SUPPORTING INFORMATION FOR:

Total Synthesis of (+)-Lasonolide A

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General Information

¹H NMR were measured in CDCl₃ solution and referenced to TMS (0.00 ppm) using JEOL GSX400 and JEOL JNM-AL400 (400 MHz) spectrophotometers, unless otherwise noted. ¹³C NMR were measured in CDCl₃ solution and referenced to CDCl₃ (77.0 ppm) using JEOL GSX400 and JEOL JNM-AL400 (100 MHz) spectrometers. Chemical shifts are reported in ppm (from TMS). When peak multiplicities are reported, the following abbreviations are used: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet; br, broadened. IR spectra were recorded on JAS.CO FT/IR-410 spectrometer. Mass spectra were obtained on JEOL JMS-DX303, JMS-SX102A, JMS-Automass SUN200 and Waters MICRO MASS LCT-Premier. Elemental analyses were performed with Yanaco MT-3 CHN-Corder. Optical rotations were determined on JAS.CO DIP-370 and JAS.CO P-1010. Melting points were measured with Yanaco MP-500D and BÜCHI 535 melting point apparatuses and are uncorrected. All reactions were performed in oven-dried glassware under positive pressure of argon or nitrogen, unless otherwise noted.

To a solution of **6** (620 mg, 1.50 mmol) and 2,6-lutidine (0.44 mL, 3.76 mmol) in DMF (13 mL) was added TBSOTf (0.52 mL, 2.25 mmol) at rt. The mixture was stirred for 3.5 h. Evaporation of volatiles gave an oil, which was dissolved in CH₂Cl₂ and washed with water. The aqueous layer was extracted with CH₂Cl₂ and the extracts were washed with 5% HCl aq., sat. NaHCO₃ aq. and brine, and dried over MgSO₄, filtered and concentrated. The residual pale yellow oil was purified through silica gel column chromatography (hexane/AcOEt = 95/5) to give the silyl ether (717 mg, 91%) as a colorless oil; $[\alpha]_D^{28} = +5.07^\circ$ (*c* 1.13, CHCl₃); IR (neat) cm⁻¹: 2956, 2930, 2887, 2857, 1748, 1472, 1428, 1389, 1362, 1252, 1189, 1111, 1007, 924, 835, 777, 703, 614, 505; ¹H NMR (400 MHz, CDCl₃): δ 0.07 (3H, s), 0.08 (3H, s), 0.91 (9H, s), 1.02 (9H, s), 1.25 (3H, d, *J* = 7.2 Hz), 1.75-1.94 (4H, m), 2.57 (1H, dq, *J* = 6.0, 6.8 Hz), 3.76-3.83 (3H, m), 3.88 (1H, ddd, *J* = 4.8, 8.4, 13.2 Hz), 4.82-4.89 (1H, m), 7.35-7.44 (6H, m), 7.63-7.66 (4H, m); ¹³C NMR (100 MHz, CDCl₃): δ -4.82 (q), -4.54 (s), 14.74 (q), 17.88 (s), 19.16 (s), 25.69 (q), 26.84 (q), 36.88 (t), 38.11 (t), 43.36 (d), 59.45 (t), 69.79 (d), 72.22 (d), 127.54 (d), 127.56 (d), 129.53 (d), 133.29 (s), 133.48 (d), 135.32 (d), 135.36 (d), 174.09 (s); MS (FAB) *m/z* 549 (M⁺+Na); HRMS (FAB) *m/z* calcd for C₃₀H₄₆O₄Si₂Na (M⁺+Na): 549.2832 found 549.2841; Anal. calcd for C₃₀H₄₆O₄Si₂: C, 68.39; H, 8.80 found C, 68.10; H, 8.81.

To a solution of freshly distilled $n\text{Bu}_3\text{SnCH}_2\text{OBn}$ (1.23 g, 2.98 mmol) in THF (15 mL) was added dropwise $n\text{BuLi}$ (1.83 mL, 1.51 M in hexane, 2.77 mmol) at -78°C . After being stirred for 30 min at same temperature, a solution of lactone (678.3 mg, 1.29 mmol) in THF (10 mL) was added and stirred for 3 h. The reaction was quenched by addition of sat. NH_4Cl aq. at -78°C and extracted with hexane. The extracts were dried over Na_2SO_4 , filtered and concentrated. The residual colorless oil was purified through silica gel column chromatography (hexane/ AcOEt = 98/2) to give the lactol (725.5 mg, 90%) as a colorless oil; $[\alpha]_{\text{D}}^{28} = +14.3^\circ$ (c 1.10, CHCl_3); IR (neat) cm^{-1} : 3454, 2953, 2929, 2857, 1471, 1428, 1254, 1173, 1112, 1053, 1028, 1007, 891, 837, 702, 614, 505; ^1H NMR (400 MHz, CDCl_3): δ 0.11 (3H, s), 0.12 (3H, s), 0.89 (3H, d, $J = 7.2$ Hz), 0.92 (9H, s), 1.02 (9H, s), 1.50 (1H, br d, $J = 14.0$ Hz), 1.57-1.76 (3H, m), 2.06 (1H, dq, $J = 2.0$, 7.2 Hz), 3.28 (1H, d, $J = 10.0$ Hz), 3.35 (1H, dd, $J = 2.0$, 10.0 Hz), 3.68-3.80 (2H, m), 3.99 (1H, ddd, $J = 2.8$, 2.8, 2.8 Hz), 4.38-4.45 (1H, m), 4.51 (1H, d, $J = 12.4$ Hz), 4.74 (1H, d, $J = 12.4$ Hz), 6.19 (1H, br d, $J = 2.0$ Hz, D_2O exchangeable), 7.26-7.42 (11H, m), 7.67 (4H, dt, $J = 1.6$, 7.6 Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -5.07 (q), 5.00 (q), 13.70 (q), 17.88 (s), 19.13 (s), 25.76 (q), 26.84 (q), 33.91 (t), 38.19 (d), 38.77 (t), 60.02 (t), 60.61 (d), 73.07 (d), 73.60 (t), 73.78 (t), 127.34 (d), 127.44 (d), 127.82 (d), 128.10 (d), 129.32 (d), 133.50 (s), 133.87 (s), 35.37 (d), 13.54 (d), 138.27 (s); MS (FAB) m/z 671 ($\text{M}^+ + \text{Na}$); HRMS (FAB) m/z calcd for $\text{C}_{38}\text{H}_{56}\text{O}_5\text{Si}_2\text{Na}$ ($\text{M}^+ + \text{Na}$): 671.3564 found 671.3601; Anal. calcd for $\text{C}_{38}\text{H}_{56}\text{O}_5\text{Si}_2$: C, 70.32; H, 8.70 found C, 69.95; H,

8.65.

To a solution of lactol (926.1 mg, 1.43 mmol) and Et_3SiH (0.34 mL, 2.14 mmol) in CH_2Cl_2 (20 mL) was added dropwise $\text{BF}_3 \cdot \text{OEt}_2$ (0.27 mL, 2.14 mmol) at -78°C . The mixture was warmed to -30°C and stirred for 90 min. The reaction was quenched by addition of sat. NaHCO_3 aq. and extracted with CH_2Cl_2 . The extracts were washed with sat. NaHCO_3 aq. and brine, and dried over MgSO_4 , filtered and concentrated. The residual colorless oil was purified through silica gel column chromatography (hexane/ AcOEt = 95/5) to give the tetrahydropyran **7** (808.8 mg, 90%) as a colorless oil; $[\alpha]_{\text{D}}^{28} = +1.43^\circ$ (c 1.65, CHCl_3); IR (neat) cm^{-1} : 2954, 2929, 2857, 1471, 1428, 1255, 1111, 1074, 908, 835, 735, 701; ^1H NMR (400 MHz, CDCl_3): δ 0.04 (3H, s), 0.05 (3H, s), 0.83 (3H, d, $J = 6.8$ Hz), 0.89 (9H, s), 1.02 (9H, s), 1.40 (1H, br d, $J = 13.6$ Hz), 1.52-1.78 (4H, m), 3.37 (1H, dd, $J = 5.6, 10.0$ Hz), 3.47 (1H, dd, $J = 7.2, 10.0$ Hz), 3.71-3.85 (2H, m), 4.03-4.10 (1H, m), 4.18 (1H, ddd, $J = 2.4, 5.6, 7.2$ Hz), 4.47 (1H, d, $J = 12.0$ Hz), 4.59 (1H, d, $J = 12.0$ Hz), 7.23-7.41 (11H, m), 7.64-7.66 (4H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -4.75 (q), 11.05 (q), 18.07 (s), 19.25 (s), 25.89 (q), 26.90 (q), 35.18 (t), 36.98 (d), 39.18 (t), 60.35 (t), 69.02 (d), 70.99 (d), 71.25 (t), 72.83 (d), 73.11 (t), 127.29 (d), 127.46 (d), 129.34 (d), 133.85 (s), 134.03 (s), 135.42 (d), 135.43 (d), 138.51 (s); MS (EI) m/z 632 (M^+), 407 (base peak); HRMS (EI) m/z calcd for $\text{C}_{38}\text{H}_{56}\text{O}_4\text{Si}_2$ (M^+): 632.3717 found 632.3744; Anal. calcd for $\text{C}_{38}\text{H}_{56}\text{O}_4\text{Si}_2$: C, 72.10; H, 8.92 found C, 71.83; H, 8.96.

