl₃).

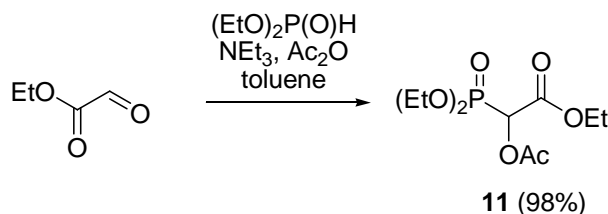


Alcohol S3: To a solution of **S2** (8.9 g, 32.7 mmol, 1 eq.) in CH₂Cl₂ (105 mL, 3.2 mL/mmol **S2**) was added DIBALH (75.2 mL, 75.2 mmol, 1 M in CH₂Cl₂, 2.3 eq.) at -78 °C. After 30 min the reaction was carefully quenched by the addition of 135 mL methanol and 170 mL sat. aqueous Rochelle salt solution and stirred for 1 h at room temperature. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. The crude product can be used for the next step without further purification. Flash chromatography (heptane/ethyl acetate 50/1 to 10/1) afforded **S3** (7.95 g, 32.5 mmol, 99%) as a colorless oil: *R_f* 0.4 (heptane/ethyl acetate 3/1). ¹H NMR (300 MHz, CDCl₃) δ -0.04 (s, 3 H), 0.00 (s, 3 H), 0.71 (d, *J* = 7.1 Hz, 3 H), 0.82 (s, 9 H), 1.65 (d, *J* = 6.2 Hz, 3 H), 1.84-1.98 (m, 1 H), 2.89 (br. s, 1 H), 3.41 (dd^{AB}, *J*₁ = 10.4 Hz, *J*₂ = 3.9 Hz, 1 H), 3.59 (dd^{AB}, *J*₁ = 10.7 Hz, *J*₂ = 8.8 Hz, 1 H), 4.11 (dd, *J*₁ = 6.5 Hz, *J*₂ = 3.9 Hz, 1H), 5.39-5.61 (m, 2 H); ¹³C NMR (75.5 MHz, CDCl₃) δ -5.1 (CH₃), -4.3 (CH₃), 12.4 (CH₃), 17.5 (CH₃), 18.0 (C), 25.8 (3 × CH₃), 41.1 (CH), 65.9 (CH₂), 77.5 (CH), 127.2 (CH=), 130.7 (CH=); IR (in substance) ν 1360, 1370, 2860-2960 cm⁻¹; Anal. Calcd. for C₁₃H₂₈O₂Si: C, 63.87; H 11.55, Found: C, 63.95; H 11.65; $[\alpha]^{25}_D$ +3.9 (c 1.45, CHCl₃).

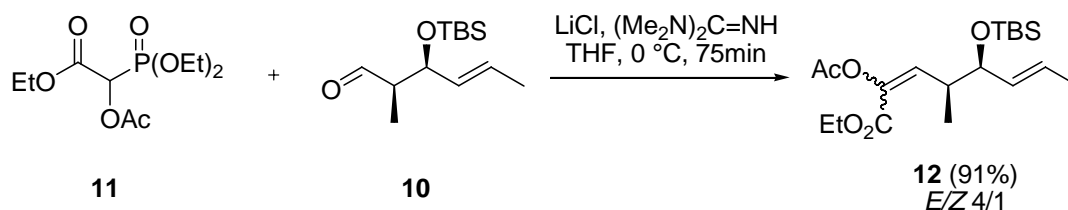


Aldehyde 10: To a solution of **S3** (6.07 g, 24.8 mmol, 1 eq.) in a mixture of DMSO (24 mL, 1 mL/mmol **S3**) and CH₂Cl₂ (96 mL, 4 mL/mmol **S3**) was added NEt₃ (13.8 mL, 99.3 mmol, 4 eq.) and the Py·SO₃ complex (7.9 g, 49.7 mmol, 2 eq.) at 0 °C. After 10 min, the ice bath was removed and the mixture was stirred at room temperature until TLC indicated complete

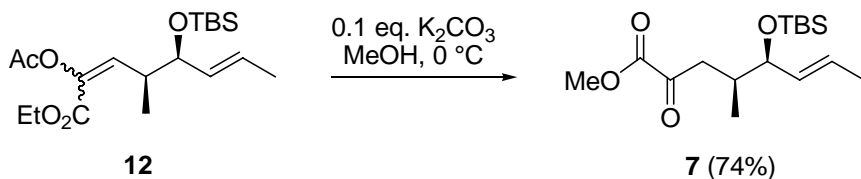
consumption of the starting material (1-4 h). The reaction mixture was then diluted with 200 mL water. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 50/1 to 10/1) afforded **10** (5.53 g, 22.8 mmol, 92%) as a colorless liquid: *R*_f 0.66 (hexane/ethyl acetate 3/1); ¹H NMR (300 MHz, CDCl₃) δ -0.03 (s, 3 H), 0.00 (s, 3 H), 0.83 (s, 9 H), 1.01 (d, *J* = 7.1 Hz, 3 H), 1.65 (dd, *J*₁ = 6.8 Hz, *J*₂ = 0.3 Hz, 3 H), 2.36-2.46 (m, 1 H), 4.39 (dd, *J*₁ = 7.0 Hz, *J*₂ = 4.7 Hz, 1 H), 5.34-5.45 (m, 1 H), 5.53-5.67 (m, 1 H), 9.72 (d, *J* = 1.4 Hz, 1 H); ¹³C NMR (75.5 MHz, CDCl₃) δ -5.1 (CH₃), -4.2 (CH₃), 8.6 (CH₃), 17.4 (CH₃), 18.0 (C), 25.7 (3 × CH₃), 52.9 (CH), 73.8 (CH), 127.4 (CH=), 131.4 (CH=), 204.8 (C=O); IR (in substance) ν 1250, 1730, 2860-2960 cm⁻¹; Anal. Calcd. for C₁₃H₂₆O₂Si: C, 64.41; H 10.81, Found: C, 64.33; H, 10.99; [α]²⁵_D -48.1 (c 1.52, CHCl₃).



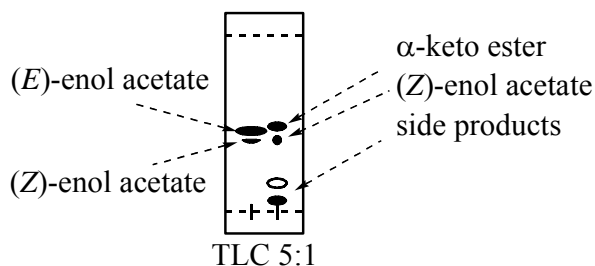
Acetoxy phosphonate 11: Diethyl phosphite (18.7 mL, 145 mmol, 1 eq.) was dissolved in toluene (34 mL, 0.23 mL/mmol). Triethylamine (60.5 mL, 435 mmol, 3 eq.) was added at 0 °C over a period of 5 min. A commercially available solution of ethyl glyoxalate in toluene (28.7 mL, 50% in toluene, 145 mmol, 1 eq.) was then added. The orange-red mixture was stirred for 1 h at room temperature. Freshly distilled acetic anhydride (13.7 mL, 145 mmol, 1 eq.) was subsequently added at 0 °C. The ice bath was then removed and the solution stirred for 12 h at room temperature. The reaction was quenched by the addition of aqueous 2 N HCl (100-140 mL) until pH 6 was reached. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 1/1 to ethyl acetate) afforded **11** (39.96 g, 142 mmol, 98%) as a yellow oil: *R*_f 0.7 (acetone, KMnO₄ staining); ¹H NMR (300 MHz, CDCl₃) 1.18-1.30 (m, 9 H), 2.12 (s, 3 H), 4.08-4.25 (m, 6 H), 5.32 (d, *J* = 16.8 Hz, 1 H).



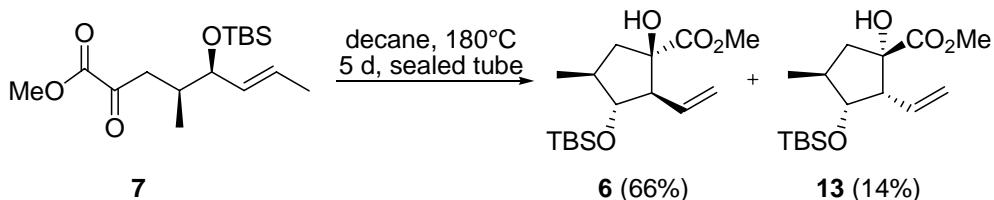
Enol acetate 12: To dry lithium chloride (2.58 g, 60.8 mol, 1.5 eq.) was added a solution of the phosphonate **11** (17.15 g, 60.8 mol, 1.5 eq.) in THF (45.6 mL, 0.75 mL/mmol **11**). The mixture was stirred until a clear yellow solution had appeared. The mixture was then cooled to 0°C and 1,1,3,3-tetramethylguanidine (7.7 mL, 60.77 mmol, 1.5 eq.) was added dropwise to give a pale yellow slurry. After 20 min, a solution of the aldehyde **10** (9.82 g, 40.51 mmol, 1 eq.) in THF (40.5 mL, 1 mL/mmol **10**) was added. After 10 min, the ice bath was removed and the slurry was stirred until TLC indicated complete consumption of the starting material (about 1 h). The reaction was then quenched by adding sat. aqueous NH₄Cl solution. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 100/1) afforded **12** (13.68 g, 36.9 mmol, 91%, mixture of double bond isomers, *E*:*Z* = 4:1) as a colorless oil: *R_f* (*E*)-**12**: 0.60 (hexane/ethyl acetate 5/1); *R_f* (*Z*)-**12**: 0.58 (hexane/ethyl acetate 5/1); ¹H NMR (300 MHz, CDCl₃) of a 4/1 mixture of double bond isomers δ -0.2 (s, 3 H^{major}), -0.01 (s, 3 H^{minor}), 0.00 (s, 3 H^{major}), 0.03 (s, 3 H^{minor}), 0.87 (s, 9 H^{major}), 0.90 (s, 9 H^{minor}), 1.00 (d, *J* = 6.9 Hz, 3 H^{minor}), 1.03 (d, *J* = 6.8 Hz, 3 H^{major}), 1.29 (t, *J* = 7.1 Hz, 3 + 3 H), 1.68 (d, *J* = 6.1 Hz, 3 + 3 H), 2.17 (s, 3 H^{major}), 2.23 (s, 3 H^{minor}), 2.45-2.60 (m, 1 H^{minor}), 3.33 (m, 1 H^{major}), 3.93-3.98 (m, 1 H^{minor}), 4.01 (dd, *J*₁ = *J*₂ = 5.7 Hz, 1 H^{major}), 4.23 (q, *J* = 7.0 Hz, 2 + 2 H), 5.36-5.47 (m, 1 + 1 H), 5.50-5.64 (m, 1 + 1 H), 5.81 (d, *J* = 10.6 Hz, 1 H^{major}), 6.47 (d, *J* = 10.3 Hz, 1 H^{minor}); ¹³C NMR (75.5 MHz, CDCl₃) of a 4/1 mixture double bond isomers δ -5.0 (1 + 1 CH₃), -4.2 (1 + 1 CH₃), 14.0 (CH₃^{major}), 14.1 (CH₃^{minor}), 14.8 (1 + 1 CH₃), 17.5 (1 + 1 CH₃), 18.1 (1 + 1 C), 20.3 (1 + 1 CH₃), 25.8 (3 + 3 CH₃), 38.2 (CH^{major}), 38.3 (CH^{minor}), 61.0 (CH₂^{major}), 61.3 (CH₂^{minor}), 75.9 (CH^{minor}), 76.5 (CH^{major}), 126.5 (CH=^{major}), 126.7 (CH=^{minor}), 132.2 (1 + 1 CH=), 134.2 (CH=^{minor}), 136.6 (CH=^{major}), 136.9 (C=^{major}), 137.4 (C=^{minor}), 161.9 (1 + 1 C=O), 169.4 (1 + 1 C=O); IR (in substance) ν 1205, 1225, 1730, 1770, 2860-2960 cm⁻¹; Anal. Calcd. for C₁₉H₃₄O₅Si: C, 61.58; H 9.25, Found: C, 61.75; H, 9.36.



α -Keto ester 7: To a solution of (*E*)- and (*Z*)-**12** (7.05 g, 19.13 mmol, 1 eq.) in MeOH (76.5 mL, 4 mL/mmol **12**) was added potassium carbonate (264 mg, 1.91 mmol, 0.1 eq.) at 0 °C. The reaction mixture was stirred at 0 °C until TLC indicated complete consumption of (*E*)-**12**.²



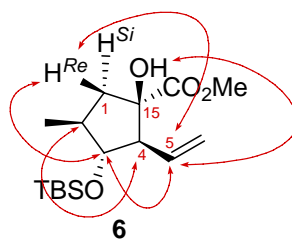
The reaction was quenched by the addition of sat. aqueous NH_4Cl solution and diluted with CH_2Cl_2 . The layers were then separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 10/1) afforded **7** (4.46 g, 14.18 mmol, 74%) as a colorless oil: R_f 0.63 (heptane/ethyl acetate 5/1); ^1H NMR (300 MHz, CDCl_3) δ -0.02 (s, 3 H), 0.00 (s, 3 H), 0.86 (s, 9 H), 0.90 (d, J = 6.8 Hz, 3 H), 1.71 (d, J = 6.2 Hz, 3 H), 2.21-2.36 (m, 1 H), 2.51 (dd^{AB}, J_1 = 16.9 Hz, J_2 = 7.8 Hz, 1 H), 3.03 (dd^{AB}, J_1 = 16.7 Hz, J_2 = 6.0 Hz, 1 H), 3.87 (s, 3 H), 3.96 (dd, J_1 = 6.5 Hz, J_2 = 5.2 Hz, 1 H), 5.34-5.45 (m, 1 H), 5.50-5.64 (m, 1 H); ^{13}C NMR (75.5 MHz, CDCl_3) δ -5.0 (CH_3), -4.3 (CH_3), 15.7 (CH_3), 17.5 (CH_3), 18.2 (C), 25.8 ($3 \times \text{CH}_3$), 36.4 (CH), 41.8 (CH_2), 52.6 (CH_3), 76.9 (CH), 127.4 (CH=), 131.3 (CH=), 161.7 (C=O), 194.0 (C=O); IR (in substance) ν 1730, 1740, 1755, 2860-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{16}\text{H}_{30}\text{O}_4\text{Si}$: C, 61.11; H 9.61, Found: C, 61.09; H, 9.79; $[\alpha]_D^{25}$ -1.2 (c 1.08, CHCl_3).



² Careful TLC control is required to prevent extensive decomposition. The *Z*-configured enol acetate (*Z*)-**12** reacts very slowly under the applied conditions. We recommend terminating the reaction once the *E*-configured enol acetate (*E*)-**12** is completely consumed.

Cyclopentanes 6 and 13: Four pressure tubes³ were each charged with a solution of 1.5 g keto ester **7** (6 g, 19.08 mmol) in decane (25 mL, 5.2 mL/mmol **7**) and sealed. The tubes were heated with an oil bath for 5 days to 180-190 °C (bath temperature). All batches were then combined and the decane was evaporated under reduced pressure. The crude product was purified by flash chromatography (heptane to heptane/ethyl acetate 50/1) to afford **6** (3.96 g, 12.59 mmol, 66%) and **13** (864 mg, 2.75 mmol, 14%) as colorless oils: **6**: R_f 0.45 (heptane/ethyl acetate 5/1); ^1H NMR (500 MHz, CDCl_3) δ -0.01 (s, TBS- CH_3 , 3 H), 0.04 (s, TBS- CH_3 , 3 H), 0.85 (s, 3 \times TBS- CH_3 , 9 H), 1.09 (d, J = 6.6 Hz, 16- CH_3 , 3 H), 1.42 (dd^{AB}, J_1 = 13.9 Hz, J_2 = 8.5 Hz, 1- CH_2 , 1 H^{Re}), 1.92-2.04 (m, 2- CH , 1 H), 2.54 (dd^{AB}, J_1 = 14.0 Hz, J_2 = 9.9 Hz, 1- CH_2 , 1 H^{Si}), 2.63 (dd, J_1 = J_2 = 9.5 Hz, 4- CH , 1 H), 3.06 (br. s, 15-OH, 1 H), 3.72 (dd, J_1 = J_2 = 8.8 Hz, 3- CH , 1 H), 3.76 (s, - OCH_3 , 3 H), 5.04 (dd, J_1 = 17.2 Hz, J_2 = 1.9 Hz, 6- CH_2 =, 1 H), 5.15 (dd, J_1 = 10.2 Hz, J_2 = 2.0 Hz, 6- CH_2 =, 1 H), 5.76 (ddd, J_1 = 17.2 Hz, J_2 = 9.9 Hz, J_3 = 9.6 Hz, 5- CH , 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ -4.1 (TBS- CH_3), -3.5 (TBS- CH_3), 18.0 (TBS-C), 18.6 (16- CH_3), 25.9 (3 \times TBS- CH_3), 40.0 (2- CH), 42.9 (1- CH_2), 52.8 (4- CH), 61.5 (- OCH_3), 80.3 (15-C), 82.7 (3- CH), 119.7 (6- CH_2 =), 134.4 (5- CH =), 176.5 (14-C=O); IR (in substance) ν 830, 1120, 1250, 1730, 2860-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{16}\text{H}_{30}\text{O}_4\text{Si}$: C, 61.11; H 9.61, Found: C, 61.29; H, 9.86; $[\alpha]^{25}_{\text{D}}$ -9.6 (c 1.04, CHCl_3);

Table S1. NOESY (CDCl_3 , 500 MHz) studies on **6**.