A mixture of **7** (104.6 mg, 0.17 mmol) and Pd/C (52.8 mg, 10% Pd, 0.050 mmol) in EtOH (3 mL) was stirred under H₂ atmosphere for 2 days. The mixture was filtered off and the filtrate was concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 92/8) to give the alcohol (89.3 mg, quant.) as a colorless oil; $[\alpha]_D^{28} = -8.25^\circ$ (c 1.47, CHCl₃); IR (neat) cm⁻¹: 3593, 3454, 2930, 2857, 1589, 1471, 1462, 1428, 1255, 1112, 1070, 835, 702, 614; ¹H NMR (400 MHz, CDCl₃): δ 0.04 (3H, s), 0.05 (3H, s), 0.83 (3H, d, $J = 7.2$ Hz), 0.89 (9H, s), 1.05 (9H, s), 1.38-1.42 (1H, m), 1.53-1.75 (4H, m), 1.78 (1H, dd, $J = 2.8, 9.6$ Hz, D₂O exchangeable), 3.41 (1H, ddd, $J = 3.2, 9.6, 11.2$ Hz), 3.60 (1H, ddd, $J = 2.8, 9.2, 11.2$ Hz), 3.69-3.82 (3H, m), 3.99-4.09 (2H, m), 7.35-7.44 (6H, m), 7.64-7.68 (4H, m); ¹³C NMR (100 MHz, CDCl₃): δ -4.81 (q), 11.44 (q), 18.03 (s), 19.20 (s), 25.84 (q), 26.88 (q), 35.18 (t), 37.03 (d), 39.09 (t), 60.11 (t), 64.41 (t), 68.95 (d), 70.95 (d), 74.72 (d), 127.47 (d), 127.53 (d), 129.39 (d), 129.43 (d), 133.69 (s), 133.86 (s), 135.41 (d); MS (FAB) m/z 565 (M⁺+Na); HRMS (FAB) m/z calcd for C₃₁H₅₀O₄Si₂Na (M⁺+Na): 565.3145 found 565.3159.

To a solution of alcohol (350.4 mg, 0.65 mmol) in CH₂Cl₂ (7 mL) was added Dess-Martin periodinane (410.6 mg, 0.9 mmol) at 0 °C. After being stirred for 2 h at rt, the reaction was quenched by addition of sat. NaHCO₃ aq./sat. Na₂S₂O₃ aq. (24 mL, 1/1, v/v) at rt and the mixture was stirred for additional 30 min and extracted with CH₂Cl₂. The extracts were washed with sat. NaHCO₃ aq. and brine, and dried over MgSO₄, filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 95/5) to give the aldehyde **8** (312.6 mg, 90%) as a colorless oil; $[\alpha]_D^{27} = +18.0^\circ$ (c 1.20, CHCl₃); IR (neat) cm⁻¹: 2929, 2857, 1737, 1589, 1471, 1428, 1389, 1362, 1312, 1255, 1111, 1049, 836, 702; ¹H NMR (400 MHz, CDCl₃): δ 0.065 (3H, s), 0.070 (3H, s), 0.86 (3H, d, *J* = 7.2 Hz), 0.90 (9H, s), 1.04 (9H, s), 1.43 (1H, br d, *J* = 13.2 Hz), 1.64 (1H, ddd, *J* = 2.4, 11.6, 13.4 Hz), 1.68-1.81 (2H, m), 1.96-2.03 (1H, m), 3.76 (1H, ddd, *J* = 4.8, 4.8, 10.4 Hz), 3.85 (1H, ddd, *J* = 2.8, 2.8, 2.8 Hz), 3.90 (1H, ddd, *J* = 4.8, 9.6, 10.4 Hz), 4.10-4.17 (1H, m), 4.27 (1H, br d, *J* = 2.8 Hz), 7.32-7.43 (6H, m), 7.64-7.86 (4H, m), 9.54 (1H, s); ¹³C NMR (100 MHz, CDCl₃): δ -4.82 (q), 11.53 (q), 18.02 (s), 19.23 (s), 25.81 (q), 26.89 (q), 34.80 (t), 37.37 (d), 38.80 (t), 59.67 (t), 69.13 (s), 70.17 (d), 79.62 (d), 127.45 (d), 129.41 (d), 129.45 (d), 133.65 (s), 133.89 (s), 135.42 (d), 135.45 (s); MS (FAB) *m/z* 563 (M⁺+Na); HRMS (FAB) *m/z* calcd for C₃₁H₄₈O₄Si₂Na (M⁺+Na): 563.2989 found 563.2996.

To a solution of ethyl 2-di(*o*-isopropylphenyl)phosphonopropionate (70.7 mg, 0.17 mmol) in THF (2 mL) were added NaI (30.4 mg, 0.20 mmol) and DBU (0.028 mL, 0.19 mmol)

successively at 0 °C. After being stirred for 10 min at same temperature, a solution of **8** (96.0 mg, 0.18 mmol) in THF (2 mL) was added at –78 °C and the mixture was stirred for additional 15 min and warmed to 0 °C. The resulting mixture was stirred for 90 min at 0 °C and quenched by addition of sat. NH₄Cl aq. and extracted with AcOEt. The extracts were washed with water and brine, and dried over MgSO₄, filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 99/1) to give the ester **9** (93.3 mg, 88%, *Z/E* = > 99/1) as a colorless oil; $[\alpha]_D^{27} = -25.5^\circ$ (*c* 1.09, CHCl₃); IR (neat) cm⁻¹: 2929, 2857, 1717, 1652, 1590, 1471, 1463, 1428, 1389, 1367, 1254, 1224, 1157, 1112, 1062, 975, 835, 702, 614, 505; ¹H NMR (400 MHz, CDCl₃): δ 0.06 (3H, s), 0.09 (3H, s), 0.89 (3H, d, *J* = 7.2 Hz), 0.92 (9H, s), 1.02 (9H, s), 1.26 (3H, t, *J* = 7.2 Hz), 1.38 (1H, br d, *J* = 14.0 Hz), 1.53-1.75 (3H, m), 1.83-1.88 (1H, m), 1.93 (3H, br s), 3.70 (1H, ddd, *J* = 5.2, 5.2, 10.8 Hz), 3.77-3.84 (2H, m), 4.05-4.13 (1H, m), 4.17 (2H, q, *J* = 7.2 Hz), 5.12 (1H, br dd, *J* = 2.0, 7.6 Hz), 5.84 (1H, br d, *J* = 7.6 Hz), 7.30-7.42 (6H, m), 7.64-7.67 (4H, m); ¹³C NMR (100 MHz, CDCl₃): δ –4.88 (q), –4.73 (q), 11.76 (q), 14.43 (q), 18.19 (s), 19.22 (s), 20.62 (q), 25.95 (q), 26.87 (q), 34.70 (t), 39.17 (d), 39.19 (t), 60.08 (t), 60.11 (t), 68.37 (d), 71.16 (d), 72.35 (d), 127.00 (s), 127.44 (d), 127.45 (d), 129.30 (d), 129.30 (d), 129.33 (d), 133.72 (s), 134.03 (s), 135.42 (d), 135.49 (d), 141.41 (d), 167.06 (s); MS (EI) *m/z* 624 (M⁺), 567 (base peak); HRMS (EI) *m/z* calcd for C₃₆H₅₆O₅Si₂ (M⁺): 624.3666 found 624.3689; Anal. calcd for C₃₆H₅₆O₅Si₂: C, 69.18; H, 9.03 found C, 68.80; H, 9.06.

To a solution of **9** (556.0 mg, 0.89 mmol) in CH_2Cl_2 (10 mL) was added dropwise DIBAL-H (2.8 mL, 0.95 M in hexane, 2.67 mmol) at -78°C . After being stirred at same temperature for 10 min, the mixture was diluted with CH_2Cl_2 at 0°C and added water (3 mL). The resulting mixture was stirred for 1 h at rt and filtered through a pad of Celite. The filtrate was dried over MgSO_4 , filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 94/6) to give the allylic alcohol (506.5 mg, 98%) as a colorless oil; $[\alpha]_{\text{D}}^{27} = -9.85^\circ$ (c 1.19, CHCl_3); IR (neat) cm^{-1} : 3433, 2930, 2857, 1589, 1471, 1428, 1254, 1111, 1060, 1008, 835, 703; ^1H NMR (400 MHz, CDCl_3): δ 0.05 (3H, s), 0.06 (3H, s), 0.91 (9H, s), 0.92 (3H, d, $J = 8.0$ Hz), 1.04 (9H, s), 1.40 (1H, br d, $J = 13.6$ Hz), 1.49-1.77 (4H, m), 1.83 (3H, br s), 1.91 (1H, dd, $J = 5.2, 7.6$ Hz), 3.71 (1H, ddd, $J = 5.6, 5.6, 10.0$ Hz), 3.78-3.85 (2H, m), 3.95 (1H, dd, $J = 7.6, 12.4$ Hz), 4.11-4.18 (1H, m), 4.16 (1H, dd, $J = 5.2, 14.4$ Hz), 4.74 (1H, br d, $J = 6.8$ Hz), 5.33 (1H, br d, $J = 6.8$ Hz), 7.33-7.43 (6H, m), 7.64-7.67 (4H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -4.84 (q), -4.78 (q), 11.31 (q), 18.03 (s), 19.21 (s), 22.04 (d), 25.84 (d), 26.84 (d), 34.50 (t), 39.02 (t), 40.34 (d), 60.10 (t), 62.16 (t), 69.25 (d), 70.74 (d), 72.22 (d), 127.13 (d), 127.47 (d), 129.36 (d), 133.73 (s), 133.88 (s), 135.41 (d), 135.446 (d), 137.90 (s); MS (FAB) m/z 605 ($\text{M}^+ + \text{Na}$); HRMS (FAB) m/z calcd for $\text{C}_{34}\text{H}_{54}\text{O}_4\text{Si}_2\text{Na}$ ($\text{M}^+ + \text{Na}$): 605.3458 found 605.3458; Anal. calcd for $\text{C}_{34}\text{H}_{54}\text{O}_4\text{Si}_2$: C, 70.05; H, 9.34 found C, 69.81; H, 9.31.

The mixture of alcohol (87.5 mg, 0.15 mmol) and MnO_2 (651.0 mg, 7.50 mmol) in $\text{CH}_2\text{Cl}_2/\text{PhH}$ (10 mL, 1/2, v/v) was stirred for 24 h at rt. The resulting mixture was filtered off and the filtrate was concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 98/2) to give the aldehyde (86.2 mg, 99%) as a colorless oil; $[\alpha]_{\text{D}}^{27} = -9.47^\circ$ (c 1.07, CHCl_3); IR (neat) cm^{-1} : 2953, 2929, 2857, 1685, 1589, 1472, 1428, 1254, 1112, 1065, 834, 703; ^1H NMR (400 MHz, CDCl_3): δ 0.06 (3H, s), 0.07 (3H, s), 0.91 (9H, s), 0.92 (3H, d, $J = 8.0$ Hz), 1.03 (9H, s), 1.41 (1H, br d, $J = 13.6$ Hz), 1.53-1.71 (4H, m), 1.81 (3H, s), 3.71 (1H, ddd, $J = 5.2, 5.2, 10.4$ Hz), 3.88 (1H, br d, $J = 2.4$ Hz), 4.12-4.19 (1H, m), 5.24 (1H, br d, $J = 7.6$ Hz), 6.38-6.41 (1H, m), 7.30-7.42 (6H, m), 7.23-7.65 (4H, m), 10.1 (1H, s); ^{13}C NMR (100 MHz, CDCl_3): δ -4.85 (q), -4.79 (q), 11.14 (q), 16.44 (q), 17.99 (s), 19.23 (s), 25.80 (q), 26.85 (q), 34.31 (t), 38.95 (t), 41.73 (d), 59.87 (t), 68.98 (d), 70.6 (d), 70.85 (d), 127.45 (d), 127.46 (d), 129.38 (d), 133.62 (s), 133.87 (s), 135.38 (d), 135.43 (d), 135.56 (s), 191.91 (s); MS (EI) m/z 580 (M^+), 255 (base peak); HRMS (EI) m/z calcd for $\text{C}_{34}\text{H}_{52}\text{O}_4\text{Si}_2$ (M^+): 580.3404 found 580.3431.

A stirred mixture of aldehyde (468.0 mg, 0.80 mmol) and (carbethoxymethylene)triphenylphosphorane (363.9 mg, 1.05 mmol) in PhMe (10 mL) was heated at 130 °C for 43 h and concentrated. The residue was purified through silica gel column chromatography (hexane/AcOEt = 98/2) to give the ester (491.9 mg, 94%) as a colorless oil; $[\alpha]_D^{27} = -60.9^\circ$ (*c* 1.19, CHCl₃); IR (neat) cm⁻¹: 2930, 2857, 1714, 1638, 1615, 1471, 1428, 1302, 1275, 1254, 1110, 1062, 979, 836, 774, 703; ¹H NMR (400 MHz, CDCl₃): δ 0.07 (3H, s), 0.10 (3H, s), 0.88 (3H, d, *J* = 7.2 Hz), 0.94 (9H, s), 1.03 (9H, s), 1.26 (3H, t, *J* = 7.2 Hz), 1.42 (1H, br d, *J* = 13.6 Hz), 1.57-1.76 (4H, m), 1.89 (3H, s), 3.72 (1H, ddd, *J* = 5.2, 5.2, 10.4 Hz), 3.79-3.87 (2H, m), 4.11-4.25 (3H, m), 4.98 (1H, br dd, *J* = 2.1, 8.0 Hz), 5.70 (1H, br d, *J* = 8.0 Hz), 5.89 (1H, d, *J* = 15.6 Hz), 7.30-7.41 (6H, m), 7.63-7.69 (5H, m); ¹³C NMR (100 MHz, CDCl₃): δ -4.92 (q), -4.66 (q), 11.33 (q), 14.43 (q), 18.08 (s), 19.23 (s), 20.21 (q), 25.90 (q), 26.86 (q), 34.51 (t), 39.10 (t), 41.10 (d), 60.08 (t), 60.14 (t), 68.87 (d), 70.88 (d), 71.06 (d), 119.49 (d), 127.42 (d), 127.45 (d), 129.32 (d), 130.42 (s), 133.69 (s), 134.03 (s), 135.41 (d), 135.48 (d), 138.32 (d), 140.26 (d), 166.65 (s); MS (EI) *m/z* 650 (M⁺), 255 (base peak); HRMS (EI) *m/z* calcd for C₃₈H₅₈O₅Si₂ (M⁺): 650.3823 found 650.3815.