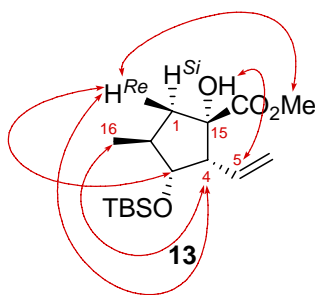
entry	NOE observed between		conclusion
1	1- H^{Re} (1.42 ppm)	3-H (3.72 ppm)	1- H^{Re} and 3-H are <i>cis</i>
2	1- H^{Re} (1.42 ppm)	5-H (5.76 ppm)	1- H^{Re} and $\text{CH}=\text{CH}_2$ are <i>cis</i>
3	2-H (1.92-2.04 ppm)	4-H (2.63 ppm)	2-H and 4-H are <i>cis</i>
4	15-OH (3.06 ppm)	5-H (5.76 ppm)	15-OH and $\text{CH}=\text{CH}_2$ are <i>cis</i>
5	3-H (3.72 ppm)	5-H (5.76 ppm)	3-H and $\text{CH}=\text{CH}_2$ are <i>cis</i>

13: R_f 0.42 (heptane/ethyl acetate 5/1); ^1H NMR (500 MHz, CDCl_3) δ 0.03 (s, TBS- CH_3 , 3 H), 0.6 (s, TBS- CH_3 , 3 H), 0.87 (s, 3 \times TBS- CH_3 , 9 H), 1.05 (d, J = 7.3 Hz, 16- CH_3 , 3 H), 1.84

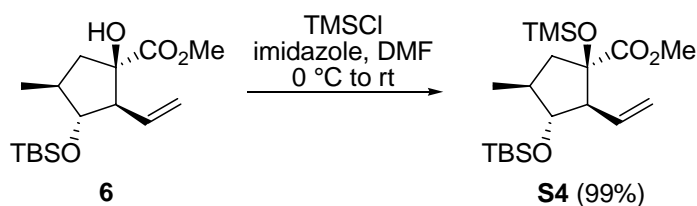
³ See Methods and Materials for a description.

(dd^{AB}, $J_1 = 13.4$ Hz, $J_2 = 5.8$ Hz, 1-CH₂, 1 H^{Re}), 2.25-2.37 (m, 2-CH, 1 H), 2.36 (dd^{AB}, $J_1 = 13.4$ Hz, $J_2 = 8.5$ Hz, 1-CH₂, 1 H^{Si}), 2.87 (dd, $J_1 = 9.0$ Hz, $J_2 = 4.6$ Hz, 4-CH, 1 H), 3.74 (s, -OCH₃, 3 H), 3.88 (dd, $J_1 = 4.7$ Hz, $J_2 = 1.6$ Hz, 3-CH, 1 H), 4.03 (br. s, 15-OH, 1 H), 5.12 (dd, $J_1 = 17.4$ Hz, $J_2 = 1.7$ Hz, 6-CH₂=, 1 H), 5.17 (dd, $J_1 = 10.4$ Hz, $J_2 = 2.0$ Hz, 6-CH₂=, 1 H), 5.99 (ddd, $J_1 = 17.3$ Hz, $J_2 = 10.3$ Hz, $J_3 = 9.0$ Hz, 5-CH=, 1 H); ¹³C NMR (126 MHz, CDCl₃) δ -5.0 (TBS-CH₃), -4.8 (TBS-CH₃), 17.9 (TBS-C), 19.7 (16-CH₃), 25.7 (3 \times TBS-CH₃), 41.4 (2-CH), 46.9 (1-CH₂), 52.4 (-OCH₃), 55.7 (4-CH), 84.4 (3-CH), 85.5 (15-C), 118.7 (6-CH₂=), 132.3 (5-CH=), 174.2 (14-C=O); IR ν (in substance) 840, 1250, 1730, 2860-2950 cm⁻¹; Anal. Calcd. for C₁₆H₃₀O₄Si: C, 61.11; H 9.61, Found: C, 61.27; H, 9.87; $[\alpha]_D^{25}$ -18.3 (c 1.03, CHCl₃).

Table S2. NOESY (CDCl₃, 500 MHz) studies on **13**.

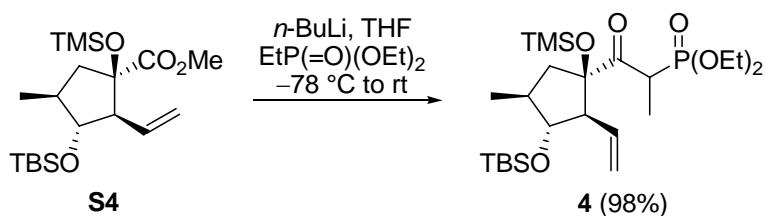


entry	NOE observed between		conclusion
1	4-H (2.87 ppm)	16-CH ₃ (1.05 ppm)	4-H and 16-CH ₃ are <i>cis</i>
2	4-H (2.87 ppm)	1-H ^{Re} (1.84 ppm)	4-H and 1-H ^{Re} are <i>cis</i>
3	ester-OCH ₃ (3.74 ppm)	1-H ^{Re} (1.84 ppm)	ester-OCH ₃ and 1-H ^{Re} are <i>cis</i>
4	3-H (3.88 ppm)	1-H ^{Re} (1.84 ppm)	3-H and 1-H ^{Re} are <i>cis</i>
5	15-OH (4.03 ppm)	5-H (5.99 ppm)	15-OH and CH=CH ₂ are <i>cis</i>



Silyl ether S4: To a solution of **6** (2 g, 6.36 mmol, 1 eq.) in DMF (6.4 mL, 1 mL/mmol **6**) was added imidazole (1.08 g, 15.9 mmol, 2.5 eq.) and TMSCl (1 mL, 12.72 mmol, 2 eq.) at 0 °C. The solution was stirred for 2 h at room temperature. The reaction mixture was then diluted with CH₂Cl₂ and sat. aqueous NH₄Cl solution. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate

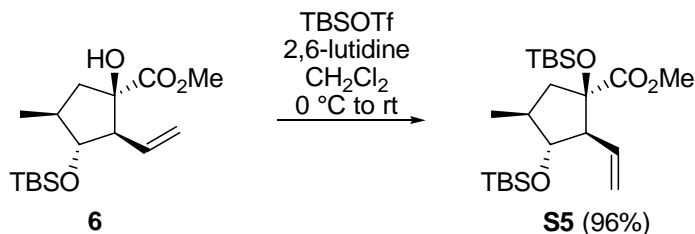
20/1) afforded **S4** (2.45 g, 6.32 mmol, 99%) as a colorless oil: R_f 0.75 (hexane/ethyl acetate 5/1); ^1H NMR (300 MHz, CDCl_3) δ -0.12 (s, 3 H), -0.08 (s, 3 H), 0.00 (s, 9 H), 0.75 (s, 9 H), 0.98 (d, $J = 6.9$ Hz, 3 H), 1.28 (dd^{AB}, $J_1 = 13.8$ Hz, $J_2 = 7.0$ Hz, 1 H), 1.80-1.95 (m, 1 H), 2.46-2.56 (m, 2 H), 3.57 (s, 3 H), 3.58 (dd, $J_1 = 9.4$ Hz, $J_2 = 7.5$ Hz, 1 H), 4.86-4.97 (m, 2 H), 5.65 (ddd, $J_1 = 17.1$ Hz, $J_2 = 10.2$ Hz, $J_3 = 9.4$ Hz, 1 H); ^{13}C NMR (75.5 MHz, CDCl_3) δ -4.1 (CH_3), -3.5 (CH_3), 1.9 ($3 \times \text{CH}_3$), 18.0 (C), 19.5 (CH_3), 25.9 ($3 \times \text{CH}_3$), 39.9 (CH), 44.9 (CH_2), 51.9 (CH_3), 62.8 (CH), 83.4 (CH), 83.8 (C), 118.3 ($\text{CH}_2=$), 135.3 ($\text{CH}=$), 175.1 (C=O); IR (in substance) ν 840, 1250, 1750, 2860-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{19}\text{H}_{38}\text{O}_4\text{Si}_2$: C, 59.02; H, 9.91, Found: C, 59.01; H, 9.71; $[\alpha]_D^{25}$ -11.9 (c 2.3, CHCl_3).



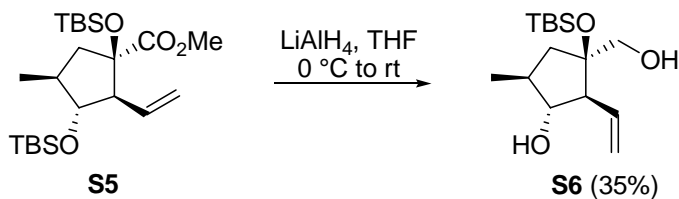
Phosphonate 4: Diethyl ethylphosphonate (6.7 mL, 41.2 mmol, 4 eq.) was dissolved in dry THF (120 mL, 2.9 mL/mmol **S4**) and treated with *n*-BuLi (19.1 mL, 2.05 M in hexane, 39.14 mmol, 3.8 eq.) at $-78\text{ }^{\circ}\text{C}$. Silyl ether **S4** (3.99 g, 10.3 mmol, 1 eq.) was dissolved in THF (20 mL, 1.9 mL/mmol **S4**) and cooled to $0\text{ }^{\circ}\text{C}$. The solution of the lithiated phosphonate was then added to the solution of the ester **S4** dropwise via cannula. After TLC-control indicated complete consumption of the starting material (0.5-1 h), the reaction was quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 5/1) afforded **4** (5.36 g, 10.3 mmol, 99%, 2/1 mixture of diastereomers) as a colorless oil: R_f 0.6 (hexane/ethyl acetate 2/1); ^1H NMR (500 MHz, CDCl_3) of a 2/1 mixture of diastereomers δ -0.05 (s, 3 H^{minor}), -0.04 (s, 3 H^{major}), 0.00 (s, 3 H^{minor}), 0.01 (s, 3 H^{major}), 0.10 (s, 6 + 6 H), 0.18 (s, 3 + 3 H), 0.82 (s, 9 H^{minor}), 0.83 (s, 9 H^{major}), 1.02 (d, $J = 6.6\text{ Hz}$, 3 H^{minor}), 1.07 (d, $J = 6.7\text{ Hz}$, 3 H^{major}), 1.24 - 1.34 (m, 10 + 9 H), 1.40 (dd^{AB}, $J_1 = 14.1\text{ Hz}$, $J_2 = 10.7\text{ Hz}$, 1 H^{minor}), 1.80 - 1.96 (m, 1 + 1 H), 2.48 (dd, $J_1 = J_2 = 9.3\text{ Hz}$, 1 H^{major}), 2.50 (dd, $J_1 = J_2 = 9.3\text{ Hz}$, 1 H^{minor}), 2.55 (dd^{AB}, $J_1 = 14.2\text{ Hz}$, $J_2 = 8.8\text{ Hz}$, 1 H^{minor}), 2.89 (dd^{AB}, $J_1 = 14.5\text{ Hz}$, $J_2 = 9.9\text{ Hz}$, 1 H^{major}), 3.49 (dq, $J_1 = 18.7\text{ Hz}$, $J_2 = 7.1\text{ Hz}$, 1 H^{major}), 3.55 (dd, $J_1 = J_2 = 9.3\text{ Hz}$, 1 H^{minor}), 3.63 (dd, $J_1 = J_2 = 8.6\text{ Hz}$, 1 H^{major}), 3.82 (dq, $J_1 = 19.5\text{ Hz}$, $J_2 = 7.2\text{ Hz}$, 1 H^{minor}), 4.02 - 4.19 (m, 4 + 4 H), 4.96 - 5.09 (m, 2 + 2 H), 5.65 - 5.75 (m, 1 +

1 H); ^{13}C NMR (126 MHz, CDCl_3) of a 2/1 mixture of diastereomers δ -4.1 ($\text{CH}_3^{\text{major}}$), -4.0 ($\text{CH}_3^{\text{minor}}$), -3.4 ($\text{CH}_3^{\text{major}}$), -3.3 ($\text{CH}_3^{\text{minor}}$), 2.3 ($3 \times \text{CH}_3^{\text{major}}$), 2.4 ($3 \times \text{CH}_3^{\text{minor}}$), 13.5 ($\text{CH}_3^{\text{minor}}$), 13.6 ($\text{CH}_3^{\text{major}}$), 16.4 ($\text{CH}_3^{\text{major}}$), 16.4 ($\text{CH}_3^{\text{minor}}$), 17.7 ($\text{CH}_3^{\text{minor}}$), 18.0 ($1 + 1 \text{ C}$), 19.0 ($\text{CH}_3^{\text{major}}$), 25.9 ($3 + 3 \text{ CH}_3$), 38.5 (CH^{minor} or $\text{CH}_3^{\text{minor}}$), 39.2 (CH^{major} or $\text{CH}_3^{\text{major}}$), 39.6 (CH^{minor} or $\text{CH}_3^{\text{minor}}$), 40.3 (CH^{major} or $\text{CH}_3^{\text{major}}$), 40.6 (CH^{major} or $\text{CH}_3^{\text{major}}$), 40.8 (CH^{minor} or $\text{CH}_3^{\text{minor}}$), 42.0 ($\text{CH}_2^{\text{major}}$), 42.9 ($\text{CH}_2^{\text{minor}}$), 60.8 (CH^{major}), 61.5 (CH^{minor}), 62.1 ($\text{CH}_2^{\text{minor}}$), 62.2 ($\text{CH}_2^{\text{major}}$), 62.4 ($\text{CH}_2^{\text{minor}}$), 62.8 ($\text{CH}_2^{\text{major}}$), 82.3 (CH^{minor}), 83.2 (CH^{major}), 87.9 (C^{minor}), 89.1 (C^{major}), 118.7 ($\text{CH}_2^{\text{minor}}$), 119.0 ($\text{CH}_2^{\text{major}}$), 135.3 (CH^{major}), 135.4 (CH^{minor}), 206.5 ($\text{C}=\text{O}^{\text{major}}$), 210.6 ($\text{C}=\text{O}^{\text{minor}}$); IR (in substance) ν 835, 1025, 1250, 1715, 2850-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{24}\text{H}_{49}\text{O}_6\text{PSi}_2$: C, 55.35; H, 9.48, Found: C, 55.41; H, 9.47.

Synthesis of the crystalline Diol S6

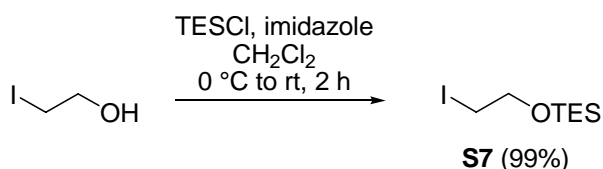
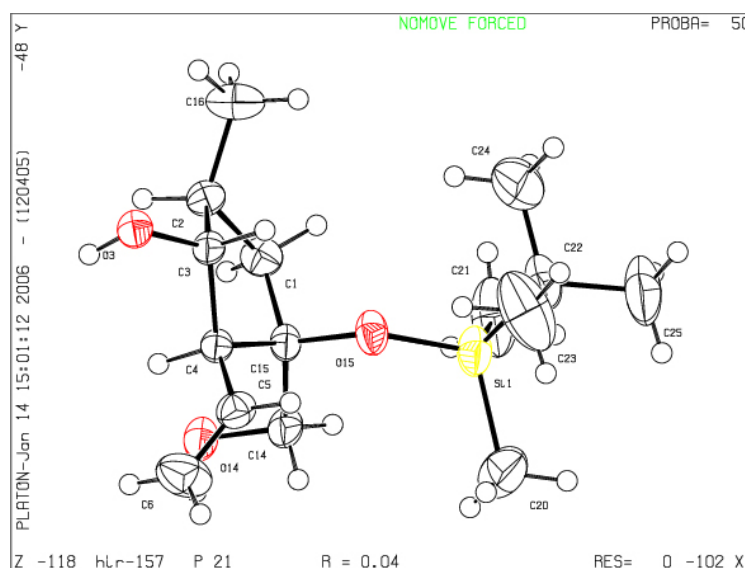


Silyl ether S5: To a solution of **6** (1.77 g, 5.65 mmol, 1 eq.) in CH_2Cl_2 (11 mL, 2 mL/mmol **6**) was added 2,6-lutidine (1.45 mL, 12.43 mmol, 2.2 eq.) and TBSOTf (1.56 mL, 6.78 mmol, 1.2 eq.) at 0°C . The reaction mixture was stirred for 12 h at room temperature. The reaction then was quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (heptane to heptane/ethyl acetate 100/1) afforded **S5** (2.34 g, 5.45 mmol, 96%) as a colorless oil: R_f 0.70 (heptane/ethyl acetate 5/1); ^1H NMR (300 MHz, CDCl_3) δ -0.11 (s, 3 H), -0.06 (s, 3 H), -0.04 (s, 3 H), 0.00 (s, 3 H), 0.76 (s, 9 H), 0.79 (s, 9 H), 0.98 (d, $J = 6.8$ Hz, 3 H), 1.29 (dd^{AB}, $J_1 = 13.9$ Hz, $J_2 = 8.6$ Hz, 1 H), 1.78 - 1.92 (m, 1 H), 2.46 - 2.57 (m, 2 H), 3.58 (s, 3 H), 3.63 (dd, $J_1 = J_2 = 9.2$ Hz, 1 H), 4.91 (dd, $J_1 = 22.2$ Hz, $J_2 = 2.2$ Hz, 1 H), 4.96 (dd, $J_1 = 15.3$ Hz, $J_2 = 2.2$ Hz, 1 H), 5.68 (ddd, $J_1 = 17.2$ Hz, $J_2 = 10.1$ Hz, $J_3 = 9.6$ Hz, 1 H); ^{13}C NMR (75.5 MHz, CDCl_3) δ -4.1 (CH_3), -3.4 (CH_3), -3.3 (CH_3), -3.1 (CH_3), 18.0 (C), 18.4 (CH_3), 18.7 (C), 25.9 ($3 \times \text{CH}_3$), 26.1 ($3 \times \text{CH}_3$), 40.0 (CH), 44.7 (CH_2), 51.8 (CH), 62.8 (CH_3), 82.5 (CH), 83.0 (C), 118.5 ($\text{CH}_2=$), 135.3 (CH=), 175.2 (C=O); IR (in substance) ν 1750, 2850-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{22}\text{H}_{44}\text{O}_4\text{Si}_2$: C, 61.63; H, 10.34, Found: C, 61.34; H, 10.53; $[\alpha]_D^{25} -7.0$ (c 1.4, CHCl_3).

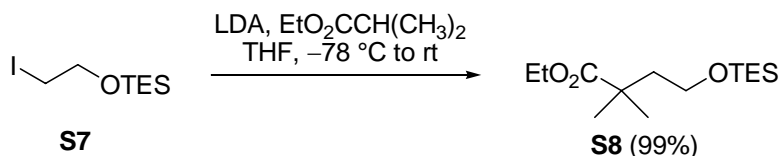


Diol S6: To a solution of **S5** (2.63 g, 6.13 mmol, 1 eq.) in THF (30 mL, 5 mL/mmol **S5**) was added LiAlH₄ (512 mg, 13.49 mmol, 2.2 eq.) at 0 °C. The ice bath was removed and the solution was stirred for 30 min at room temperature. The reaction was then quenched by the slow addition of sat. aqueous (NH₄)₂SO₄ solution. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (heptane/ethyl acetate 3/1) afforded **S6** (849 mg, 2.11 mmol, 35%) as white crystals: *R_f* 0.40 (heptane/ethyl acetate 1/2); ¹H NMR (300 MHz, CDCl₃) δ −0.03 (s, 3 H), 0.00 (s, 3 H), 0.76 (s, 9 H), 1.01 (d, *J* = 6.6 Hz, 3 H), 1.27 (dd^{AB}, *J*₁ = 13.9 Hz, *J*₂ = 9.4 Hz, 1 H), 1.60-1.68 (m, 3 H), 2.05 (dd^{AB}, *J*₁ = 13.9 Hz, *J*₂ = 9.3 Hz, 1 H), 2.12 (dd, *J*₁ = *J*₂ = 9.4 Hz, 1 H), 3.33 (d^{AB}, *J* = 10.8 Hz, 1 H), 3.38 (d^{AB}, *J* = 10.8 Hz, 1 H), 3.48 (dd, *J*₁ = *J*₂ = 9.5 Hz, 1 H), 4.99-5.07 (m, 2 H), 5.75-5.89 (m, 1 H); ¹³C NMR (75.5 MHz, CDCl₃) δ −2.3 (CH₃), −2.2 (CH₃), 18.1 (CH₃), 18.4 (C), 25.9 (3 × CH₃), 39.3 (CH), 42.4 (CH₂), 60.4 (CH), 69.8 (CH₂), 81.5 (CH), 82.1 (C), 117.8 (CH₂=), 136.9 (CH=); IR (in substance) ν 770, 830, 1050, 1260 cm^{−1}; Anal. Calcd. for C₁₅H₃₀O₃Si: C, 62.89; H 10.55, Found: C, 62.69; H, 10.80; [α]_D²⁵ −24.7 (c 1.44, CHCl₃); mp: 115.5 °C.

Figure S1. Crystal structure of **S6**. See the enclosed cif-file for details. The following crystal structure has been deposited at the Cambridge Crystallographic Data Centre and allocated the deposition number CCDC 295284.



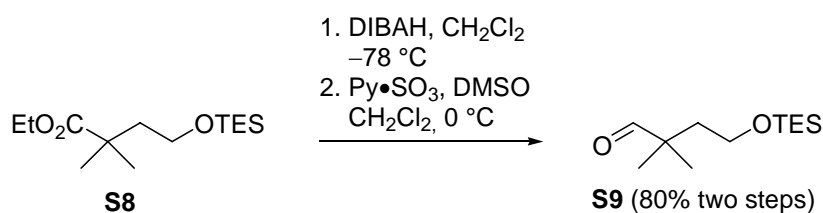
Iodide S7⁴: To a solution of 2-iodo ethanol (8.6 g, 50 mmol, 1 eq.) in CH_2Cl_2 (50 mL, 1 mL/mmol) was added imidazole (4.1 g, 60 mmol, 1.2 eq.) and TESCl (8.9 mL, 52.5 mmol, 1.05 eq.) at 0°C . The solution was stirred for 2 h at room temperature. The reaction was quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Filtration through silica gel (hexane/ethyl acetate 20/1) afforded **S7** (14.3 g, 50 mmol, 99%) as a colorless oil: R_f 0.85 (hexane/ethyl acetate 10/1, KMnO_4 staining); ^1H NMR (500 MHz, CDCl_3) δ 0.41 (q, $J = 7.9$ Hz, 6 H), 0.76 (t, $J = 7.9$ Hz, 9 H), 3.00 (t, $J = 7.1$ Hz, 2 H), 3.63 (t, $J = 7.1$ Hz, 2 H).



Ester S8: To a stirred solution of LDA [prepared in situ from diisopropylamine (10 mL, 70 mmol, 1.4 eq.) and $n\text{-BuLi}$ (25 mL, 2.18 M in hexane, 55 mol, 1.1 eq.)] in THF (100 mL, 2 mL/mmol **S7**) was added ethyl isobutyrate (9.4 mL, 70 mmol, 1.4 eq.) at -78°C . After 20 min, a solution of **S7** (14.3 g, 50 mmol, 1 eq.) in THF (20 mL, 0.4 mL/mmol **S7**) was added dropwise.

⁴ Aungst, R. A.; Funk R. L. *J. Am. Chem. Soc.* **2001**, 123, 9455-9456.

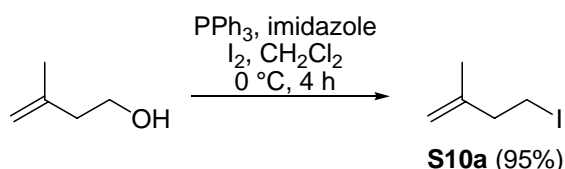
The dry ice bath was removed and the reaction mixture was stirred until TLC-control indicated complete consumption of the starting material (the iodide is UV active). The reaction was then quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 100/1) afforded **S8** (13.72 g, 50 mmol, 99%) as a colorless liquid: R_f 0.75 (hexane/ethyl acetate 10/1, KMnO_4 staining); ^1H NMR (300 MHz, CDCl_3) δ 0.46 (q, $J = 7.9$ Hz, 6 H), 0.83 (t, $J = 7.9$ Hz, 9 H), 1.07 (s, 6 H), 1.13 (t, $J = 7.1$ Hz, 3 H), 1.70 (t, $J = 6.2$ Hz, 2 H), 3.50 (t, $J = 6.2$ Hz, 2 H), 3.98 (q, $J = 7.2$ Hz, 2 H); ^{13}C NMR (126 MHz, CDCl_3) δ 4.3 ($3 \times \text{CH}_2$), 6.7 ($3 \times \text{CH}_3$), 14.1 (CH_3), 25.4 ($2 \times \text{CH}_3$), 40.5 (C), 42.9 (CH_2), 59.6 (CH_2), 60.2 (CH_2), 177.6 (C=O); IR (in substance) ν 725, 1100, 1150, 1750, 2880, 2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{14}\text{H}_{30}\text{O}_3\text{Si}$: C, 61.26; H, 11.02, Found: C, 61.43; H, 11.14.



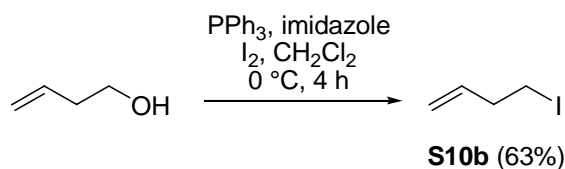
Aldehyde S9: To a solution of **S8** (1.5 g, 5.47 mmol, 1 eq.) in CH_2Cl_2 (5.5 mL, 1 mL/mmol **S8**) was added DIBALH (12 mL, 12 mmol, 1 M in CH_2Cl_2 , 2.2 eq.) at -78°C . After 30 min, the reaction was carefully quenched by the addition of 30 mL methanol and 60 mL sat. aqueous Rochelle salt solution and then stirred for 1 h at room temperature. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. The crude alcohol was used for the next step without purification.

To a solution of the crude alcohol (5.47 mmol, 1 eq.) in a mixture of DMSO (3 mL, 0.55 mL/mmol **S8**) and CH_2Cl_2 (6 mL, 1.1 mL/mmol **S8**) was added NEt_3 (3.05 mL, 21.88 mmol, 4 eq.) and the $\text{Py}\cdot\text{SO}_3$ complex (1.74 g, 10.94 mmol, 2 eq.) at 0°C . After 10 min, the ice bath was removed and the mixture was stirred at room temperature. When TLC indicated complete consumption of the starting material (1-4 h), the reaction mixture was diluted with water. The layers were then separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 100/1 to 20/1) afforded **S9** (1.01 g, 4.38 mmol, 80% two

steps) as a colorless liquid: R_f 0.63 (hexane/ethyl acetate 5/1); ^1H NMR (300 MHz, CDCl_3) δ 0.46 (q, $J = 7.9$ Hz, 6 H), 0.83 (t, $J = 7.9$ Hz, 9 H), 0.96 (s, 6 H), 1.65 (t, $J = 6.2$ Hz, 2 H), 3.52 (t, $J = 6.2$ Hz, 2 H), 9.26 (s, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 4.2 ($3 \times \text{CH}_2$), 6.7 ($3 \times \text{CH}_3$), 21.5 ($2 \times \text{CH}_3$), 41.0 (CH_2), 44.4 (C), 58.8 (CH_2), 205.3 (C=O); IR (in substance) ν 1100, 1730, 2880-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{12}\text{H}_{26}\text{O}_2\text{Si}$: C, 62.55; H, 11.37; Found: C, 62.71, H, 11.48.



Iodide S10a:⁵ To a solution of PPh_3 (22.03 g, 84 mmol, 1.05 eq.) and imidazole (5.72 g, 84 mmol, 1.05 eq.) in CH_2Cl_2 (200 mL, 2.5 mL/mmol alcohol) was carefully added iodine (21.32 g, 84 mmol, 1.05 eq.) at 0 °C (exothermic reaction). After 15 min, 3-methyl-3-buten-1-ol (8.11 mL, 80 mmol, 1 eq.) was added dropwise (exothermic reaction). The ice bath was removed and the suspension was stirred for 4 h at room temperature. The CH_2Cl_2 was almost completely removed under reduced pressure (880 mbar, 40 °C) to provide an orange slurry which was then diluted with 400 mL pentane and filtered through a pad of celite. The solvents were removed under reduced pressure (880 mbar, 40 °C). Distillation (45 °C, 15-30 mbar, bath temperature 75 °C) afforded **S10a** (12.78 g, 75.6 mmol, 95%) as a colorless liquid: ^1H NMR (300 MHz, CDCl_3) δ 1.73 (s, 3 H), 2.58 (t, $J = 7.5$ Hz, 2 H), 3.25 (t, $J = 7.6$ Hz, 2 H), 4.75 (s, 1 H), 4.85 (s, 1 H).

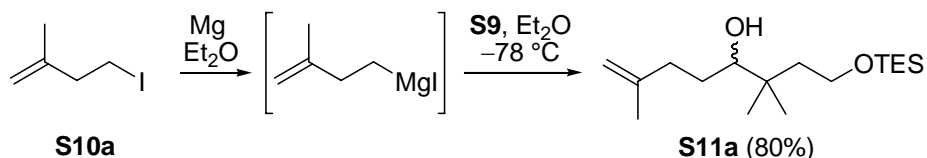


Iodide S10b:⁶ To a solution of PPh_3 (11.01 g, 42 mmol, 1.05 eq.) and imidazole (2.86 g, 42 mmol, 1.05 eq.) in CH_2Cl_2 (100 mL, 2.5 mL/mmol alcohol) was carefully added iodine (10.66 g, 42 mmol, 1.05 eq.) at 0 °C (exothermic reaction). After 15 min, 3-buten-1-ol (3.48 mL, 40 mmol, 1 eq.) was added dropwise (exothermic reaction). The ice bath was removed and the suspension stirred for 4 h at room temperature. The CH_2Cl_2 was almost completely removed under reduced pressure (880 mbar, 40 °C, **S10b** is extremely volatile!) to provide an orange slurry which was diluted with 200 mL pentane and filtered through a pad of celite. The solvents were then removed under reduced pressure (880 mbar, 40 °C). Distillation (25 °C, 15-30 mbar, bath temperature 50

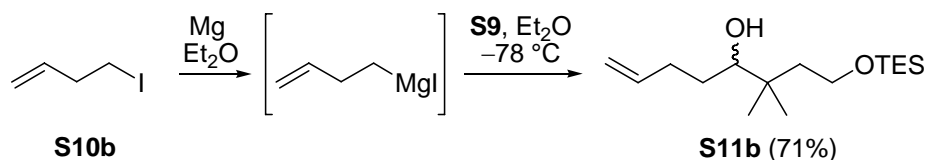
⁵ Yong, K. H.; Lotoski, J. A.; Chong, J. M. *J. Org. Chem.* **2001**, 66, 8248-8251.

⁶ Fields, L. J.; Heathcock C. H. *J. Org. Chem.* **1999**, 64, 8263-8266.

°C) afforded iodide **S10b** (4.6 g, 25.3 mmol, 63%) as a colorless liquid: ^1H NMR (300 MHz, CDCl_3) δ 2.61 (q, $J = 7.1$ Hz, 2 H), 3.17 (t, $J = 7.2$ Hz, 2 H), 5.07-5.15 (m, 2 H), 5.68-5.82 (m, 1 H).

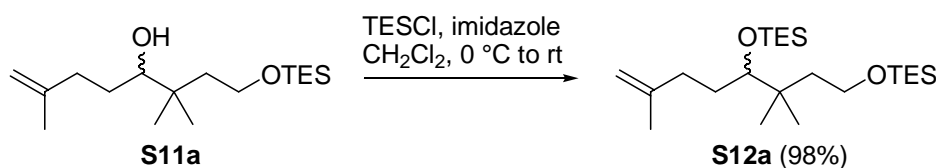


Alcohol S11a: A flask equipped with a reflux condenser was charged with a solution of **S10a** (6.8 g, 34.69 mmol, 5.8 eq.) in Et_2O (30 mL, 0.9 mL/mmol **S10a**). Magnesium turnings (656 mg, 27 mmol, 4.5 eq.) were added and the mixture was stirred until the exothermic reaction had subsided. Meanwhile, aldehyde **S9** (1.39 g, 6 mmol, 1 eq.) was dissolved in Et_2O (30 mL, 5 mL/mmol **S9**) in a separate flask. The solution of **S9** was then treated with the Grignard reagent of **S10a** at -78°C . The reaction was then allowed to warm to room temperature and quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 5/1) afforded alcohol **S11a** (1.44 g, 4.79 mmol, 80%) as a colorless oil: R_f 0.58 (hexane/ethyl acetate 5/1); ^1H NMR (300 MHz, CDCl_3) δ 0.61 (q, $J = 7.8$ Hz, 6 H), 0.87 (s, 3 H), 0.91 (s, 3 H), 0.96 (t, $J = 7.9$ Hz, 9 H), 1.29 (ddd^{AB}, $J_1 = 14.8$ Hz, $J_2 = 5.2$ Hz, $J_3 = 3.2$ Hz, 1 H), 1.38-1.50 (m, 1 H), 1.52-1.65 (m, 1 H), 1.73 (s, 3 H), 1.72-1.85 (m, 1 H), 1.98-2.10 (m, 1 H), 2.32 (ddd^{AB}, $J_1 = 14.6$ Hz, $J_2 = 9.8$ Hz, $J_3 = 4.9$ Hz, 1 H), 3.24 (ddd, $J_1 = 10.5$ Hz, $J_2 = 5.6$ Hz, $J_3 = 1.4$ Hz, 1 H), 3.53-3.78 (m, 3 H), 4.70 (s, 2 H); ^{13}C NMR (75.5 MHz, CDCl_3) δ 4.2 ($3 \times \text{CH}_2$), 6.7 ($3 \times \text{CH}_3$), 22.6 (CH_3), 24.2 (CH_3), 24.6 (CH_3), 29.2 (CH_2), 35.4 (CH_2), 37.6 (C), 42.3 (CH_2), 59.4 (CH_2), 76.9 (CH), 109.7 ($\text{CH}_2=$), 146.5 (C=); IR (in substance) ν 1100, 2880-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{17}\text{H}_{36}\text{O}_2\text{Si}$: C, 67.94; H, 12.07, Found: C, 67.70; H, 12.16.



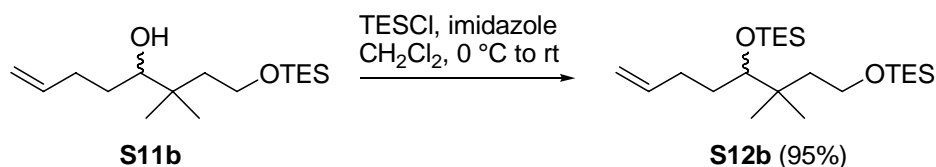
Alcohol S11b: A flask equipped with a reflux condenser was charged with **S10b** (4.59 g, 25.23 mmol, 1.7 eq.) in Et_2O (30 mL, 1.2 mL/mmol **S10b**). Magnesium turnings (816 mg, 33.6 mmol, 2 eq.) were added and the mixture was stirred until the exothermic reaction had subsided. Meanwhile, aldehyde **S9** (3.42 g, 14.84 mmol, 1 eq.) was dissolved in Et_2O (30 mL, 2 mL/mmol

S9) in a separate flask. The solution of **S9** was then treated with the Grignard reagent of **S10b** at $-78\text{ }^{\circ}\text{C}$. The reaction was allowed to warm to room temperature and then quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 5/1) afforded **S11b** (3.03 g, 10.56 mmol, 71%) as a colorless oil: R_f 0.56 (hexane/ethyl acetate 5/1); ^1H NMR (300 MHz, CDCl_3) δ 0.61 (q, $J = 7.8$ Hz, 6 H), 0.86 (s, 3 H), 0.90 (s, 3 H), 0.96 (t, $J = 7.9$ Hz, 9 H), 1.28 (ddd^{AB}, $J_1 = 14.8$ Hz, $J_2 = 5.2$ Hz, $J_3 = 3.0$ Hz, 1 H), 1.35-1.58 (m, 2 H), 1.73-1.84 (m, 1 H), 2.07 (dq^{AB}, $J_1 = 14.7$ Hz, $J_2 = 7.4$ Hz, 1 H), 2.28-2.43 (m, 1 H), 3.25 (ddd, $J_1 = 10.1$ Hz, $J_2 = 5.9$ Hz, $J_3 = 2.0$ Hz, 1 H), 3.56-3.77 (m, 3 H), 4.90-5.07 (m, 2 H), 5.76-5.92 (m, 1 H); ^{13}C NMR (75.5 MHz, CDCl_3) δ 4.2 ($3 \times \text{CH}_2$), 6.7 ($3 \times \text{CH}_3$), 24.1 (CH_3), 24.6 (CH_3), 30.5 (CH_2), 31.4 (CH_2), 37.5 (C), 42.4 (CH_2), 59.4 (CH_2), 76.6 (CH), 114.3 ($\text{CH}_2=$), 139.3 ($\text{CH}=$); IR (in substance) ν 1100, 2900, 2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{16}\text{H}_{34}\text{O}_2\text{Si}$: C, 67.07; H, 11.96, Found: C, 67.12; H, 12.03.