To a solution of ester (65.6 mg, 0.10 mmol) in CH₂Cl₂ (3.0 mL) was added dropwise DIBAL-H (0.32 mL, 0.95 M in hexane, 0.30 mmol) at -78 °C. After being stirred for 90 min at

same temperature, the reaction was quenched by addition of H₂O (0.3 mL) at 0 °C and the mixture was stirred for additional 1 h at rt and filtered through a pad of Celite. The filtrate was dried over MgSO₄, filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 90/10) to give the dienyl alcohol (59.1 mg, 96%) as a colorless oil; $[\alpha]_D^{27} = -51.8^\circ$ (*c* 1.38, CHCl₃); IR (neat) cm⁻¹: 3583, 3411, 2929, 2857, 1651, 1620, 1590, 1471, 1463, 1428, 1254, 1105, 1062, 1008, 965, 906, 836, 703; ¹H NMR (400 MHz, CDCl₃): δ 0.06 (3H, s), 0.07 (3H, s), 0.91 (3H, d, *J* = 7.2 Hz), 0.94 (9H, s), 1.03 (9H, s), 1.23 (1H, t, *J* = 6.0 Hz, D₂O exchangeable), 1.39 (1H, br d, *J* = 13.6 Hz), 1.54-1.76 (4H, m), 1.87 (3H, s), 3.71 (1H, ddd, *J* = 5.2, 5.2, 10.0 Hz), 3.79-3.86 (2H, m), 4.11-4.17 (1H, m), 4.16 (2H, t, *J* = 6.0 Hz), 4.94 (1H, dd, *J* = 2.0, 8.0 Hz), 5.43 (1H, br d, *J* = 8.0 Hz), 5.83 (1H, dt, *J* = 6.0, 15.6 Hz), 6.59 (1H, d, *J* = 15.6 Hz), 7.30-7.42 (6H, m), 7.64-7.67 (4H, m); ¹³C NMR (100 MHz, CDCl₃): δ -4.90 (q), -4.74 (q), 11.23 (q), 18.01 (s), 19.20 (s), 20.42 (q), 25.84 (q), 26.82 (q), 34.57 (t), 39.04 (t), 40.70 (d), 60.04 (t), 63.91 (t), 68.95 (d), 70.83 (d), 70.94 (d), 127.41 (d), 127.44 (d), 128.45 (d), 129.20 (d), 129.28 (d), 129.31 (d), 130.85 (d), 131.34 (s), 133.67 (s), 133.94 (s), 135.37 (d), 135.44 (d); MS (EI) *m/z* 608 (M⁺), 255 (base peak); HRMS (EI) *m/z* calcd for C₃₆H₅₆O₄Si₂ (M⁺): 608.3717 found 608.3740.

A mixture of alcohol (974.3 mg, 1.60 mmol) and PPh₃ (839.2 mg, 3.20 mmol) in CH₂Cl₂/CCl₄

(20 mL, 3/1, v/v) was stirred for 30 min at 70 °C and cooled to 0 °C and 5% H₂O₂ aq. was added. After being stirred for 10 min at same temperature, the resulting mixture was extracted with CH₂Cl₂ and the extracts were washed with brine, and dried over MgSO₄, filtered and concentrated. The residue was purified through silica gel column chromatography (hexane/AcOEt = 90/10) to give the dienyl chloride **10** (1.0 g, quant.) as a colorless oil; $[\alpha]_D^{27} = -91.6^\circ$ (c 1.24, MeOH); IR (neat) cm⁻¹: 3071, 3049, 2953, 2930, 2883, 2857, 1651, 1620, 1590, 1471, 1428, 1389, 1361, 1251, 1111, 1063, 1008, 962, 838, 774, 738, 702, 614, 505; ¹H NMR (400 MHz, CDCl₃): δ 0.07 (6H, s), 0.90 (3H, d, *J* = 7.2 Hz), 0.94 (9H, s), 1.03 (9H, s), 1.39 (1H, br d, *J* = 13.6 Hz), 1.52-1.76 (4H, m), 1.86 (3H, s), 3.71 (1H, ddd, *J* = 5.2, 5.2, 10.0 Hz), 3.79-3.85 (2H, m), 4.03-4.17 (3H, m), 4.90-4.94 (1H, m), 5.47 (1H, br d, *J* = 7.6 Hz), 5.80 (1H, ddd, *J* = 7.6, 7.6, 15.6 Hz), 6.64 (1H, d, *J* = 15.6 Hz), 7.31-7.42 (6H, m), 7.63-7.66 (4H, m); ¹³C NMR (100 MHz, CDCl₃): δ -4.90 (q), -4.68 (q), 11.24 (q), 18.06 (s), 19.25 (s), 20.29 (q), 25.88 (q), 26.86 (q), 34.58 (t), 39.08 (t), 40.86 (d), 45.51 (t), 60.07 (t), 69.00 (d), 70.85 (d), 70.94 (d), 125.54 (d), 127.45 (d), 127.46 (d), 129.34 (d), 129.35 (d), 130.83 (s), 131.15 (d), 132.45 (d), 133.68 (s), 134.00 (s), 135.41 (d), 135.48 (d); MS (EI) *m/z* 626 (M⁺), 81 (base peak); HRMS (EI) *m/z* calcd for C₃₆H₅₅ClO₃Si₂ (M⁺): 626.3378 found 626.3389.

To a solution of $\text{Pd}_2(\text{dba})_3 \cdot \text{CHCl}_3$ (0.9 mg, 0.8 μmol) in degassed THF (0.2 mL) was added tri-*o*-tolylphosphine (1.9 mg, 6.4 μmol) at rt. After being stirred for 5 min at rt, a solution of **10** (20 mg, 0.032 mmol) and tributylvinyltin (0.019 mL, 0.064 mmol) in degassed THF (0.8 mL) was added. The mixture was stirred for 37 h at 50 °C and concentrated. The residual black oil was purified through silica gel column chromatography (hexane/AcOEt = 98/2) to give the triene (18.1 mg, 90%) as a colorless oil; $[\alpha]_{\text{D}}^{27} = -48.4^\circ$ (*c* 1.81, CHCl_3); IR (neat) cm^{-1} : 3072, 2929, 2857, 1638, 1590, 1471, 1428, 1361, 1255, 1189, 1110, 1062, 1008, 964, 909, 835, 774, 738, 702, 614, 505; ^1H NMR (400 MHz, CDCl_3): δ 0.07 (6H, s), 0.91 (3H, d, $J = 8.8$ Hz), 1.03 (9H, s), 1.39 (1H, br d, $J = 14.0$ Hz), 1.55-1.75 (4H, m), 1.85 (3H, s), 2.83 (2H, br t, $J = 6.4$ Hz), 3.70-3.73 (1H, m), 3.79-3.85 (2H, m), 4.10-4.18 (1H, m), 4.94-5.08 (3H, m), 5.33 (1H, br d, $J = 7.6$ Hz), 5.69 (1H, dt, $J = 6.4, 15.6$ Hz), 5.81 (1H, ddt, $J = 6.4, 10.4, 16.8$ Hz), 6.10 (1H, d, $J = 15.6$ Hz), 7.30-7.42 (6H, m), 7.63-7.67 (4H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -4.84 (q), -4.70 (q), 11.32 (q), 18.09 (s), 19.27 (s), 20.58 (q), 25.93 (q), 26.88 (q), 34.69 (t), 37.40 (t), 39.16 (t), 40.67 (d), 60.13 (t), 68.95 (d), 70.81 (d), 71.08 (d), 115.24 (t), 127.47 (d), 128.20 (d), 128.72 (d), 128.93 (d), 129.31 (d), 129.34 (d), 131.89 (s), 133.72 (s), 134.10 (s), 135.45 (d), 135.52 (d), 136.56 (d); MS (FAB) m/z 641 ($\text{M}^+ + \text{Na}$); HRMS (FAB) m/z calcd for $\text{C}_{38}\text{H}_{58}\text{O}_3\text{Si}_2\text{Na}$ ($\text{M}^+ + \text{Na}$): 641.3822 found 641.3826.

To a solution of TBAF (0.4 mL, 1.0 M in THF, 0.4 mmol) and AcOH (0.02 mL, 0.4 mmol) in DMF (3 mL) was added a solution of TBDPS ether (248.0 mg, 0.4 mmol) in DMF (3 mL) at rt. After being stirred for 50 h at 40 °C, the mixture was concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 90/10) to give the alcohol **2** (138.8 mg, 92%) as a colorless oil; $[\alpha]_D^{27} = -54.4^\circ$ (*c* 1.16, CHCl₃); IR (neat) cm⁻¹: 3436, 3080, 2928, 2857, 1638, 1471, 1429, 1377, 1255, 1080, 1060, 965, 911, 836, 774; ¹H NMR (400 MHz, CDCl₃): δ 0.06 (3H, s), 0.07 (3H, s), 0.91 (3H, d, *J* = 6.8 Hz), 0.94 (9H, s), 1.31 (1H, br d, *J* = 13.6 Hz), 1.57-1.78 (4H, m), 1.82 (3H, s), 2.86 (2H, br t, *J* = 6.4 Hz), 2.97 (1H, dd, *J* = 3.6, 6.8 Hz, D₂O exchangeable), 3.73-3.81 (2H, m), 3.83 (1H, dd, *J* = 3.2, 3.2 Hz), 4.07 (1H, dddd, *J* = 2.8, 5.6, 5.6, 10.0 Hz), 4.94 (1H, dd, *J* = 2.0, 8.4 Hz), 5.00-5.08 (2H, m), 5.27 (1H, br d, *J* = 8.4 Hz), 5.71 (1H, dt, *J* = 6.4, 15.6 Hz), 5.83 (1H, ddt, *J* = 6.4, 10.0, 16.8 Hz), 6.61 (1H, d, *J* = 15.6 Hz); ¹³C NMR (100 MHz, CDCl₃): δ -4.88 (q), -4.78 (q), 11.18 (q), 18.08 (s), 20.43 (q), 25.87 (q), 34.32 (t), 37.35 (t), 37.79 (t), 40.38 (d), 61.77 (t), 70.66 (d), 71.01 (d), 73.31 (d), 115.31 (t), 127.89 (d), 128.12 (d), 129.11 (d), 132.34 (s), 136.45 (d); MS (FAB) *m/z* 403 (M⁺+Na); HRMS (FAB) *m/z* calcd for C₂₂H₄₀O₃SiNa (M⁺+Na): 403.2644 found 403.2668.