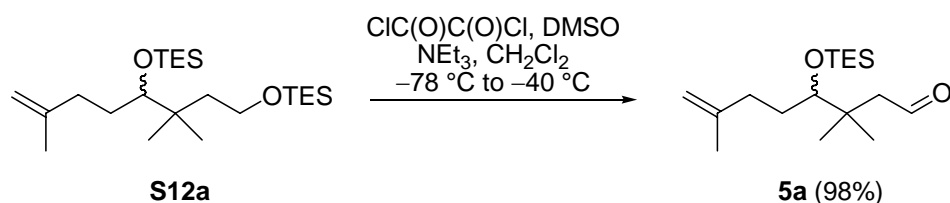


Silyl ether S12a: To a solution of **S11a** (1.44 g, 4.79 mmol, 1 eq.) in CH_2Cl_2 (5 mL, 1 mL/mmol **S11a**) was added imidazole (652 mg, 9.58 mmol, 2 eq.) and TESCl (0.89 mL, 5.27 mmol, 1.1 eq.) at $0\text{ }^{\circ}\text{C}$. After stirring the reaction mixture for 5 h at room temperature, the reaction was quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 20/1) afforded **S12a** (1.94 g, 4.68 mmol, 98%) as a colorless oil: R_f 0.88 (hexane/ethyl acetate 10/1); ^1H NMR (300 MHz, CDCl_3) δ 0.59 (q, $J = 7.9$ Hz, 6 H), 0.62 (q, $J = 7.9$ Hz, 6 H), 0.86 (s, 3 H), 0.87 (s, 3 H), 0.96 (t, $J = 7.9$ Hz, 9 H), 0.97 (t, $J = 7.9$ Hz, 9 H), 1.34-1.74 (m, 4 H), 1.72 (s, 3 H), 1.85-1.97 (m, 1 H), 2.13-2.25 (m, 1 H), 3.27 (dd, $J_1 = 8.2$ Hz, $J_2 = 2.3$ Hz, 1 H), 3.58-3.77 (m, 2 H), 4.67 (s, 1 H), 4.69 (s, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 4.4 ($3 \times \text{CH}_2$), 5.7 ($3 \times \text{CH}_2$), 6.8 ($3 \times \text{CH}_3$), 7.1 ($3 \times \text{CH}_3$), 22.6 (CH_3), 23.9 (CH_3), 24.9 (CH_3), 31.1 (CH_2), 35.9 (CH_2), 37.7 (C), 40.9 (CH_2), 59.8 (CH_2), 81.0 (CH), 109.5 ($\text{CH}_2=$), 146.4 (C); IR (in

substance) ν 1100, 2880-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{23}\text{H}_{50}\text{O}_2\text{Si}_2$: C, 66.60; H, 12.15, Found: C, 66.82; H, 12.24.

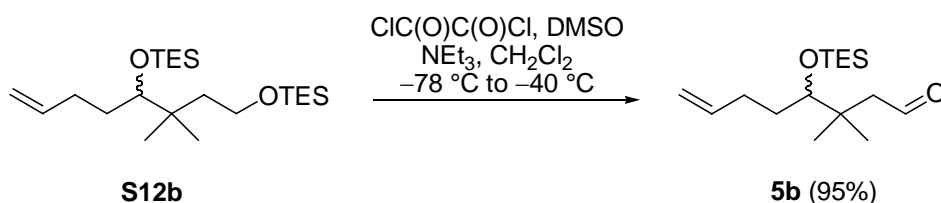


Silyl ether S12b: To a solution of **S11b** (1.01 g, 3.52 mmol, 1 eq.) in CH_2Cl_2 (3.5 mL, 1 mL/mmol **S11b**) was added imidazole (480 mg, 7.04 mmol, 2 eq.) and TESCl (0.72 mL, 4.22 mmol, 1.2 eq.) at 0 °C. After stirring the reaction mixture for 5 h at room temperature, the reaction was quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 20/1) afforded **S12b** (1.33 g, 3.33 mmol, 95%) as a colorless oil: R_f 0.88 (hexane/ethyl acetate 10/1); ^1H NMR (500 MHz, CDCl_3) δ 0.58 (q, J = 8.0 Hz, 6 H), 0.61 (q, J = 7.9 Hz, 6 H), 0.85 (s, 3 H), 0.86 (s, 3 H), 0.95 (t, J = 7.9 Hz, 9 H), 0.96 (t, J = 7.9 Hz, 9 H), 1.35-1.49 (m, 2 H), 1.56-1.65 (m, 2 H), 1.92-2.01 (m, 1 H), 2.18-2.27 (m, 1 H), 3.27 (dd, J_1 = 8.4 Hz, J_2 = 2.3 Hz, 1 H), 3.59-3.74 (m, 2 H), 4.94 (dd, J_1 = 10.1 Hz, J_2 = 1.2 Hz, 1 H), 5.00 (ddd, J_1 = 17.1 Hz, J_2 = 3.3 Hz, J_3 = 1.6 Hz, 1H), 5.80 (ddt, J_1 = 16.9 Hz, J_2 = 10.2 Hz, J_3 = 6.6 Hz, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 4.4 ($3 \times \text{CH}_2$), 5.7 ($3 \times \text{CH}_2$), 6.8 ($3 \times \text{CH}_3$), 7.1 ($3 \times \text{CH}_3$), 23.8 (CH_3), 24.9 (CH_3), 31.8 (CH_2), 32.1 (CH_2), 37.6 (C), 41.0 (CH_2), 59.8 (CH_2), 80.5 (CH), 114.3 ($\text{CH}_2=$), 139.0 (CH=); IR (in substance) ν 1100, 2880-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{22}\text{H}_{48}\text{O}_2\text{Si}_2$: C, 65.93; H, 12.07, Found: C, 65.75; H, 12.15.



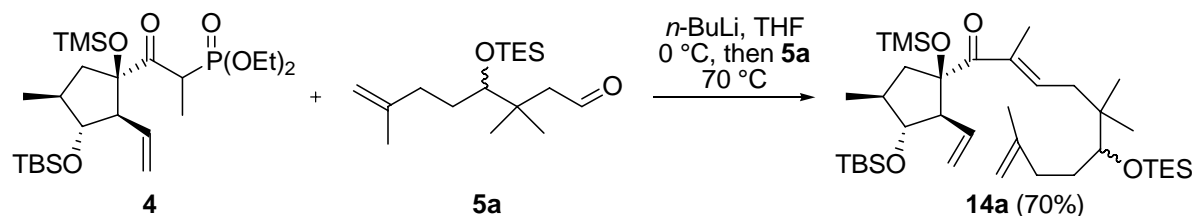
Aldehyde 5a: Oxalyl chloride (1.25 mL, 14.32 mmol, 4 eq.) was dissolved in CH_2Cl_2 (20 mL, 1.4 mL/mmol oxalyl chloride) and cooled to -78 °C. A mixture of DMSO (2.03 mL, 28.64 mmol, 8 eq.) and CH_2Cl_2 (3 mL, 0.1 mL/mmol DMSO) was then added dropwise. After 15 min at -78 °C, a solution of **S12a** (1.49 g, 3.58 mmol, 1 eq.) in CH_2Cl_2 (3.6 mL, 1 mL/mmol **S12a**) was added at -78 °C. The mixture was warmed to -40 °C over a period of 10 min and then cooled to -78 °C. Triethylamine (7.5 mL, 53.7 mmol, 15 eq.) was added at -78 °C. The cooling

bath was removed and the mixture was allowed to warm to room temperature. Sat. aqueous NH_4Cl solution was added and the layers were separated. The aqueous layer was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane/triethylamine 50/1) afforded **5a** (1.04 g, 3.50 mmol, 98%) as a yellow oil: R_f 0.47 (hexane/ethyl acetate 10/1); ^1H NMR (300 MHz, CDCl_3) δ 0.62 (q, $J = 7.8$ Hz, 6 H), 0.96 (t, $J = 7.9$ Hz, 9 H), 1.00 (s, 3 H), 1.09 (s, 3 H), 1.39-1.52 (m, 1 H), 1.64-1.77 (m, 1 H), 1.72 (s, 3 H), 1.88-2.00 (m, 1 H), 2.12-2.25 (m, 2 H), 2.41 (dd^{AB}, $J_1 = 14.4$ Hz, $J_2 = 3.4$ Hz, 1 H), 3.36 (dd, $J_1 = 7.8$ Hz, $J_2 = 2.6$ Hz, 1 H), 4.67 (s, 1 H), 4.71 (s, 1 H), 9.84 (t, $J = 3.2$ Hz, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 5.6 ($3 \times \text{CH}_2$), 7.1 ($3 \times \text{CH}_3$), 22.6 (CH_3), 24.8 (CH_3), 25.4 (CH_3), 31.3 (CH_2), 35.7 (CH_2), 39.7 (C), 51.7 (CH_2), 80.6 (CH), 109.9 ($\text{CH}_2=$), 145.8 (C=), 203.5 (C); IR (in substance) ν 1720, 2850-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{17}\text{H}_{34}\text{O}_2\text{Si}$: C, 68.39; H, 11.48, Found: C, 68.45; H, 11.51.



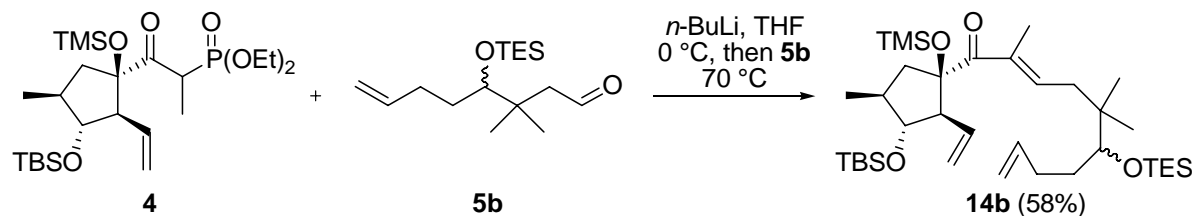
Aldehyde 5b: Oxalyl chloride (2.04 mL, 23.36 mmol, 4 eq.) was dissolved in CH_2Cl_2 (20 mL, 0.85 mL/mmol oxalyl chloride) and cooled to -78 $^\circ\text{C}$. A mixture of DMSO (3.32 mL, 46.73 mmol, 8 eq.) and CH_2Cl_2 (4.6 mL, 0.1 mL/mmol DMSO) was added dropwise. After 15 min at -78 $^\circ\text{C}$, a solution of **S12b** (2.34 g, 5.84 mmol, 1 eq.) in CH_2Cl_2 (5.8 mL, 1 mL/mmol **S12b**) was added at -78 $^\circ\text{C}$. The mixture was allowed to warm to -40 $^\circ\text{C}$ over a period of 10 min and then cooled to -78 $^\circ\text{C}$. Triethylamine (12.2 mL, 87.6 mmol, 15 eq.) was added at -78 $^\circ\text{C}$. The cooling bath was removed and the mixture allowed warming to room temperature. Sat. aqueous NH_4Cl solution was then added and the layers were separated. The aqueous layer was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane/triethylamine 50/1) afforded **5b** (1.58 g, 5.54 mmol, 95%) as a yellow oil: R_f 0.47 (hexane/ethyl acetate 10/1); ^1H NMR (300 MHz, CDCl_3) δ 0.58 (q, $J = 7.9$ Hz, 6 H), 0.92 (t, $J = 8.0$ Hz, 9 H), 0.95 (s, 3 H), 1.04 (s, 3 H), 1.32-1.46 (m, 1 H), 1.54-1.68 (m, 1 H), 1.85-2.03 (m, 1 H), 2.10 (dd^{AB}, $J_1 = 14.4$ Hz, $J_2 = 2.8$ Hz, 1 H), 2.13-2.23 (m, 1 H), 2.35 (dd^{AB}, $J_1 = 14.4$ Hz, $J_2 = 3.4$ Hz, 1 H), 3.33 (dd, $J_1 = 7.8$ Hz, $J_2 = 2.7$ Hz, 1 H), 4.88-5.01 (m, 2 H), 5.74 (m, 1 H), 9.78 (t, $J = 3.2$ Hz, 1 H); ^{13}C NMR (75.5 MHz,

CDCl₃) δ 5.4 (3 \times CH₂), 6.9 (3 \times CH₃), 24.6 (CH₃), 25.2 (CH₃), 31.5 (CH₂), 32.2 (CH₂), 39.5 (C), 51.7 (CH₂), 80.1 (CH), 114.6 (CH₂=), 138.4 (CH=), 203.0 (C=O); IR (in substance) ν 1720, 2880-2950 cm⁻¹; Anal. Calcd. for C₁₆H₃₂O₂Si: C, 67.54; H, 11.34, Found: C, 67.67; H, 11.44.



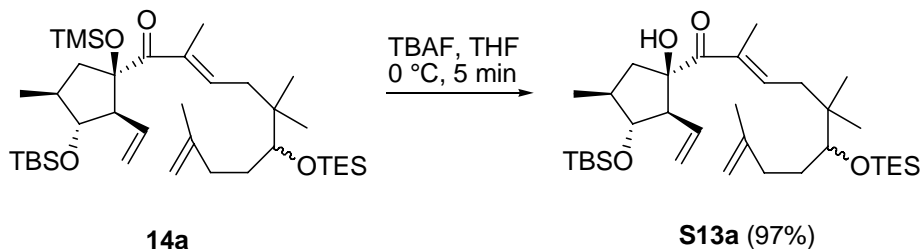
Triene 14a: Phosphonate **4** (1.47 g, 2.83 mmol, 1.5 eq.) was dissolved in THF (14 mL, 5 mL/mmol **4**) and placed in a pressure tube³. The solution was cooled to 0 °C and *n*-BuLi (1.26 mL, 2.1 M in hexane, 1.4 eq.) was added dropwise to give a light yellow reaction mixture. After 5 min of stirring, a solution of **5a** (563 mg, 1.89 mmol, 1 eq.) in THF (3.8 mL, 2 mL/mmol **5a**) was added at 0 °C. The pressure tube³ was sealed and heated to 70 °C (bath temperature) for 12 h. Sat. aqueous NH₄Cl solution was then added and the layers were separated. The aqueous layer was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 1/1) afforded **14a** (885 mg, 1.33 mmol, 70%, 1/1 mixture of C9-diastereomers) as a yellow oil: *R*_f 0.88 (hexane/ethyl acetate 10/1) and recovered **4** (656 mg, 1.26 mmol, 45% based on the initial amount of **4**). **14a:** ¹H NMR (300 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ -0.07 (s, 3 + 3 H), -0.02 (s, 3 + 3 H), 0.00 (s, 9 + 9 H), 0.57 (q, *J* = 7.9 Hz, 6 H), 0.59 (q, *J* = 7.9 Hz, 6 H), 0.78 (s, 3 + 3 H), 0.80 (s, 9 + 9 H), 0.84 (s, 3 + 3 H), 0.94 (t, *J* = 7.9 Hz, 9 + 9 H), 0.99 (d, *J* = 6.6 Hz, 3 + 3 H), 1.23-1.34 (m, 1 + 1 H), 1.37-1.50 (m, 1 + 1 H), 1.55-1.68 (m, 1 + 1 H), 1.69 (s, 3 + 3 H), 1.72 (s, 3 + 3 H), 1.80-1.96 (m, 2 + 2 H), 2.00-2.23 (m, 3 + 3 H), 2.44 (dd, *J*₁ = *J*₂ = 8.8 Hz, 1 + 1 H), 2.69 (dd^{AB}, *J*₁ = 12.7 Hz, *J*₂ = 7.5 Hz, 1 + 1 H), 3.27 (d, *J* = 8.1 Hz, 1 H), 3.28 (d, *J* = 7.8 Hz, 1 H), 3.45 (dd, *J*₁ = *J*₂ = 8.5 Hz, 1 + 1 H), 4.64 (s, 1 + 1 H), 4.67 (s, 1 + 1 H), 4.94 (d, *J* = 17.3 Hz, 1 + 1 H), 5.10 (dd, *J*₁ = 10.1 Hz, *J*₂ = 1.9 Hz, 1 + 1 H), 5.77-5.92 (m, 1 + 1 H), 6.80 (dd, *J*₁ = *J*₂ = 7.5 Hz, 1 + 1 H); ¹³C NMR (126 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ -4.0 (1 + 1 CH₃), -3.3 (1 + 1 CH₃), 1.9 (3 + 3 CH₃), 5.7 (3 + 3 CH₂), 7.2 (3 + 3 CH₃), 13.0 (1 + 1 CH₃), 17.9 (1 + 1 C), 18.0 (1 + 1 CH₃), 22.6 (1 + 1 CH₃), 22.8 (1 + 1 CH₃), 23.8 (1 + 1 CH₃), 25.9 (3 + 3 CH₃), 31.1 (1 + 1 CH₂), 35.9 (1 + 1 CH₂), 37.3 (CH₂), 37.5 (CH₂), 39.6 (1 + 1 C), 40.6 (1 + 1 CH), 45.4 (1 + 1 CH₂), 62.5 (1 + 1 CH), 81.1 (CH), 81.2 (CH), 83.8 (1 + 1 CH), 86.9 (1 + 1 C), 109.7 (1 + 1 CH₂=), 118.6 (1 + 1 CH₂=), 134.3 (1 + 1 C=), 136.3 (1 + 1 CH=), 142.3 (1

+ 1 CH=), 146.2 (1 + 1 C=), 204.7 (1 + 1 C=O); IR (in substance) ν 840, 1250, 1660, 2880-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{37}\text{H}_{72}\text{O}_4\text{Si}_3$: C, 66.80; H, 10.91, Found: C, 66.88; H, 10.83.