To a suspension of CuBr•SMe₂ (10.7 g, 52 mmol) in Et₂O (80 mL) was added dropwise MeLi (81.2 mL, 1.2 M in Et₂O, 96 mmol) at -78 °C. After being stirred for 30 min at same temperature, a solution of **5** (8.0 g, 32 mmol) in Et₂O (80 mL) was added dropwise to the mixture and stirred for 30 min and TMSCl (7.0 mL, 55 mmol) was added. After being stirred for 1.5 h at rt, the

resulting mixture was quenched by addition of 28% NH_4OH aq./sat. NH_4Cl aq. (100 mL, 1/1, v/v) and stirred for 30 min and filtered through a pad of Celite. The filtrate was extracted with Et_2O and the extracts were washed with water and brine, and dried over Na_2SO_4 , filtered and concentrated to give the crude silyl enol ether (11.9 g) as a yellow oil; ^1H NMR (400 MHz, CDCl_3): δ 0.22 (9H, s), 1.01 (3H, d, $J = 7.2$ Hz), 2.13-2.20 (1H, m), 3.36 (1H, dd, $J = 7.2, 9.6$ Hz), 3.45 (1H, dd, $J = 6.4, 9.6$ Hz), 4.17 (1H, br s), 4.27 (1H, dd, $J = 6.4, 7.2$ Hz), 4.49-4.54 (2H, m), 4.59 (1H, d, $J = 12.0$ Hz), 5.27 (1H, br s), 7.28-7.36 (5H, m).

The mixture of the crude silyl enol ether (11.9 g) and $\text{Pd}(\text{OAc})_2$ (1.45 g, 6.4 mmol) in DMSO (120 mL) was stirred under O_2 atmosphere at rt for 43 h and diluted with Et_2O and added water. The aqueous layer was extracted with Et_2O . The extracts were washed with brine, and dried over MgSO_4 , filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/ $\text{AcOEt} = 85/15$) to give the enone **11** (8.2 g, 96%, 2 steps) as a pale yellow oil; $[\alpha]_D^{26} = -198.1^\circ$ (c 1.78, CHCl_3); IR (neat) cm^{-1} : 3030, 1689, 1123, 1089, 741, 699; ^1H NMR (400 MHz, CDCl_3): δ 2.06 (3H, d, $J = 2.0$ Hz), 3.52 (1H, dd, $J = 6.0, 9.6$ Hz), 3.60 (1H, dd, $J = 6.0, 9.6$ Hz), 3.99 (1H, ddd, $J = 0.8, 6.0, 6.0$ Hz), 4.52 (1H, dd, $J = 0.8, 1.2$ Hz), 4.57 (1H, d, $J = 12.0$ Hz), 4.61 (1H, d, $J = 12.0$ Hz), 5.59 (1H, d, $J = 1.2$ Hz), 5.83 (1H, m), 7.27-7.38 (5H, m); ^{13}C NMR (100 MHz, CDCl_3): δ 19.58 (q), 70.05 (t), 73.46 (t), 73.72 (d), 80.89 (d), 100.62 (d), 122.60 (d), 127.65 (d), 127.73 (d), 128.35 (d), 137.44 (s), 160.52 (s), 193.45 (s); MS (EI) m/z 260 (M^+), 91 (base peak); HRMS (EI) m/z calcd for $\text{C}_{15}\text{H}_{16}\text{O}_4$ (M^+): 260.1049 found 260.1054; Anal. calcd for $\text{C}_{15}\text{H}_{16}\text{O}_4$: C, 69.22; H, 6.20 found C, 69.40; H, 6.34.

To a suspension of $\text{CuBr} \cdot \text{SMe}_2$ (5.1 g, 24 mmol) in THF (100 mL) was added dropwise HMPA (13 mL, 72 mmol) at 0 °C and the mixture was cooled to –20 °C, then vinylmagnesium chloride (54 mL, 1.3 M in THF, 70 mmol) was added. After being stirred for 30 min at same temperature, the resulting mixture was cooled to –78 °C and a solution of **11** (6.3 g, 24 mmol) in THF (50 mL) was added dropwise and the resulting mixture was stirred for 15 min. The reaction was quenched by addition of 28% NH_4OH aq./sat. NH_4Cl aq (100 mL, 1/1, v/v) at –78 °C and stirred at rt for 30 min. The resulting mixture was filtered through a pad of Celite and the filtrate was extracted with Et_2O and the extracts were washed with brine, and dried over MgSO_4 , filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/ AcOEt = 80/20) to give the ketone **12** (6.8 g, 97%) as a colorless oil; $[\alpha]_{\text{D}}^{21} = -56.8^\circ$ (c 2.80, CHCl_3); IR (neat) cm^{-1} : 1733, 1097, 699; ^1H NMR (400 MHz, CDCl_3): δ 1.16 (3H, s), 2.33 (1H, d, $J = 16.4$ Hz), 2.44 (1H, ddd, $J = 1.6, 1.6, 16.4$ Hz), 3.40 (1H, dd, $J = 7.2, 9.6$ Hz), 3.50 (1H, dd, $J = 6.0, 9.6$ Hz), 4.26 (1H, m), 4.30 (1H, br d, $J = 1.6$ Hz), 4.53 (1H, d, $J = 11.6$ Hz), 4.58 (1H, d, $J = 11.6$ Hz), 5.10 (1H, dd, $J = 0.4, 17.2$ Hz), 5.14 (1H, dd, $J = 0.4, 10.8$ Hz), 5.17 (1H, br d, $J = 1.6$ Hz), 5.89 (1H, dd, $J = 10.8, 17.2$ Hz), 7.28-7.37 (5H, m); ^{13}C NMR (100 MHz, CDCl_3): δ 21.89 (q), 44.88 (t), 47.65 (s), 69.84 (t), 73.44 (t), 76.65 (d), 80.41 (d), 106.61 (d), 114.64 (t), 127.65 (d), 127.77 (d), 128.36 (d), 137.44 (d), 140.93 (d), 202.42 (s); MS (EI) m/z 288 (M^+), 91 (base peak); HRMS (EI) m/z calcd for $\text{C}_{17}\text{H}_{20}\text{O}_4$ (M^+): 288.1362 found 288.1357; Anal. calcd for $\text{C}_{17}\text{H}_{20}\text{O}_4$: C, 70.81; H, 6.99 found C, 70.73; H, 7.06.

O₃ was bubbled through a stirred solution of **12** (7.4 g, 25 mmol) in CH₂Cl₂/MeOH (150 mL, 1/1, v/v) at –78 °C for 90 min. After releasing excess O₃, NaBH₄ (4.8 g, 120 mmol) was added at –78 °C and the mixture was stirred at 0 °C for 2.5 h. Removal of volatiles gave an oil, which was diluted with AcOEt and washed with water. The aqueous layer was extracted with AcOEt and the extracts were washed with brine, and dried over MgSO₄, filtered and concentrated. The residual colorless oil was purified through silica gel column chromatography (CHCl₃/MeOH = 95/5) to give a diastereomeric mixture of the diol (7.5 g, 99%, dr = 2/1) as a colorless oil; IR (neat) cm^{–1}: 3398, 1456, 1384, 1037; ¹H NMR (400 MHz, CDCl₃): δ 0.78 (1H, s), 0.88 (2H, s), 1.32 (2/3H, dd, *J* = 10.0, 13.2 Hz), 1.62 (1/3H, br dd, *J* = 1.6, 15.2 Hz), 1.82–1.92 (1H, m), 3.29–3.50 (4H, m), 3.57–3.62 (2/3H, m), 4.00 (1/3H, m), 4.12–4.19 (4/3H, m), 4.30 (1/3H, br s), 4.38 (2/3H, t, *J* = 6.4 Hz), 4.52 (1/3H, d, *J* = 12.0 Hz), 4.54 (2/3H, d, *J* = 12.0 Hz), 4.58 (1/3H, d, *J* = 12.0 Hz), 4.60 (2/3H, d, *J* = 12.0 Hz), 5.10 (1/3H, br s), 7.28–7.38 (5H, m) ; ¹³C NMR (100 MHz, CDCl₃): δ 20.34 (q), 21.13 (q), 34.99 (t), 35.59 (t), 39.45 (s), 42.63 (s), 63.50 (d), 65.35 (d), 68.25 (t), 68.80 (t), 70.99 (t), 71.04 (t), 72.35 (d), 73.39 (t), 73.47 (t), 74.97 (d), 77.41 (d), 80.17 (d), 105.85 (d), 107.31 (d), 127.69 (d), 127.71 (d), 127.76 (d), 128.32 (d), 128.35 (d), 137.58 (s), 137.64 (s); MS (EI) *m/z* 294 (M⁺), 91 (base peak); HRMS (EI) *m/z* calcd for C₁₆H₂₂O₅ (M⁺): 294.1467 found 294.1453.

To a solution of diol (7.7 g, 26 mmol) in DMF (150 mL) were added pyridine (5.3 mL, 65 mmol) and TBSCl (4.37 g, 31 mmol) sequentially at 0 °C and the mixture was stirred for 27 h at same temperature. The resulting mixture was diluted with Et₂O and added water. The aqueous layer was extracted with Et₂O and the extracts were washed with brine, and dried over MgSO₄, filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 70/30) to give a diastereomeric mixture of the silyl ether (10.4 g, 98%, dr = 2/1) as a colorless oil; IR (neat) cm⁻¹: 3435, 2954, 2929, 2858, 1470, 1455, 1254, 1161, 1087, 838, 777, 698; ¹H NMR (400 MHz, CDCl₃): δ 0.03 (4H, s), 0.11 (1H, s), 0.12 (1H, s), 0.82 (1H, s), 0.88 (6H, s), 0.92 (3H, s), 0.94 (2H, s), 1.18-1.28 (1H, m), 1.61-1.79 (2H, m), 3.31 (2/3H, d, *J* = 9.2 Hz), 3.33-3.54 (8/3H, m), 3.60 (2/3H, d, *J* = 9.2 Hz), 3.94-4.00 (1H, m), 4.13-4.15 (2/3H, m), 4.24 (1/3H, br s), 4.30-4.35 (1H, m), 4.52 (1/3H, d, *J* = 12.0 Hz), 4.53 (2/3H, d, *J* = 12.0 Hz), 4.57 (1/3H, d, *J* = 12.0 Hz), 4.60 (2/3H, d, *J* = 12.0 Hz), 7.27-7.37 (5H, m); ¹³C NMR (100 MHz, CDCl₃): δ -5.67 (q), -5.53 (q), -5.50 (q), 18.26 (s), 18.47 (s), 20.66 (q), 21.75 (q), 25.88 (q), 25.93 (q), 34.83 (t), 35.04 (t), 39.78 (s), 43.21 (s), 63.70 (d), 65.72 (d), 67.21 (t), 69.30 (t), 71.14 (t), 71.28 (t), 72.42 (d), 73.41 (t), 73.52 (t), 74.84 (d), 77.65 (d), 79.77 (d), 104.95 (d), 107.05 (d), 127.65 (d), 127.69 (d), 127.73 (d), 127.77 (d), 128.31 (d), 128.34 (d), 137.75 (s), 137.82 (s); MS (EI) *m/z* 408 (M⁺), 92 (base peak); HRMS (EI) *m/z* calcd for C₂₂H₃₆O₅Si (M⁺): 408.2332 found 408.2350.

To a solution of alcohol (10.0 g, 24 mmol) in CH_2Cl_2 (150 mL) were added MS 4Å (15g), NaOAc (4.0 g, 48 mmol) and PCC (8.0 g, 36 mmol) sequentially at rt. After being stirred for 2.5 h, the resulting mixture was diluted with Et_2O and filtered through a pad of Celite and the filtrate was concentrated. The residue was purified through silica gel column chromatography (hexane/AcOEt = 85/15) to give the ketone **13** (9.75 g, 98%) as a colorless oil; $[\alpha]_{\text{D}}^{25} = -2.81^\circ$ (c 1.07, CHCl_3); IR (neat) cm^{-1} : 2954, 2930, 2897, 2858, 1735, 1471, 1455, 1254, 1101, 937, 839, 815, 698; ^1H NMR (400 MHz, CDCl_3): δ 0.03 (3H, s), 0.04 (3H, s), 0.88 (9H, s), 1.05 (3H, s), 2.12 (1H, d, $J = 17.2$ Hz), 2.18 (1H, ddd, $J = 1.0, 1.0, 17.2$ Hz), 3.29 (1H, d, $J = 9.6$ Hz), 3.40 (1H, dd, $J = 7.2, 9.6$ Hz), 3.50 (1H, dd, $J = 5.6, 9.6$ Hz), 3.60 (1H, d, $J = 9.6$ Hz), 4.20 (1H, br t, $J = 6.6$ Hz), 4.30 (1H, br s), 4.53 (1H, d, $J = 12.0$ Hz), 4.58 (1H, d, $J = 12.0$ Hz), 5.41 (1H, br s), 7.26-7.37 (5H, m) ; ^{13}C NMR (100 MHz, CDCl_3): δ -5.55 (q), 18.26 (s), 19.76 (q), 25.84 (q), 43.07 (t), 45.28 (s), 67.75 (t), 70.01 (t), 73.48 (t), 76.39 (d), 80.56 (d), 105.25 (d), 127.69 (d), 127.76 (d), 128.37 (d), 202.75 (s); MS (EI) m/z 406 (M^+), 349 (base peak); HRMS (EI) m/z calcd for $\text{C}_{22}\text{H}_{34}\text{O}_5\text{Si}$ (M^+): 406.2176 found 406.2168; Anal. calcd for $\text{C}_{22}\text{H}_{34}\text{O}_5\text{Si}$: C, 64.99; H, 8.43 found C, 64.71; H, 8.36.

To a solution of **13** (7.78 g, 19 mmol) in THF/MeOH (120 mL, 1/1, v/v) was added *p*-toluenesulfonyl hydrazine (5.3 g, 29 mmol) at rt. After being stirred for 2 h, the resulting mixture was concentrated. The residue was purified through silica gel column chromatography (hexane/AcOEt = 85/15 to 80/20) to give the hydrazone **14** (10.6 g, 97%) as colorless solids; mp: 50.2-51.2 °C; $[\alpha]_D^{25} = +30.1^\circ$ (*c* 1.03, CHCl₃); IR (CHCl₃) cm⁻¹: 3303, 3217, 2955, 2930, 1599, 1167, 1092, 988, 839, 551; ¹H NMR (400 MHz, CDCl₃): δ -0.02 (3H, s), -0.01 (3H, s), 0.86 (9H, s), 1.00 (3H, s), 1.76 (1H, d, *J* = 16.8 Hz), 2.26 (1H, br d, *J* = 16.8 Hz), 2.41 (3H, s), 3.16 (1H, d, *J* = 9.6 Hz), 3.34-3.45 (3H, m), 4.04 (1H, dd, *J* = 6.4, 6.4 Hz), 4.50 (1H, d, *J* = 12.0 Hz), 4.54 (1H, s), 4.56 (1H, d, *J* = 12.0 Hz), 5.23 (1H, br s), 7.26-7.34 (7H, m), 7.52 (1H, br s, D₂O exchangeable), 7.80 (1H, d, *J* = 8.4 Hz); ¹³C NMR (100 MHz, CDCl₃): δ -5.59 (q), 18.22 (s), 19.95 (q), 21.65 (q), 25.84 (q), 28.68 (t), 43.57 (s), 66.98 (t), 70.54 (t), 73.40 (t), 77.52 (d), 78.16 (d), 105.38 (d), 127.64 (d), 127.69 (d), 127.85 (d), 128.33 (d), 129.54 (d), 134.98 (s), 137.68 (s), 144.18 (s), 152.67 (s); MS (FAB) *m/z* 575 (M⁺+H); HRMS (FAB) *m/z* calcd for C₂₉H₄₃N₂O₆SSi (M⁺+H): 575.2611 found 575.2575; Anal. calcd for C₂₉H₄₂N₂O₆SSi: C, 60.60; H, 7.36; N, 4.87 found C, 60.37; H, 7.39; N, 4.89.