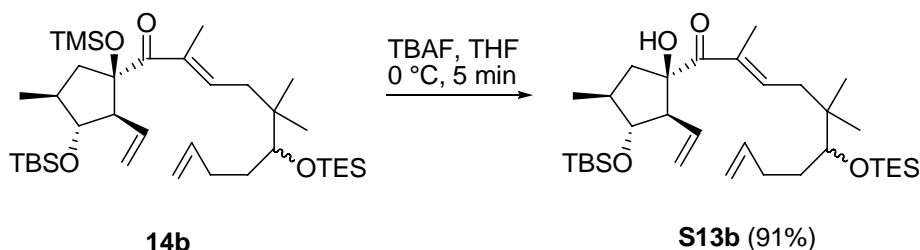


Triene 14b: Phosphonate **4** (918 mg, 1.76 mmol, 2 eq.) was dissolved in THF (5 mL, 2.8 mL/mmol **4**) and placed in a pressure tube³. The solution was cooled to 0 °C and *n*-BuLi (0.74 mL, 2.1 M in hexane, 1.75 eq.) was added dropwise to afford a light yellow reaction mixture. After stirring for 5 min, a solution of **5b** (251 mg, 0.88 mmol, 1 eq.) in THF (1.8 mL, 2 mL/mmol **5b**) was added at 0 °C. The pressure tube³ was then sealed and heated to 70 °C (bath temperature) for 12 h. Sat. aqueous NH_4Cl solution was added and the layers were separated. The aqueous layer was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 1/1) afforded **14b** (335 mg, 0.51 mmol, 58%, 1/1 mixture of C9-diastereomers) as a yellow oil: R_f 0.89 (hexane/ethyl acetate 10/1) and recovered **4** (583 mg, 1.12 mmol, 63% based on the initial amount of **4**). **14b**: ^1H NMR (500 MHz, CDCl_3) of a 1/1 mixture of diastereomers δ -0.04 (s, 3 + 3 H), 0.01 (s, 3 + 3 H), 0.02 (s, 9 H), 0.03 (s, 9 H), 0.62 (q, $J = 7.9$ Hz, 6 H), 0.63 (q, $J = 7.9$ Hz, 6 H), 0.80 (s, 3 + 3 H), 0.83 (s, 9 + 9 H), 0.85 (s, 3 H), 0.86 (s, 3 H), 0.96 (t, $J = 8.0$ Hz, 9 H), 0.97 (t, $J = 7.9$ Hz, 9 H), 1.02 (d, $J = 6.6$ Hz, 3 + 3 H), 1.32 (dd^{AB}, $J_1 = J_2 = 12.2$ Hz, 1 + 1 H), 1.37-1.46 (m, 1 + 1 H), 1.56-1.65 (m, 1 + 1 H), 1.74 (s, 3 + 3 H), 1.85-2.03 (m, 2 + 2 H), 2.08-2.28 (m, 3 + 3 H), 2.47 (dd, $J_1 = J_2 = 8.6$ Hz, 1 + 1 H), 2.71 (dd^{AB}, $J_1 = 12.7$ Hz, $J_2 = 7.5$ Hz, 1 + 1 H), 3.31 (d, $J = 8.2$ Hz, 1 H), 3.32 (d, $J = 8.3$ Hz, 1 H), 3.48 (dd, $J_1 = J_2 = 8.5$ Hz, 1 + 1 H), 4.93-5.04 (m, 3 + 3 H), 5.13 (dd, $J_1 = 10.2$ Hz, $J_2 = 2.2$ Hz, 1 + 1 H), 5.76-5.91 (m, 2 + 2 H), 6.80-6.85 (m, 1 + 1 H); ^{13}C NMR (126 MHz, CDCl_3) of a 1/1 mixture of diastereomers δ -4.0 (1 + 1 CH_3), -3.3 (1 + 1 CH_3), 1.9 (3 + 3 CH_3), 5.7 (3 + 3 CH_2), 7.2 (3 + 3 CH_3), 13.0 (1 + 1 CH_3), 17.9 (1 + 1 C), 18.0 (1 + 1 CH_3), 22.6 (CH_3), 22.8 (CH_3), 23.8 (1 + 1 CH_3), 25.9 (3 + 3 CH_3), 31.7 (1 + 1 CH_2), 32.1 (1 + 1 CH_2), 37.3 (CH_2), 37.4 (CH_2), 39.6 (1 + 1 C), 40.6 (1 + 1 CH), 45.4 (1 + 1 CH_2), 62.5 (1 + 1 CH), 80.7 (CH), 80.8 (CH), 83.8 (1 + 1 CH), 86.9 (1 + 1 C), 114.5 (1 + 1 CH_2 =), 118.6 (1 + 1 CH_2 =), 134.3 (1 + 1 C=), 136.3 (1 + 1 CH=), 138.9 (1 + 1 CH=), 142.3 (1 +

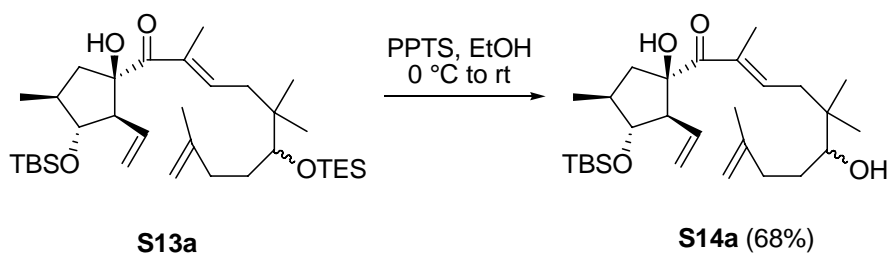
1 CH=), 204.7 (1 + 1 C=O); IR (in substance) ν 1100, 1250, 1660, 2880-2950 cm^{-1} ; Anal. Calcd. for $\text{C}_{36}\text{H}_{70}\text{O}_4\text{Si}_3$: C, 66.40; H, 10.83, Found: C, 66.54; H, 10.86.



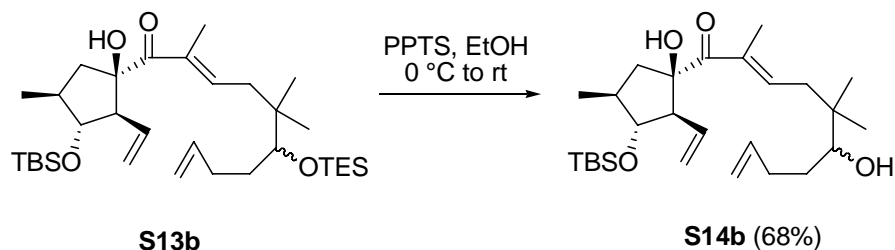
Alcohol S13a: To a solution of **14a** (72.9 mg, 0.109 mmol, 1 eq.) in THF (2 mL, 18 mL/mmol **14a**) was slowly added a solution of TBAF in THF (0.11 mL, 0.11 mmol, 1 M in THF, 1 eq.) at 0 °C. Stirring for 5 min followed. The solution was diluted with CH_2Cl_2 and sat. aqueous NH_4Cl was added. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 20/1) afforded **S13a** (62.9 mg, 0.106 mmol, 97%, 1/1 mixture of C9-diastereomers) as a yellow oil: R_f 0.48 (hexane/ethyl acetate 20/1); ^1H NMR (500 MHz, CDCl_3) of a 1/1 mixture of diastereomers δ -0.02 (s, 3 + 3 H), 0.05 (s, 3 + 3 H), 0.63 (q, $J = 7.8$ Hz, 6 + 6 H), 0.85 (s, 9 + 9 H), 0.89 (s, 3 H), 0.90 (s, 3 H), 0.92 (s, 3 H), 0.93 (s, 3 H), 0.97 (t, $J = 7.9$ Hz, 9 + 9 H), 1.14 (d, $J = 6.6$ Hz, 3 + 3 H), 1.42-1.52 (m, 1 + 1 H), 1.58 (dd^{AB}, $J_1 = 14.7$ Hz, $J_2 = 9.6$ Hz, 1 + 1 H), 1.65-1.72 (m, 1 + 1 H), 1.72 (s, 3 + 3 H), 1.82 (s, 3 + 3 H), 1.88-1.97 (m, 1 + 1 H), 2.00-2.10 (m, 1 + 1 H), 2.16-2.33 (m, 3 + 3 H), 2.70 (dd^{AB}, $J_1 = 14.6$ Hz, $J_2 = 10.1$ Hz, 1 + 1 H), 2.84 (dd, $J_1 = J_2 = 9.3$ Hz, 1 + 1 H), 3.36 (dd, $J_1 = 6.3$ Hz, $J_2 = 2.3$ Hz, 1 H), 3.38 (dd, $J_1 = 6.2$ Hz, $J_2 = 2.1$ Hz, 1 H), 3.82 (dd, $J_1 = J_2 = 9.2$ Hz, 1 + 1 H), 4.20 (br. s, 1 H), 4.21 (br. s, 1 H), 4.68 (s, 1 + 1 H), 4.71 (s, 1 + 1 H), 4.90 (ddd, $J_1 = 17.3$ Hz, $J_2 = J_3 = 1.9$ Hz, 1 + 1 H), 5.07 (ddd, $J_1 = 10.3$ Hz, $J_2 = J_3 = 1.3$ Hz, 1 + 1 H), 5.68-5.78 (m, 1 + 1 H), 6.79-6.84 (m, 1 + 1 H); ^{13}C NMR (126 MHz, CDCl_3) of a 1/1 mixture of diastereomers δ -4.0 (1 + 1 CH_3), -3.4 (1 + 1 CH_3), 5.7 (3 + 3 CH_2), 7.2 (3 + 3 CH_3), 13.1 (1 + 1 CH_3), 17.9 (1 + 1 C), 18.4 (1 + 1 CH_3), 22.6 (1 + 1 CH_3), 23.4 (1 + 1 CH_3), 23.9 (1 + 1 CH_3), 25.9 (3 + 3 CH_3), 31.2 (1 + 1 CH_2), 35.9 (1 + 1 CH_2), 37.5 (1 + 1 CH_2), 39.9 (1 + 1 C), 40.5 (1 + 1 CH), 45.3 (1 + 1 CH_2), 63.6 (1 + 1 CH), 80.5 (CH), 80.6 (CH), 82.5 (1 + 1 CH), 84.2 (1 + 1 C), 109.8 (1 + 1 $\text{CH}_2=$), 119.3 (1 + 1 $\text{CH}_2=$), 133.7 (1 + 1 C=), 134.8 (1 + 1 CH=), 141.9 (CH=), 142.0 (CH=), 146.0 (1 + 1 C=), 203.5 (1 + 1 C=O); IR (in substance) ν 1100, 1250, 1650, 2880-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{34}\text{H}_{64}\text{O}_4\text{Si}_2$: C, 68.86; H, 10.88, Found: C, 69.00; H, 10.99.



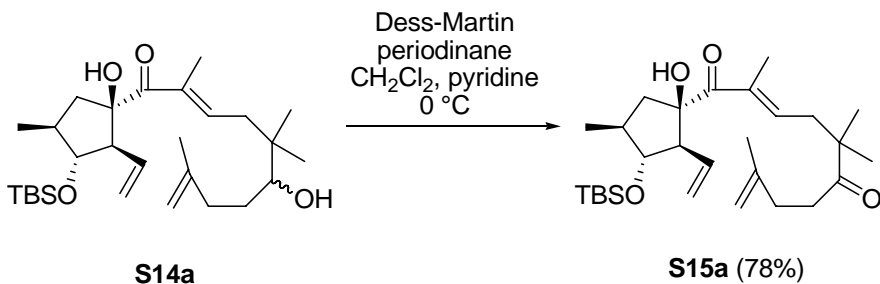
Alcohol S13b: To a solution of **14b** (1.696 g, 2.60 mmol, 1 eq.) in THF (13 mL, 5 mL/mmol **14b**) was slowly a solution of TBAF in THF (2.6 mL, 2.6 mmol, 1 M in THF, 1 eq.). After stirring the reaction mixture for 5 min, the solution was diluted with CH₂Cl₂ and sat. aqueous NH₄Cl solution was added. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 20/1) afforded **S13b** (1.367 g, 2.36 mmol, 91%, 1/1 mixture of C₉-diastereomers) as a yellow oil: *R_f* 0.50 (hexane/ethyl acetate 20/1); ¹H NMR (500 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ –0.02 (s, 3 + 3 H), 0.05 (s, 3 + 3 H), 0.63 (q, *J* = 7.7 Hz, 6 + 6 H), 0.85 (s, 9 + 9 H), 0.89 (s, 3 H), 0.89 (s, 3 H), 0.91 (s, 3 H), 0.92 (s, 3 H), 0.97 (t, *J* = 8.0 Hz, 9 + 9 H), 1.14 (d, *J* = 5.6 Hz, 3 + 3 H), 1.40-1.49 (m, 1 + 1 H), 1.57 (dd^{AB}, *J*₁ = 14.9 Hz, *J*₂ = 9.8 Hz, 1 + 1 H), 1.60-1.67 (m, 1 + 1 H), 1.81 (s, 3 + 3 H), 1.95-2.09 (m, 2 + 2 H), 2.20-2.32 (m, 3 + 3 H), 2.70 (dd^{AB}, *J*₁ = 14.8 Hz, *J*₂ = 10.1 Hz, 1 + 1 H), 2.84 (dd, *J*₁ = *J*₂ = 9.3 Hz, 1 + 1 H), 3.38 (dd, *J*₁ = *J*₂ = 8.0 Hz, 1 H), 3.39 (dd, *J*₁ = *J*₂ = 8.1 Hz, 1 H), 3.82 (dd, *J*₁ = *J*₂ = 9.2 Hz, 1 + 1 H), 4.21 (br. s, 1 + 1 H), 4.87-5.08 (m, 4 + 4 H), 5.67-5.84 (m, 2 + 2 H), 6.78-6.83 (m, 1 + 1 H); ¹³C NMR (126 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ –4.0 (1 + 1 CH₃), –3.4 (1 + 1 CH₃), 5.7 (3 + 3 CH₂), 7.1 (3 + 3 CH₃), 13.0 (1 + 1 CH₃), 17.9 (1 + 1 C), 18.4 (1 + 1 CH₃), 23.4 (1 + 1 CH₃), 23.9 (1 + 1 CH₃), 25.8 (3 + 3 CH₃), 31.7 (1 + 1 CH₂), 32.3 (1 + 1 CH₂), 37.5 (1 + 1 CH₂), 39.9 (1 + 1 C), 40.5 (1 + 1 CH), 45.3 (1 + 1 CH₂), 63.6 (1 + 1 CH), 80.1 (CH), 80.2 (CH), 82.5 (1 + 1 CH), 84.2 (1 + 1 C), 114.6 (1 + 1 CH₂=), 119.2 (1 + 1 CH₂=), 133.6 (C=), 133.7 (C=), 134.8 (1 + 1 CH=), 138.6 (1 + 1 CH=), 141.9 (1 + 1 CH=), 203.5 (1 + 1 C=O); IR (in substance) ν 1100, 1650, 2880-2950 cm^{–1}; Anal. Calcd. for C₃₃H₆₂O₄Si₂: C, 68.45; H, 10.79, Found: C, 68.59; H, 10.84.



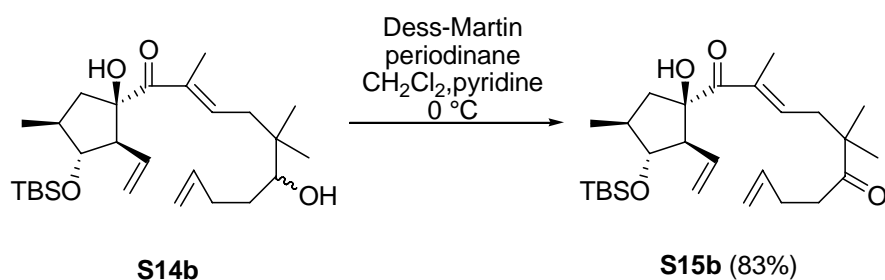
Diol S14a: To a solution of **S13a** (715 mg, 1.2 mmol, 1 eq.) in EtOH (20 mL, 16.6 mL/mmol **S13a**) was added pyridinium *p*-toluenesulfonate (PPTS, 1.51 g, 6.03 mmol, 5 eq.) at 0 °C. The cooling bath was removed and the mixture was stirred at room temperature until TLC indicated the consumption of almost the entire starting material (about 5 h). The reaction was diluted with CH₂Cl₂ and sat. aqueous NH₄Cl solution. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 5/1) afforded **S14a** (388 mg, 0.81 mmol, 68%, 1/1 mixture of C9-diastereomers) as a clear oil: *R*_f 0.43 (hexane/ethyl acetate 5/1). A small amount of **S13a** that was contaminated with an inseparable impurity of unknown structure was also isolated. **S14a**: ¹H NMR (500 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ –0.03 (s, 3 + 3 H), 0.04 (s, 3 + 3 H), 0.84 (s, 9 + 9 H), 0.95 (s, 6 + 6 H), 1.12 (d, *J* = 6.6 Hz, 3 + 3 H), 1.44 (dtdd, *J*₁ = 16.3 Hz, *J*₂ = 8.3 Hz, *J*₃ = 5.6 Hz, *J*₄ = 2.5 Hz, 1 + 1 H), 1.55 (dd^{AB}, *J*₁ = 14.8 Hz, *J*₂ = 9.7 Hz, 1 + 1 H), 1.65-1.72 (m, 2 + 2 H), 1.72 (s, 3 + 3 H), 1.81 (s, 3 + 3 H), 2.01-2.12 (m, 2 + 2 H), 2.16-2.29 (m, 2 + 2 H), 2.31-2.42 (m, 1 + 1 H), 2.69 (dd^{AB}, *J*₁ = 14.7 Hz, *J*₂ = 10.1 Hz, 1 + 1 H), 2.86 (dd, *J*₁ = *J*₂ = 9.3 Hz, 1 + 1 H), 3.29 (d, *J* = 10.3 Hz, 1 H), 3.30 (d, *J* = 10.2 Hz, 1 H), 3.80 (dd, *J*₁ = *J*₂ = 9.2 Hz, 1 + 1 H), 4.21 (s, 1 H), 4.22 (s, 1 H), 4.73 (br. s, 2 + 2 H), 4.89 (dd, *J*₁ = 17.2 Hz, *J*₂ = 0.8 Hz, 1 + 1 H), 5.05 (dd, *J*₁ = 10.2 Hz, *J*₂ = 2.0 Hz, 1 + 1 H), 5.71 (ddd, *J*₁ = 17.3 Hz, *J*₂ = 10.1 Hz, *J*₃ = 9.2 Hz, 1 + 1 H), 6.85 (dd, *J*₁ = *J*₂ = 7.6 Hz, 1 + 1 H); ¹³C NMR (126 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ –4.0 (1 + 1 CH₃), –3.4 (1 + 1 CH₃), 13.0 (1 + 1 CH₃), 17.9 (1 + 1 C), 18.4 (1 + 1 CH₃), 22.4 (1 + 1 CH₃), 23.0 (1 + 1 CH₃), 23.9 (1 + 1 CH₃), 25.8 (3 + 3 CH₃), 29.1 (1 + 1 CH₂), 35.2 (1 + 1 CH₂), 38.0 (CH₂), 38.2 (CH₂), 39.1 (1 + 1 C), 40.4 (1 + 1 CH), 45.3 (1 + 1 CH₂), 63.4 (1 + 1 CH), 78.5 (1 + 1 CH), 82.5 (1 + 1 CH), 84.2 (1 + 1 C), 110.6 (1 + 1 CH₂=), 119.2 (1 + 1 CH₂=), 133.4 (1 + 1 C=), 134.8 (1 + 1 CH=), 141.6 (1 + 1 CH=), 145.7 (1 + 1 C=), 203.7 (1 + 1 C=O); IR (in substance) ν 1100, 1650, 2860-2950 cm^{–1}; Anal. Calcd. for C₂₈H₅₀O₄Si: C, 70.24; H, 10.53, Found: C, 69.88; H, 10.68.



Diol S14b: To a solution of **S13b** (1.35 g, 2.33 mmol, 1 eq.) in EtOH (12 mL, 5 mL/mmol **S13b**) was added pyridinium *p*-toluenesulfonate (PPTS, 1.76 g, 7.0 mmol, 3 eq.) at 0 °C. The cooling bath was removed and the mixture stirred at room temperature until TLC indicated the consumption of almost the entire starting material (about 5 h). The reaction was diluted with CH₂Cl₂ and sat. aqueous NH₄Cl solution. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 5/1) afforded **S14b** (736 mg, 1.58 mmol, 68%, 1/1 mixture of C9-diastereomers) as a clear oil: *R*_f 0.41 (hexane/ethyl acetate 5/1). A small amount of **S13a** that was contaminated with an inseparable impurity of unknown structure was also isolated. **S14b**: ¹H NMR (500 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ −0.02 (s, 3 + 3 H), 0.05 (s, 3 + 3 H), 0.85 (s, 9 + 9 H), 0.94 (s, 3 + 3 H), 0.95 (s, 3 + 3 H), 1.13 (d, *J* = 6.6 Hz, 3 + 3 H), 1.38-1.47 (m, 1 + 1 H), 1.56 (dd^{AB}, *J*₁ = 14.8 Hz, *J*₂ = 9.7 Hz, 1 + 1 H), 1.58-1.68 (m, 2 + 2 H), 1.82 (s, 3 + 3 H), 2.01-2.43 (m, 5 + 5 H), 2.70 (dd^{AB}, *J*₁ = 14.7 Hz, *J*₂ = 10.1 Hz, 1 + 1 H), 2.86 (ddd, *J*₁ = 2.3 Hz, *J*₂ = *J*₃ = 9.4 Hz, 1 + 1 H), 3.32 (d, *J* = 10.4 Hz, 1 H), 3.32 (d, *J* = 10.4 Hz, 1 H), 3.81 (dd, *J*₁ = *J*₂ = 9.2 Hz, 1 + 1 H), 4.21 (br. s, 1 H), 4.22 (br. s, 1 H), 4.90 (d, *J* = 17.3 Hz, 1 + 1 H), 4.99 (d, *J* = 10.2 Hz, 1 + 1 H), 5.04-5.10 (m, 2 + 2 H), 5.72 (ddd, *J*₁ = 17.3 Hz, *J*₂ = 10.0 Hz, *J*₃ = 9.3 Hz, 1 + 1 H), 5.78-5.88 (m, 1 + 1 H), 6.83-6.88 (m, 1 + 1 H); ¹³C NMR (126 MHz, CDCl₃) of a 1/1 mixture of diastereomers δ −4.0 (1 + 1 CH₃), −3.4 (1 + 1 CH₃), 13.0 (1 + 1 CH₃), 17.9 (1 + 1 C), 18.4 (1 + 1 CH₃), 23.0 (1 + 1 CH₃), 23.9 (1 + 1 CH₃), 25.8 (3 + 3 CH₃), 30.6 (1 + 1 CH₂), 31.2 (1 + 1 CH₂), 38.0 (CH₂), 38.2 (CH₂), 39.1 (1 + 1 C), 40.4 (1 + 1 CH), 45.3 (1 + 1 CH₂), 63.4 (1 + 1 CH), 78.3 (1 + 1 CH), 82.5 (1 + 1 CH), 84.3 (1 + 1 C), 115.2 (1 + 1 CH₂=), 119.2 (1 + 1 CH₂=), 133.5 (1 + 1 C=), 134.8 (1 + 1 CH=), 138.4 (1 + 1 CH=), 141.5 (1 + 1 CH=), 203.7 (1 + 1 C=O); IR (in substance) ν 1050, 1120, 1250, 1650, 2950 cm^{−1}; Anal. Calcd. for C₂₇H₄₈O₄Si: C, 69.78; H, 10.41, Found: C, 68.82; H, 10.62.



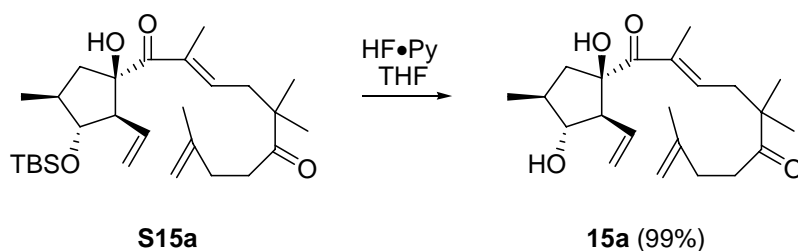
Ketone S15a: To a solution of **S14a** (263.8 mg, 0.55 mmol, 1 eq.) in CH₂Cl₂ (16 mL, 29 mL/mmol **S14a**) and pyridine (8 mL, 14.5 mL/mmol **S14a**) was added the Dess-Martin periodinane⁷ (486 mg, 1.1 mmol, 2 eq.) at 0 °C. The mixture was stirred until TLC control indicated complete consumption of the starting material (~40 min). The reaction was then quenched by the addition of sat. aqueous Na₂S₂O₃ solution and diluted with CH₂Cl₂. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 10/1) afforded **S15a** (203.7 mg, 0.427 mmol, 78%) as a clear oil: *R*_f 0.44 (hexane/ethyl acetate 10/1); ¹H NMR (300 MHz, CDCl₃) δ -0.03 (s, 3 H), 0.04 (s, 3 H), 0.85 (s, 9 H), 1.12 (d, *J* = 6.6 Hz, 3 H), 1.20 (s, 3 H), 1.22 (s, 3 H), 1.53 (dd^{AB}, *J*₁ = 14.8 Hz, *J*₂ = 9.7 Hz, 1 H), 1.72 (s, 3 H), 1.81 (d, *J* = 0.9 Hz, 3 H), 1.91-2.03 (m, 1 H), 2.21-2.26 (m, 2 H), 2.47 (d, *J* = 7.3 Hz, 2 H), 2.59-2.66 (m, 3 H), 2.76 (dd, *J*₁ = *J*₂ = 9.3 Hz, 1 H), 3.79 (dd, *J*₁ = *J*₂ = 9.2 Hz, 1 H), 4.06 (br. s, 1 H), 4.64 (s, 1 H), 4.72 (s, 1 H), 4.89 (dd, *J*₁ = 17.3 Hz, *J*₂ = 1.8 Hz, 1 H), 5.06 (dd, *J*₁ = 10.3 Hz, *J*₂ = 2.1 Hz, 1 H), 5.70 (ddd, *J*₁ = 17.3 Hz, *J*₂ = 10.2 Hz, *J*₃ = 9.0 Hz, 1 H), 6.56-6.60 (m, 1 H); ¹³C NMR (126 MHz, CDCl₃) δ -4.0 (CH₃), -3.4 (CH₃), 13.1 (CH₃), 17.9 (C), 18.4 (CH₃), 22.7 (CH₃), 24.4 (CH₃), 24.6 (CH₃), 25.9 (3 × CH₃), 31.4 (CH₂), 35.3 (CH₂), 38.5 (CH₂), 40.4 (CH), 45.1 (CH₂), 47.9 (C), 63.3 (CH), 82.4 (CH), 84.3 (C), 110.1 (CH₂=), 119.3 (CH₂=), 134.2 (C=), 134.7 (CH=), 139.6 (CH₂=), 144.7 (C=), 203.7 (C=O), 213.5 (C=O); IR (in substance) ν 1120, 1650, 1700, 2930-2960 cm⁻¹; Anal. Calcd. for C₂₈H₄₈O₄Si: C, 70.54; H, 10.15, Found: C, 70.82; H, 10.27; [α]_D²⁵ +6.1 (c 2.05, CHCl₃).



Ketone S15b: To a solution of **S14b** (726.7 mg, 1.56 mmol, 1 eq.) in CH₂Cl₂ (8 mL, 5 mL/mmol **S14b**) and pyridine (4 mL, 2.56 mL/mmol **S14b**) was added the Dess-Martin periodinane⁷ (1.33 g, 3.13 mmol, 2 eq.) at 0 °C. The mixture was stirred until TLC control indicated complete consumption of the starting material (~40 min). The reaction was then quenched by the addition of sat. aqueous Na₂S₂O₃ solution and diluted with CH₂Cl₂. The layers

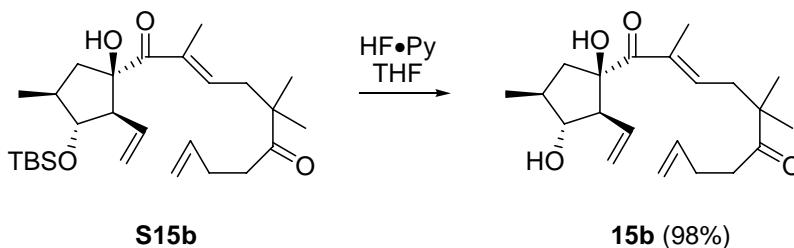
⁷ prepared according to: Dess, D. B.; Martin, J. C. *J. Am. Chem. Soc.* **1991**, *113*, 7277-7287.

were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 10/1) afforded **S15b** (599.3 mg, 1.295 mmol, 83%) as a clear oil: R_f 0.63 (hexane/ethyl acetate 5/1); ^1H NMR (300 MHz, CDCl_3) δ -0.07 (s, 3 H), 0.00 (s, 3 H), 0.81 (s, 9 H), 1.08 (d, $J = 6.6$ Hz, 3 H), 1.15 (s, 3 H), 1.17 (s, 3 H), 1.49 (dd^{AB}, $J_1 = 14.7$ Hz, $J_2 = 9.7$ Hz, 1 H), 1.77 (s, 3 H), 1.84-2.00 (m, 1 H), 2.20-2.30 (m, 2 H), 2.42 (d, $J = 7.3$ Hz, 2 H), 2.53 (dd, $J_1 = J_2 = 7.3$ Hz, 2 H), 2.59 (dd^{AB}, $J_1 = 14.6$ Hz, $J_2 = 9.9$ Hz, 1 H), 2.71 (dd, $J_1 = J_2 = 9.3$ Hz, 1 H), 3.75 (dd, $J_1 = J_2 = 9.2$ Hz, 1 H), 4.03 (br. s, 1 H), 4.81-5.05 (m, 4 H), 5.59-5.81 (m, 2 H), 6.50-6.57 (m, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ -4.0 (CH_3), -3.4 (CH_3), 13.1 (CH_3), 17.9 (CH_3), 18.4 (C), 24.4 (CH_3), 24.6 (CH_3), 25.9 ($3 \times \text{CH}_3$), 27.8 (CH_2), 36.3 (CH_2), 38.5 (CH_2), 40.4 (CH), 45.1 (CH_2), 47.8 (C), 63.3 (CH), 82.4 (CH), 84.3 (C), 115.3 ($\text{CH}_2=$), 119.3 ($\text{CH}_2=$), 134.1 (C=), 134.7 (CH=), 137.2 (CH=), 139.6 (CH=), 203.7 (C=O), 213.3 (C=O); IR (in substance) ν 1120, 1250, 1640, 1700, 2930-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{27}\text{H}_{46}\text{O}_4\text{Si}$: C, 70.08; H, 10.02, Found: C, 70.14; H, 10.00; $[\alpha]_D^{25} +7.0$ (c 2.3, CHCl_3).

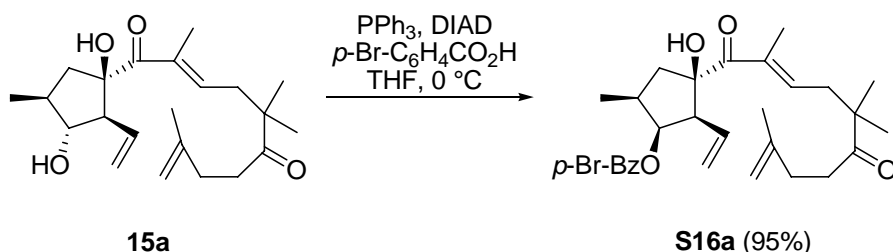


Diol 15a: Ketone **S15a** (53 mg, 0.111 mmol, 1 eq.) was dissolved in THF (3 mL, 27 mL/mmol **S15a**) in a polyethylene vial. After cooling to 0 °C, hydrogen fluoride-pyridine (1 mL, SIGMA-ALDRICH) was added. The cooling bath was then removed and the solution was stirred at room temperature for 75 min. The reaction was carefully quenched by the addition of sat. aqueous NaHCO₃ solution and diluted with CH₂Cl₂. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 10/1) afforded **15a** (40 mg, 0.11 mmol, 99%) as a clear oil: R_f 0.26 (hexane/ethyl acetate 3/1); ¹H NMR (500 MHz, CDCl₃) δ 1.20 (d, *J* = 6.6 Hz, 3 H), 1.21 (s, 3 H), 1.22 (s, 3 H), 1.58 (dd^{AB}, *J*₁ = 14.8 Hz, *J*₂ = 9.6 Hz, 1 H), 1.72 (s, 3 H), 1.81 (s, 3 H), 1.94-2.04 (m, 1 H), 2.24 (dd, *J*₁ = *J*₂ = 7.7 Hz, 2 H), 2.46 (d, *J* = 7.3 Hz, 2 H), 2.60-2.67 (m, 3 H), 2.80 (dd, *J*₁ = 9.6 Hz, *J*₂ = 8.7 Hz, 1 H), 3.76 (dd, *J*₁ = *J*₂ = 9.6 Hz, 1 H), 3.93 (br. s, 1 H), 4.64 (s, 1 H), 4.72 (s, 1 H), 5.04-5.09 (m, 1 H), 5.18 (dd, *J*₁ = 10.4 Hz, *J*₂ = 1.8 Hz, 1 H), 5.78 (ddd, *J*₁ = 17.8 Hz, *J*₂ = 10.4 Hz, *J*₃ = 8.3 Hz, 1 H), 6.58-6.62

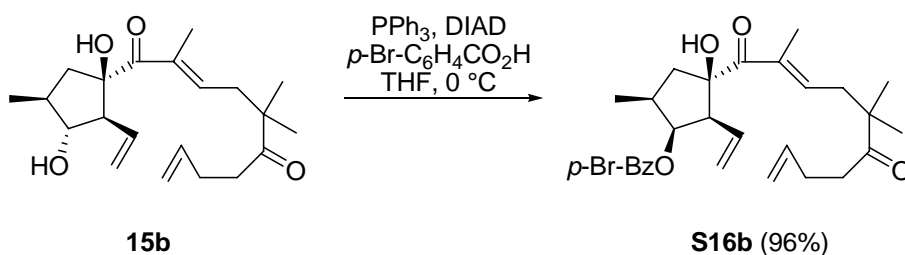
(m, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 13.0 (CH_3), 18.1 (CH_3), 22.7 (CH_3), 24.6 (CH_3), 24.7 (CH_3), 31.4 (CH_2), 35.4 (CH_2), 38.8 (CH_2), 39.6 (CH), 45.4 (CH_2), 48.0 (C), 62.2 (CH), 81.2 (CH), 83.9 (C), 110.1 ($\text{CH}_2=$), 119.6 ($\text{CH}_2=$), 133.9 ($\text{CH}=$), 134.1 (C=), 139.9 ($\text{CH}=$), 144.7 (C=), 203.4 (C=O), 213.8 (C=O); IR (in substance) ν 1100, 1650, 1700, 2930-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{22}\text{H}_{34}\text{O}_4$: C, 72.89; H, 9.45, Found: C, 72.88; H, 9.54; $[\alpha]^{25}_{\text{D}} +3.1$ (c 2.3, CHCl_3).