A stirred mixture of Na (1.4 g, 60 mmol) and ethylene glycol (70 mL) was heated at 120 °C until Na was dissolved. The resulting mixture was added to **14** (7.0 g, 12 mmol) at rt and the

mixture was stirred at 120 °C for 2 h. The reaction was quenched by addition of sat. NH_4Cl aq. and extracted with Et_2O . The extracts were washed with water and brine, and dried over MgSO_4 , filtered and concentrated. The residual yellow oil was purified through silica gel column chromatography (hexane/ AcOEt = 95/5) to give the olefin **15** (4.03 g, 86%) as a colorless oil; $[\alpha]_{\text{D}}^{25} = +65.1^\circ$ (c 1.07, CHCl_3); IR (neat) cm^{-1} : 3031, 2955, 2929, 2857, 1496, 1471, 1454, 1361, 1255, 1089, 838. 777, 698; ^1H NMR (400 MHz, CDCl_3): δ 0.02 (3H, s), 0.03 (3H, s), 0.88 (9H, s), 1.03 (3H, s), 3.24 (1H, d, J = 9.6 Hz), 3.34 (1H, dd, J = 8.0, 9.2 Hz), 3.40 (1H, dd, J = 5.6, 9.2 Hz), 3.60 (1H, d, J = 9.6 Hz), 4.14 (1H, dd, J = 5.6, 8.0 Hz), 4.45 (1H, d, J = 4.4 Hz), 4.51 (1H, d, J = 12.0 Hz), 4.56 (1H, d, J = 12.0 Hz), 5.32 (1H, dd, J = 2.0, 9.6 Hz), 5.39 (1H, d, J = 2.0 Hz), 5.97 (1H, dd, J = 4.4, 9.6 Hz), 7.29-7.37 (5H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -5.53 (q), -5.50 (q), 17.59 (s), 18.29 (q), 25.88 (q), 43.95 (s), 67.21 (t), 70.74 (t), 72.60 (d), 73.45 (t), 80.96 (d), 104.11 (d), 127.68 (d), 127.73 (d), 128.06 (d), 128.34 (d), 131.91 (d), 137.82 (s); MS (EI) m/z 390 (M^+), 92 (base peak); HRMS (EI) m/z calcd for $\text{C}_{22}\text{H}_{34}\text{O}_4\text{Si}$ (M^+): 390.2226 found 390.2204; Anal. calcd for $\text{C}_{22}\text{H}_{34}\text{O}_4\text{Si}$: C, 67.65; H, 8.77 found C, 67.46; H, 8.73.

To a solution of **15** (1.69 g, 4.33 mmol) and methyl(trifluoromethyl)acetone (4.3 mL) in MeCN/4x10⁻⁴ M Na₂EDTA aq. (65 mL, 2/1, v/v) was added a mixture of NaHCO₃ (3.75 g, 44.6 mmol) and oxone[®] (16.8 g, 27.3 mmol) over 1 h at -2 °C. After being stirred for 1 h, the mixture was poured into water. The aqueous layer was extracted with CH₂Cl₂ and the extracts were dried

over MgSO_4 , filtered and concentrated. The residual oil was dissolved in EtOH/cyclohexene (40 mL, 2/1, v/v) and added $\text{Pd}(\text{OH})_2/\text{C}$ (473 mg, 20% Pd, 50wt% for substrate). The resulting mixture was stirred at 100 °C for 12 h and filtered through a pad of Celite. The filtrate was concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 50/50) to give a diastereomeric mixture of the alcohol **17** (1.26 g, 92%, 2 steps, 90% de) as solids, which was recrystallized from hot hexane to afford the optical pure alcohol **17** (788 mg, 58%) as colorless needles; mp: 53.6-54.2 °C; $[\alpha]_{\text{D}}^{25} = +69.9^\circ$ (*c* 1.28, CHCl_3); IR (CHCl_3) cm^{-1} : 3538, 3019, 2955, 2931, 2858, 1471, 1257, 1104, 1092, 961, 940, 870, 840; ^1H NMR (400 MHz, CDCl_3): δ 0.06 (3H, s), 0.07 (3H, s), 0.90 (9H, s), 1.05 (3H, s), 1.81 (1H, br s, D_2O exchangeable), 2.74 (1H, dd, $J = 2.8, 4.0$ Hz), 3.61 (1H, br d, $J = 6.0$ Hz), 3.64 (1H, d, $J = 9.6$ Hz), 3.70 (1H, d, $J = 9.6$ Hz), 4.20 (1H, dd, $J = 6.0, 6.0$ Hz), 4.49 (1H, br s), 5.14 (1H, d, $J = 2.8$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -5.54 (q), -5.50 (q), 17.02 (q), 18.26 (s), 25.86 (q), 40.51 (s), 49.54 (d), 52.71 (d), 63.69 (t), 64.72 (t), 71.32 (d), 77.60 (d), 102.90 (d); MS (EI) m/z : 316 (M^+), 95 (base peak); HRMS (EI) m/z calcd for $\text{C}_{15}\text{H}_{28}\text{O}_5\text{Si}$ (M^+): 316.1706 found 316.1658; Anal. calcd for $\text{C}_{15}\text{H}_{28}\text{O}_5\text{Si}$: C, 56.93; H, 8.92 found C, 56.66; H, 8.83.

To a solution of **17** (1.46 g, 4.61 mmol) in PhH (30 mL) were added imidazole (783 mg, 11.5 mmol), PPh₃ (1.63 g, 6.22 mmol) and I₂ (1.52 g, 5.99 mmol) sequentially at rt. After being stirred

for 14 h, the reaction was quenched by addition of sat. $\text{Na}_2\text{S}_2\text{O}_3$ aq. and the resulting mixture was stirred for additional 10 min and diluted with AcOEt. The organic layer was washed with brine, and dried over MgSO_4 , filtered and concentrated. The residue was purified through silica gel column chromatography (hexane/AcOEt = 98/2 to 95/5) to give the iodide (1.95 g, 99%) as colorless needles; mp: 84.0-85.3 °C (recrystallized from hexane); $[\alpha]_{\text{D}}^{24} = +14.4^\circ$ (c 1.09, CHCl_3); IR (CHCl_3) cm^{-1} : 2956, 2934, 2858, 1471, 1256, 1109, 1093, 1078, 971, 947, 923, 871, 839; ^1H NMR (400 MHz, CDCl_3): δ 0.055 (3H, s), 0.064 (3H, s), 0.89 (9H, s), 1.02 (3H, s), 2.74-2.75 (1H, m), 3.09-3.13 (2H, m), 3.17 (1H, dd, $J = 4.4, 9.6$ Hz), 3.62 (1H, d, $J = 9.6$ Hz), 3.68 (1H, d, $J = 9.6$ Hz), 4.35 (1H, dd, $J = 4.8, 9.6$ Hz), 4.66 (1H, br s), 5.19 (1H, d, $J = 2.0$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -5.51 (q), -5.49 (q), 5.91 (t), 16.92 (s), 18.30 (q), 25.89 (q), 40.32 (s), 49.24 (d), 52.80 (d), 64.61 (t), 73.35 (d), 77.99 (d), 103.70 (d); MS (EI) m/z 426 (M^+), 95 (base peak); HRMS (EI) m/z calcd for $\text{C}_{15}\text{H}_{27}\text{O}_5\text{ISi}$ (M^+): 426.0723 found 426.0732; Anal. calcd for $\text{C}_{15}\text{H}_{27}\text{O}_5\text{ISi}$: C, 42.26; H, 6.38 found C, 42.07; H, 6.23.