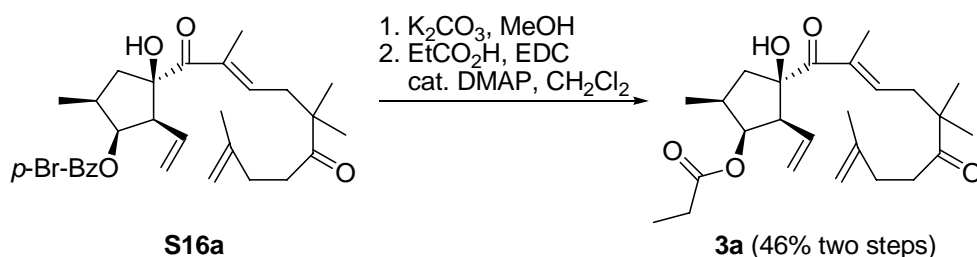
Diol 15b: Ketone **S15b** (45 mg, 0.097 mmol, 1 eq.) was dissolved in THF (3 mL, 30 mL/mmol **S15b**) in a polyethylene vial. After cooling to 0 °C, hydrogen fluoride·pyridine (0.75 mL, SIGMA-ALDRICH) was added. The cooling bath was then removed and the solution was stirred at room temperature for 75 min. The reaction was carefully quenched by the addition of sat. aqueous NaHCO_3 solution and diluted with CH_2Cl_2 . The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 10/1) afforded **15b** (33.2 mg, 0.095 mmol, 98%) as a clear oil: R_f 0.20 (hexane/ethyl acetate 3/1); ^1H NMR (300 MHz, CDCl_3) δ 1.20 (d, $J = 6.3$ Hz, 3 H), 1.21 (s, 6 H), 1.57 (dd^{AB}, $J_1 = 14.8$ Hz, $J_2 = 9.5$ Hz, 1 H), 1.81 (s, 3 H), 1.93-2.08 (m, 1 H), 2.24-2.35 (m, 2 H), 2.45 (d, $J = 7.3$ Hz, 2 H), 2.57 (dd, $J_1 = 7.5$ Hz, $J_2 = 7.0$ Hz, 2 H), 2.64 (dd^{AB}, $J_1 = 14.5$ Hz, $J_2 = 9.8$ Hz, 1 H), 2.80 (dd, $J_1 = 9.9$ Hz, $J_2 = 8.5$ Hz, 1 H), 3.76 (dd, $J_1 = J_2 = 9.6$ Hz, 1 H), 3.94 (br. s, 1 H), 4.93-5.21 (m, 4 H), 5.71-5.85 (m, 2 H), 6.56-6.64 (m, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 13.0 (CH_3), 18.1 (CH_3), 24.5 (CH_3), 24.6 (CH_3), 27.7 (CH_2), 36.3 (CH_2), 38.7 (CH_2), 39.6 (CH), 45.4 (CH_2), 47.8 (C), 62.1 (CH), 81.1 (CH), 83.9 (C), 115.3 ($\text{CH}_2=$), 119.5 ($\text{CH}_2=$), 133.9 ($\text{CH}=$), 134.1 (C=), 137.1 ($\text{CH}=$), 139.8 ($\text{CH}=$), 203.3 (C=O), 213.7 (C=O); IR (in substance) ν 915, 1050, 1640, 1700, 2860-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{21}\text{H}_{32}\text{O}_4$: C, 72.38; H, 9.26, Found: C, 72.30; H, 9.34; $[\alpha]^{25}_{\text{D}} +3.6$ (c 3.3, CHCl_3).



Benzoate S16a: To a solution of **15a** (140.6 mg, 0.388 mmol, 1 eq.) in THF (2 mL, 5.2 mL/mmol **15a**) was added PPh₃ (203.4 mg, 0.776 mmol, 2 eq.), *p*-Br-C₆H₄CO₂H (156 mg, 0.776 mmol, 2 eq.) and diisopropyl azodicarboxylate (DIAD, 0.154 mL, 0.776 mmol, 2 eq.) at 0 °C. The mixture was stirred for 2.5 h at 0 °C. The reaction was then quenched by the addition of sat. aqueous NH₄Cl solution and subsequently diluted with CH₂Cl₂. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 20/1) afforded **S16a** (201 mg, 0.368 mmol, 95%) as a clear oil: *R*_f 0.57 (hexane/ethyl acetate 3/1); ¹H NMR (300 MHz, CDCl₃) δ 1.03 (d, *J* = 6.7 Hz, 3 H), 1.21 (s, 6 H), 1.71 (s, 3 H), 1.83 (s, 3 H), 1.91 (dd^{AB}, *J*₁ = 14.2 Hz, *J*₂ = 10.8 Hz, 1 H), 2.23 (dd, *J*₁ = *J*₂ = 7.5 Hz, 2 H), 2.33-2.45 (m, 1 H), 2.46 (d, *J* = 7.2 Hz, 2 H), 2.60 (dd^{AB}, *J*₁ = 10.2 Hz, *J*₂ = 7.4 Hz, 1 H), 2.62 (dd, *J*₁ = *J*₂ = 7.6 Hz, 2 H), 3.35 (dd, *J*₁ = 8.0 Hz, *J*₂ = 4.0 Hz, 1 H), 3.50 (br. s, 1 H), 4.63 (s, 1 H), 4.70 (s, 1 H), 4.98-5.10 (m, 2 H), 5.63 (dd, *J*₁ = *J*₂ = 4.0 Hz, 1 H), 5.71 (ddd, *J*₁ = 17.4 Hz, *J*₂ = 10.5 Hz, *J*₃ = 8.1 Hz, 1 H), 6.59-6.66 (m, 1 H), 7.58 (d, *J* = 8.5 Hz, 2 H), 7.96 (d, *J* = 8.5 Hz, 2 H); ¹³C NMR (75.5 MHz, CDCl₃) δ 13.1 (CH₃), 14.4 (CH₃), 22.8 (CH₃), 24.6 (CH₃), 24.7 (CH₃), 31.4 (CH₂), 35.4 (CH₂), 38.1 (CH), 38.7 (CH₂), 48.0 (CH₂ and C), 57.0 (CH), 81.0 (CH), 87.6 (C), 110.0 (CH₂=), 119.7 (CH₂=), 128.2 (C=), 129.0 (C=), 131.3 (3 × CH=), 131.8 (2 × CH=), 134.7 (C=), 139.5 (CH=), 144.7 (C=), 165.4 (C=O), 203.6 (C=O), 213.8 (C=O); IR (in substance) ν 1270, 1590, 1650, 1700, 1720 cm⁻¹; Anal. Calcd. for C₂₉H₃₇BrO₅: C, 63.85; H 6.84, Found: C, 63.65; H, 6.72; [α]_D²⁵ +64 (c 1.29, CHCl₃).



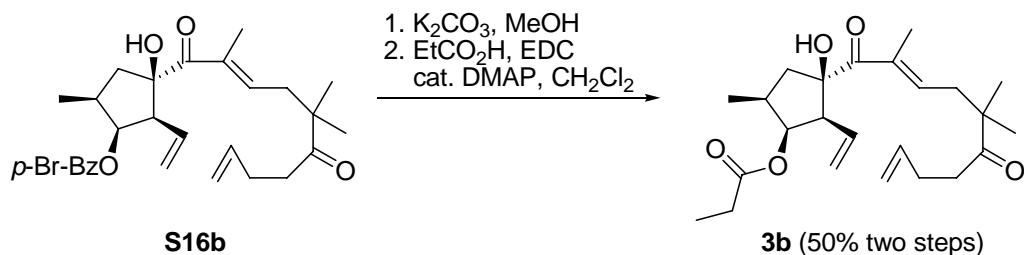
Benzoate S16b: To a solution of **15b** (395 mg, 1.13 mmol, 1 eq.) in THF (5 mL, 5 mL/mmol **15b**) was added PPh₃ (595 mg, 2.27 mmol, 2 eq.), *p*-Br-C₆H₄CO₂H (456 mg, 2.27 mmol, 2 eq.) and diisopropyl azodicarboxylate (DIAD, 0.45 mL, 2.27 mmol, 2 eq.) at 0 °C. The mixture was stirred for 3 h at 0 °C. The reaction was then quenched by the addition of sat. aqueous NH₄Cl solution and subsequently diluted with CH₂Cl₂. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 20/1) afforded **S16b** (580 mg, 1.09 mmol, 96%) as a clear oil: *R*_f 0.48 (hexane/ethyl acetate 3/1); ¹H NMR (500 MHz, CDCl₃) δ 1.03 (d, *J* = 6.8 Hz, 3 H), 1.19 (s, 3 H), 1.20 (s, 3 H), 1.83 (s, 3 H), 1.91 (dd^{AB}, *J*₁ = 14.4 Hz, *J*₂ = 11.0 Hz, 1 H), 2.29 (dd, *J*₁ = 14.1 Hz, *J*₂ = 7.0 Hz, 2 H), 2.36-2.44 (m, 1 H), 2.45 (dd, *J*₁ = 3.8 Hz, *J*₂ = 7.2 Hz, 2 H), 2.57 (dd, *J*₁ = *J*₂ = 7.3 Hz, 2 H), 2.61 (dd^{AB}, *J*₁ = 14.2 Hz, *J*₂ = 9.0 Hz, 1 H), 3.35 (dd, *J*₁ = 8.1 Hz, *J*₂ = 4.1 Hz, 1 H), 3.49 (s, 1 H), 4.94-4.97 (m, 1 H), 4.99-5.02 (m, 1 H), 5.03-5.05 (m, 1 H), 5.07-5.11 (m, 1 H), 5.63 (dd, *J*₁ = *J*₂ = 4.0 Hz, 1 H), 5.67-5.82 (m, 2 H), 6.60-6.65 (m, 1 H), 7.58 (d, *J* = 8.5 Hz, 2 H), 7.96 (d, *J* = 8.5 Hz, 2 H); ¹³C NMR (126 MHz, CDCl₃) δ 13.1 (CH₃), 14.4 (CH₃), 24.6 (CH₃), 24.7 (CH₃), 27.8 (CH₂), 36.4 (CH₂), 38.2 (CH), 38.7 (CH₂), 47.8 (C), 48.0 (CH₂), 57.0 (CH), 81.0 (CH), 87.6 (C), 115.4 (CH₂=), 119.8 (CH₂=), 128.2 (C=), 129.0 (C=), 129.7 (CH=), 131.3 (2 × CH=), 131.9 (2 × CH=), 134.7 (C=), 137.2 (CH=), 139.5 (CH=), 165.4 (C=O), 203.7 (C=O), 213.6 (C=O); IR (in substance) ν 1270, 1590, 1640, 1700, 1720 cm⁻¹; Anal. Calcd. for C₂₈H₃₅BrO₅: C, 63.28; H 6.64, Found: C, 63.54; H, 6.60; [α]³⁰_D +68.2 (c 1.97, CHCl₃).



Ester 3a: To a solution of **S16a** (108 mg, 0.199 mmol, 1 eq.) in MeOH (2 mL, 20 mL/mol **S16a**) was added potassium carbonate (15.5 mg, 0.112 mmol, 0.56 eq.) at room temperature. After being stirred for 20 h at room temperature, the reaction mixture was diluted by the addition of sat. aqueous NH₄Cl solution and CH₂Cl₂. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 10/1)

afforded 56.7 mg of the desired diol contaminated with an inseparable byproduct of unknown constitution: R_f 0.30 (hexane/ethyl acetate 3/1).

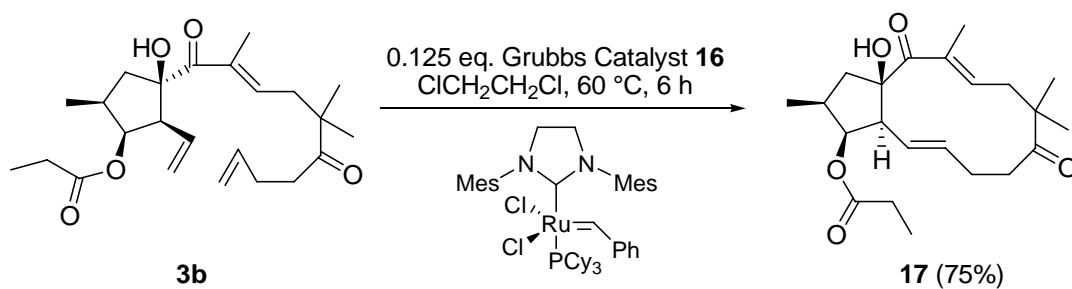
To a solution of *N*-(3-dimethylaminopropyl)-*N*'-ethylcarbodiimide hydrochloride (EDC, 442.6 mg, 2.3 mmol, 11.6 eq. based on **S16a**) and DMAP (9.4 mg, 0.077 mmol, 0.38 eq. based on **S16a**) in CH_2Cl_2 (2 mL, 10 mL/mmol based on **S16a**) was added propionic acid (0.16 mL, 2.16 mmol, 10.8 eq. based on **S16a**) at 0 °C. After stirring the reaction mixture for 5 min at 0 °C, a solution of the contaminated diol in CH_2Cl_2 (3 mL, 15 mL/mmol based on **S16a**) was added and the cooling bath was removed. The reaction mixture was stirred for 14 h at room temperature. The reaction was then quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 5/1) afforded **3a** (38.8 mg, 0.093 mmol, 46% two steps) as a light yellow oil: R_f 0.60 (hexane/ethyl acetate 3/1); ^1H NMR (500 MHz, CDCl_3) δ 0.98 (d, J = 6.8 Hz, 3 H), 1.17 (t, J = 7.5 Hz, 3 H), 1.18 (s, 3 H), 1.19 (s, 3 H), 1.71 (s, 3 H), 1.75 (dd^{AB}, J_1 = 14.6 Hz, J_2 = 10.6 Hz, 1 H), 1.80 (s, 3 H), 2.23 (dd, $J_1 = J_2$ = 7.4 Hz, 2 H), 2.22-2.30 (m, 1 H), 2.40 (q, J = 7.6 Hz, 2 H), 2.44 (d, J = 7.3 Hz, 2 H), 2.52 (dd^{AB}, J_1 = 14.4 Hz, J_2 = 9.4 Hz, 1 H), 2.61 (dd, $J_1 = J_2$ = 7.9 Hz, 2 H), 3.15 (br. s, 1 H), 3.31 (dd, J_1 = 7.7 Hz, J_2 = 4.0 Hz, 1 H), 4.63 (s, 1 H), 4.71 (s, 1 H), 5.04 (d, J = 17.5 Hz, 1 H), 5.12 (d, J = 10.5 Hz, 1 H), 5.45 (dd, $J_1 = J_2$ = 4.0 Hz, 1 H), 5.69 (ddd, J_1 = 17.9 Hz, J_2 = 10.5 Hz, J_3 = 7.7 Hz, 1 H), 6.64-6.69 (m, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 9.4 (CH_3), 12.9 (CH_3), 14.3 (CH_3), 22.7 (CH_3), 24.5 (CH_3), 24.6 (CH_3), 27.6 (CH_2), 31.4 (CH_2), 35.4 (CH_2), 37.6 (CH), 38.7 (CH_2), 47.9 (C), 48.4 (CH_2), 55.9 (CH), 80.2 (CH), 88.0 (C), 110.0 ($\text{CH}_2=$), 119.4 ($\text{CH}_2=$), 131.3 ($\text{CH}=$), 135.0 (C=), 139.7 ($\text{CH}=$), 144.7 (C=), 173.7 (C=O), 203.1 (C=O), 213.9 (C=O); IR (in substance) ν 1180, 1650, 1700, 1735, 2870-2970 cm^{-1} ; Anal. Calcd. for $\text{C}_{25}\text{H}_{38}\text{O}_5$: C, 71.74; H, 9.15, Found: C, 71.95; H, 9.25; $[\alpha]_D^{22}$ +26.4 (c 1.9, CHCl_3).



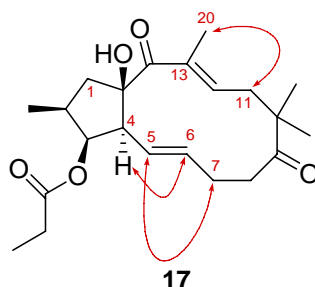
Ester 3b: To a solution of **S16b** (73.9 mg, 0.139 mmol, 1 eq.) in MeOH (5 mL, 36 mL/mol **S16b**) was added potassium carbonate (19.2 mg, 0.139 mmol, 1 eq.) at room temperature. After

stirring the reaction mixture for 24 h at room temperature, the reaction was quenched by the addition of sat. aqueous NH_4Cl solution and diluted with CH_2Cl_2 . The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 10/1) afforded 38.3 mg of the desired diol contaminated with an inseparable byproduct of unknown constitution: R_f 0.35 (hexane/ethyl acetate 3/1).

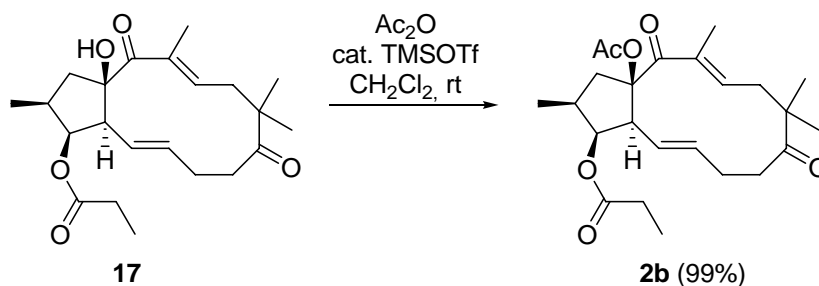
To a solution of *N*-(3-dimethylaminopropyl)-*N'*-ethylcarbodiimide hydrochloride (EDC, 189 mg, 0.985 mmol, 7 eq. based on **S16b**) and DMAP (8 mg, 0.065 mmol, 0.47 eq. based on **S16b**) in CH_2Cl_2 (2 mL, 14 mL/mmol based on **S16b**) was added propionic acid (0.071 mL, 0.82 mmol, 6 eq. based on **S16b**) at 0 °C. After stirring the reaction mixture for 5 min at 0 °C, a solution of the contaminated diol in CH_2Cl_2 (3 mL, 21 mL/mmol based on **S16b**) was added and the cooling bath was removed. The reaction mixture was stirred for 48 h at room temperature. The reaction was then quenched by the addition of sat. aqueous NH_4Cl solution. The layers were separated and the aqueous phase was extracted three times with CH_2Cl_2 . The combined organic phases were dried with MgSO_4 and concentrated under reduced pressure. Flash chromatography (hexane to hexane/ethyl acetate 5/1) afforded **3b** (28.2 mg, 0.07 mmol, 50% two steps) as a light yellow oil: R_f 0.40 (hexane/ethyl acetate 3/1); ^1H NMR (500 MHz, CDCl_3) δ 0.98 (d, $J = 6.8$ Hz, 3 H), 1.17 (t, $J = 7.6$ Hz, 3 H), 1.17 (s, 3 H), 1.18 (s, 3 H), 1.75 (dd^{AB}, $J_1 = 14.4$ Hz, $J_2 = 10.6$ Hz, 1 H), 1.80 (s, 3 H), 2.22-2.28 (m, 1 H), 2.28 (dd, $J_1 = 14.2$ Hz, $J_2 = 7.3$ Hz, 2 H), 2.37-2.45 (m, 4 H), 2.49-2.58 (m, 3 H), 3.14 (s, 1 H), 3.32 (dd, $J_1 = 7.7$ Hz, $J_2 = 4.1$ Hz, 1 H), 4.92-4.97 (m, 1 H), 4.98-5.07 (m, 2 H), 5.10-5.14 (m, 1 H), 5.45 (dd, $J_1 = J_2 = 4.1$ Hz, 1 H), 5.65-5.73 (m, 1 H), 5.73-5.82 (m, 1 H), 6.64-6.68 (m, 1 H); ^{13}C NMR (126 MHz, CDCl_3) δ 9.4 (CH_3), 12.9 (CH_3), 14.3 (CH_3), 24.4 (CH_3), 24.5 (CH_3), 27.6 (CH_2), 27.8 (CH_2), 36.4 (CH_2), 37.6 (CH), 38.6 (CH_2), 47.8 (C), 48.4 (CH_2), 55.9 (CH), 80.2 (CH), 88.0 (C), 115.3 ($\text{CH}_2=$), 119.4 ($\text{CH}_2=$), 131.3 ($\text{CH}=$), 135.0 (C=), 137.3 ($\text{CH}=$), 139.7 ($\text{CH}=$), 173.7 (C=O), 203.1 (C=O), 213.7 (C=O); IR (in substance) ν 1180, 1640, 1660, 1700, 1730, 2880-2960 cm^{-1} ; Anal. Calcd. for $\text{C}_{24}\text{H}_{36}\text{O}_5$: C, 71.26; H 8.97, Found: C, 71.47; H, 9.11; $[\alpha]_D^{30} +28$ (c 1.2, CHCl_3).



17-Norjatrophane 17: To a solution of **3b** (81.2 mg, 0.2 mmol, 1 eq.) in ClCH₂CH₂Cl (75 mL, 375 mL/mmol of **3b**, 0.0026 M) was added the second generation Grubbs catalyst **16** (4 mg, 0.0047 mmol, 0.025 eq.) and the solution was heated to 60 °C. The catalyst **16** (4 mg, 0.0047 mmol, 0.025 eq.) was added portionwise every 1 h for another four times. After the complete consumption of the starting material (6 h), the solvent was removed under reduced pressure. Flash chromatography (hexane/ethyl acetate 20/1 to 5/1) afforded **17** (56.4 mg, 0.15 mmol, 75%) as a yellowish brown foam: *R_f* 0.33 (hexane/ethyl acetate 3/1); ¹H NMR (500 MHz, CDCl₃) 0.93 (d, *J* = 6.8 Hz, 16-CH₃, 3 H), 1.11 (s, 18-CH₃ or 19-CH₃, 3 H), 1.18 (s, 18-CH₃ or 19-CH₃, 3 H), 1.19 (t, *J* = 7.5 Hz, 23-CH₃, 3 H), 1.41 (dd^{AB}, *J*₁ = 13.5 Hz, *J*₂ = 12.2 Hz, 1-CH₂, 1 H^{*Re*}), 1.71 (s, 20-CH₃, 3 H), 2.07-2.20 (m, 2-CH, 1 H and 7-CH₂, 1 H and 8-CH₂, 1 H), 2.29 (dd, *J*₁ = 9.9 Hz, *J*₂ = 3.9 Hz, 4-CH, 1 H), 2.39-2.46 (m, 11-CH₂, 1 H and 22-CH₂, 2 H), 2.53 (dd^{AB}, *J*₁ = 17.6 Hz, *J*₂ = 6.6 Hz, 11-CH₂, 1 H), 2.62-2.71 (m, 7-CH₂, 1 H), 2.73-2.81 (m, 8-CH₂, 1 H), 3.08 (dd^{AB}, *J*₁ = 13.6 Hz, *J*₂ = 8.3 Hz, 1-CH₂, 1 H^{*Si*}), 5.14 (ddd, *J*₁ = 14.9 Hz, *J*₂ = 10.6 Hz, *J*₃ = 4.0 Hz, 6-CH=, 1 H), 5.29 (dd, *J*₁ = *J*₂ = 3.5 Hz, 3-CH, 1 H), 5.42 (dd, *J*₁ = 15.3 Hz, *J*₂ = 9.9 Hz, 5-CH=, 1 H), 6.85-6.89 (m, 12-CH=, 1 H); ¹³C NMR (126 MHz, CDCl₃) 9.4 (23-CH₃), 12.8 (20-CH₃), 14.0 (16-CH₃), 24.4 (18-CH₃ or 19-CH₃), 25.0 (18-CH₃ or 19-CH₃), 27.6 (7-CH₂ or 22-CH₂), 27.6 (7-CH₂ or 22-CH₂), 35.3 (8-CH₂), 38.3 (2-CH), 40.2 (11-CH₂), 48.0 (10-C), 48.5 (1-CH₂), 57.8 (4-CH), 82.0 (3-CH), 90.5 (15-C), 125.7 (5-CH=), 135.5 (6-CH=), 135.9 (13-C=), 145.2 (12-CH=), 173.6 (21-C=O), 201.4 (14-C=O), 215.2 (9-C=O); IR (in substance) ν 1060, 1080, 1140, 1185, 1650, 1700, 1730, 2930, 2970 cm⁻¹; Anal. Calcd. for C₂₂H₃₂O₅: C, 70.18; H, 8.57, Found: C, 70.04; H, 8.23; [α]_D²⁵ +36 (c 1.0, CHCl₃).

Table S3. NOESY (CDCl₃, 500 MHz) studies on **17**.


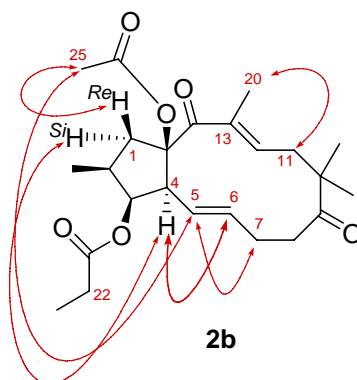
entry	NOE observed between		conclusion
1	20-CH ₃ (1.71 ppm)	11-CH ₂ (2.53 ppm)	(12 <i>E</i>)
2	4-H (2.29 ppm)	6-H (5.14 ppm) (<i>J</i> ^{5,6} = 15 Hz)	(5 <i>E</i>)
3	5-H (5.42 ppm)	7-H (2.62-2.71 ppm)	(5 <i>E</i>)
4	no NOE observed between 5-H (5.42 ppm) and 6-H (5.14 ppm)		(5 <i>E</i>)



(-)-15-Acetyl-3-propionyl-17-norcharaciol 2b: To a solution of **17** (30 mg, 0.079 mmol, 1 eq.) in CH₂Cl₂ (1.2 mL, 15 mL/mmol **17**) was added acetic anhydride (0.1 mL, 1.058 mmol, 13.4 eq.) at room temperature. A micro drop of TMSOTf (1 M in CH₂Cl₂) was then added at the same temperature. The color of the solution changed from colorless to slightly yellow. After 10 min, the reaction was quenched by the addition of MeOH and sat. aqueous NH₄Cl solution and subsequently diluted with CH₂Cl₂. The layers were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with MgSO₄ and concentrated under reduced pressure. Flash chromatography (hexane/ethyl acetate 10/1 to 5/1) afforded **2b** (32.8 mg, 0.078 mmol, 99%) as a yellow thick oil: *R*_f 0.33 (hexane/ethyl acetate 3/1, substrate and product with identical *R*_f values); ¹H NMR (500 MHz, CDCl₃) δ 0.91 (d, *J* = 6.7 Hz, 16-CH₃, 3 H), 1.03 (s, 18-CH₃ or 19-CH₃, 3 H), 1.18 (s, 18-CH₃ or 19-CH₃, 3 H), 1.19 (t, *J* = 7.6 Hz, 23-CH₃, 3 H), 1.47 (dd^{AB}, *J*₁ = *J*₂ = 13.2 Hz, 1-CH₂, 1 H^{*Re*}), 1.69 (s, 20-CH₃, 3 H), 2.06 (s, 25-CH₃, 3 H), 2.10-2.22 (m, 2-CH, 1H and 7-CH₂, 1 H and 8-CH₂, 1 H), 2.36 (dd, *J*₁ = 9.9 Hz,

$J_2 = 4.2$ Hz, 4-CH, 1 H), 2.41 (q, $J = 7.7$ Hz, 22-CH₂, 2 H), 2.43 (d, $J = 8.6$ Hz, 11-CH₂, 2 H), 2.66-2.74 (m, 7-CH₂, 1 H), 2.80-2.87 (m, 8-CH₂, 1 H), 3.21 (dd^{AB}, $J_1 = 13.5$ Hz, $J_2 = 7.4$ Hz, 1-CH₂, 1 H^{Si}), 5.16 (ddd, $J_1 = 15.2$ Hz, $J_2 = 10.8$ Hz, $J_3 = 3.8$ Hz, 6-CH=, 1 H), 5.25 (dd, $J_1 = J_2 = 3.7$ Hz, 3-CH, 1 H), 5.54 (dd, $J_1 = 15.4$ Hz, $J_2 = 9.9$ Hz, 5-CH=, 1 H), 6.26-6.31 (m, 12-CH=, 1 H); ¹³C NMR (126 MHz, CDCl₃) δ 9.4 (23-CH₃), 12.1 (20-CH₃), 13.4 (16-CH₃), 21.4 (25-CH₃), 24.5 (18-CH₃ or 19-CH₃), 24.8 (18-CH₃ or 19-CH₃), 27.7 (22-CH₂), 28.0 (7-CH₂), 35.2 (8-CH₂), 38.5 (2-CH), 39.7 (11-CH₂), 46.3 (1-CH₂), 47.7 (10-C), 56.7 (4-CH), 80.7 (3-CH), 92.7 (15-C), 126.0 (5-CH₂=), 135.4 (13-C=), 135.9 (6-CH=), 140.4 (12-CH=), 170.3 (24-C=O), 173.8 (21-C=O), 198.8 (14-C=O), 215.1 (9-C=O); IR (in substance) ν 1183, 1246, 1660, 1703, 1734 cm⁻¹; Anal. Calcd. for C₂₄H₃₄O₆: C, 68.87; H 8.19, Found: C, 68.60; H, 8.10; $[\alpha]^{25}_D -51.9$ (c 1.35, CHCl₃).

Table S4. NOESY (CDCl₃, 500 MHz) studies on **2b**.



entry	NOE observed between		conclusion
1	20-CH ₃ (1.69 ppm)	11-CH ₂ (2.43 ppm)	(12 <i>E</i>)
2	25-CH ₃ (2.06 ppm)	5-H (5.54 ppm)	15-OAc and 5-CH are <i>cis</i>
3	1-H ^{Re} (1.47 ppm)	25-CH ₃ (2.06 ppm)	15-OAc and 1-H ^{Re} are <i>cis</i>
4	5-H (5.54 ppm)	7-H (2.66-2.74) ppm	(5 <i>E</i>)
5	4-H (2.36 ppm)	1-H ^{Si} (3.21 ppm)	4-CH and 1-H ^{Si} are <i>cis</i>
6	4-H (2.36 ppm)	6-H (5.16 ppm)	(5 <i>E</i>)

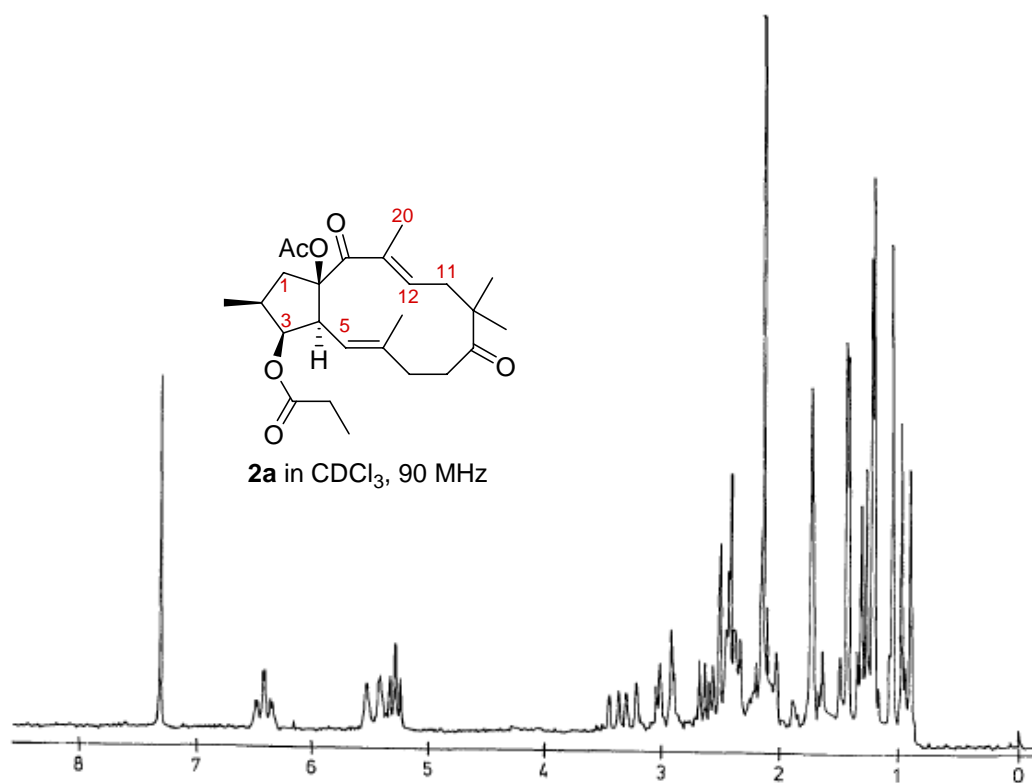


Figure S2. ^1H NMR (90 MHz, in CDCl_3) of natural **2a**⁸

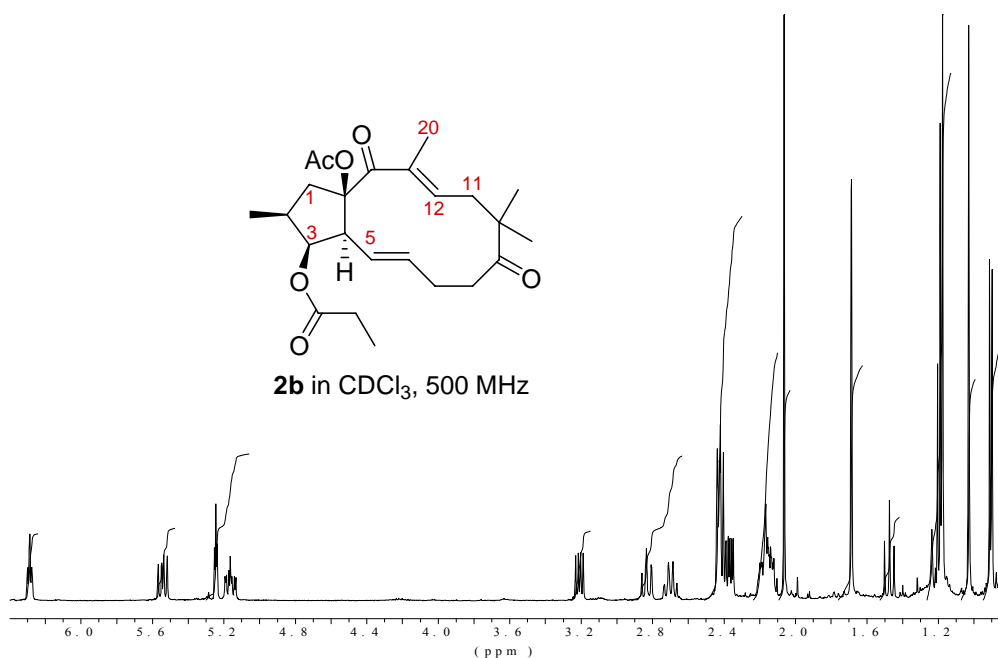


Figure S3. ^1H NMR (500 MHz, in CDCl_3) of non-natural **2b**

⁸ Seip, E. in "Neue Diterpenester aus *Euphorbia Esula* L. sowie *Euphorbia Characias* L. und ihre biologische Wirkung"; Dissertation, Heidelberg, Ruprecht-Karls-Universität, 1980.

Table S5. Comparison of ^1H NMR data of natural **2a** and non-natural **2b**.

entry	proton	2a	2b
		chemical shift δ in ppm (90 MHz, CDCl_3) ⁸	chemical shift δ in ppm (500 MHz, CDCl_3)
1	12-H	6.36	6.26-6.31
2	3-H	5.23	5.25
3	5-H	5.41	5.54
4	1-H ^{Si}	3.28	3.21
5	11-CH ₂	2.43	2.43
6	20-CH ₃	1.70	1.69