A stirred mixture of iodide (1.40 g, 3.28 mmol) and activated Zn (4.23 g, 65.6 mmol) was heated at 100 °C for 30 min and filtered through a pad of Celite and the filtrate was concentrated. The residual yellow oil was purified through silica gel column chromatography (hexane/AcOEt = 80/20) to give a diastereomeric mixture of the lactol **18** (992 mg, quant., dr = 37/20) as a colorless oil; IR (neat) cm^{-1} : 3437, 2955, 2929, 2857, 1650, 1471, 1257, 1098, 1033, 937, 838,

777, 669; ^1H NMR (400 MHz, CDCl_3): δ 0.087 (180/57H, s), 0.094 (333/57H, s), 1.10 (111/57H, s), 1.15 (60/57H, s), 3.11 (37/57H, d, $J = 4.4$ Hz), 3.15 (37/57H, d, $J = 3.6$ Hz, D_2O exchangeable), 3.17 (20/57H, d, $J = 4.4$ Hz), 3.26 (37/57H, d, $J = 4.4$ Hz), 3.30 (20/57H, br d, $J = 4.4$ Hz), 3.69 (37/57H, d, $J = 10.0$ Hz), 3.72 (20/57H, d, $J = 10.0$ Hz), 3.76 (37/57H, d, $J = 10.0$ Hz), 3.78 (20/57H, d, $J = 10.0$ Hz), 4.54-4.68 (77/57H, m), 4.80 (1H, d, $J = 4.0$ Hz), 5.29-5.35 (1H, m), 5.50 (1H, ddd, $J = 1.2, 1.2, 7.6$ Hz), 5.92-6.01 (1H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -5.56 (q), -5.54 (q), -5.50 (q), 11.91 (q), 18.21 (q), 18.29 (q), 25.86 (q), 25.89 (q), 39.25 (s), 40.42 (s), 54.31 (d), 54.88 (d), 57.37 (d), 58.69 (d), 65.69 (t), 66.47 (t), 69.10 (d), 74.71 (d), 94.14 (d), 96.84 (d), 117.51 (t), 117.93 (t), 134.32 (d), 134.46 (d); MS (FAB) m/z 323 ($\text{M}^+ + \text{Na}$); HRMS (FAB) m/z calcd for $\text{C}_{15}\text{H}_{28}\text{O}_4\text{SiNa}$ ($\text{M}^+ + \text{Na}$): 323.1655 found 323.1629.

To a suspension of KH (6.96 g, 40% in oil, 69.4 mmol) in DME (10 mL) was added dropwise ethyl diethylphosphonoacetate (13.8 mL, 69.4 mmol) at 0 °C. After being stirred for 1 h at rt, a solution of **18** (2.98 g, 9.92 mmol) in DME (30 mL) was added. The resulting mixture was stirred at rt for 84 h and quenched by addition of sat. NH_4Cl aq. The aqueous layer was extracted with AcOEt and the extracts were washed with water and brine, and dried over MgSO_4 , filtered and concentrated. The residual yellow oil was purified through silica gel column chromatography (hexane/AcOEt = 90/10) to give the ester **20** (3.01 g, 82%) and the C23-epimer (215 mg, 6%),

respectively.

20: a colorless oil; $[\alpha]_D^{28} = +45.6^\circ$ (c 1.04, CHCl_3); IR (neat) cm^{-1} : 2955, 2931, 2898, 2857, 1740, 1646, 1471, 1409, 1389, 1372, 1301, 1257, 1192, 1095, 1065, 1034, 1006, 935, 838, 778, 733, 669; ^1H NMR (400 MHz, CDCl_3): δ 0.06 (3H, s), 0.07 (3H, s), 0.87 (9H, s), 1.03 (3H, s), 1.23 (3H, t, $J = 6.8$ Hz), 2.31 (1H, dd, $J = 10.4, 15.6$ Hz), 2.57 (1H, dd, $J = 2.4, 15.6$ Hz), 3.04 (1H, br d, $J = 4.0$ Hz), 3.10 (1H, d, $J = 4.0$ Hz), 3.53 (1H, d, $J = 10.0$ Hz), 3.60 (1H, d, $J = 10.0$ Hz), 3.89 (1H, dd, $J = 2.4, 10.4$ Hz), 4.06-4.19 (2H, m), 4.33 (1H, br d, $J = 6.0$ Hz), 5.23 (1H, ddd, $J = 1.6, 1.6, 10.4$ Hz), 5.40 (1H, ddd, $J = 1.6, 1.6, 17.2$ Hz), 5.89 (1H, ddd, $J = 6.0, 10.4, 17.2$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -5.60 (q), -5.53 (q), 13.44 (q), 14.26 (q), 18.30 (s), 25.89 (q), 36.40 (t), 38.72 (s), 54.86 (d), 57.64 (d), 60.36 (t), 66.92 (t), 71.57 (d), 76.69 (d), 117.15 (t), 135.33 (d), 171.65 (s); MS (EI) m/z 370 (M^+), 75 (base peak); HRMS (EI) m/z calcd for $\text{C}_{19}\text{H}_{34}\text{O}_5\text{Si}$ (M^+): 370.2176 found 370.2176; Anal. calcd for $\text{C}_{19}\text{H}_{34}\text{O}_5\text{Si}$: C, 61.58; H, 9.25 found C, 61.64; H, 9.24.

C-23 epimer: a colorless oil; $[\alpha]_D^{28} = +20.8^\circ$ (c 1.33, CHCl_3); IR (neat) cm^{-1} : 2956, 2930, 2857, 1739, 1640, 1471, 1388, 1309, 1255, 1198, 1173, 1096, 1032, 937, 857, 837, 777; ^1H NMR (400 MHz, CDCl_3): δ 0.07 (3H, s), 0.08 (3H, s), 0.90 (9H, s), 1.08 (3H, s), 1.25 (3H, t, $J = 7.2$ Hz), 2.47 (2H, d, $J = 6.8$ Hz), 3.04 (1H, d, $J = 4.0$ Hz), 3.16 (1H, d, $J = 4.0$ Hz), 3.59 (1H, d, $J = 9.6$ Hz), 3.69 (1H, d, $J = 9.6$ Hz), 3.73 (1H, t, $J = 6.8$ Hz), 4.10-4.17 (2H, m), 4.59 (1H, br d, $J = 5.6$ Hz), 5.34-5.39 (2H, m), 6.02 (1H, ddd, $J = 5.6, 10.8, 18.0$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -5.61 (q), -5.52 (q), 14.21 (q), 18.18 (s), 19.89 (q), 25.83 (q), 35.61 (t), 36.05 (s), 52.05 (d), 5.54 (d), 60.45 (t), 63.50 (t), 71.48 (d), 71.89 (d), 118.33 (t), 134.25 (d), 171.77 (s); MS (EI) m/z 370 (M^+), 75 (base peak); HRMS (EI) m/z calcd for $\text{C}_{19}\text{H}_{34}\text{O}_5\text{Si}$ (M^+): 370.2176 found 370.2175; Anal. calcd for $\text{C}_{19}\text{H}_{34}\text{O}_5\text{Si}$: C, 61.58; H, 9.25 found C, 61.20; H, 9.12.

To a suspension of LiAlH_4 (2.10 g, 55.9 mmol) in THF (15 mL) was added dropwise a solution of **20** (2.07 g, 5.59 mmol) in THF (35 mL) at 0 °C. The resulting mixture was stirred at reflux for 30 min and quenched by slow addition of H_2O (2.1 mL), 15% NaOH aq. (2.1 mL) and H_2O (6.3 mL) sequentially at 0 °C and stirred at rt for additional 1 h. The mixture was filtered through a pad of Celite and the filtrate was dried over MgSO_4 , filtered and concentrated. The residual oil was purified through silica gel column chromatography ($\text{CHCl}_3/\text{MeOH} = 95/5$) to give the triol **21** (1.21 g, quant.) as a colorless oil; $[\alpha]_D^{28} = +75.2^\circ$ (c 1.19, CHCl_3); IR (neat) cm^{-1} : 3364, 2932, 2882, 1645, 1470, 1428, 1319, 1028, 922; ^1H NMR (400 MHz, CDCl_3): δ 0.82 (3H, s), 1.62 (1H, ddd, $J = 2.8, 2.8, 14.0$ Hz), 1.69-1.73 (2H, m), 1.79 (1H, ddd, $J = 2.8, 12.0, 14.0$ Hz), 3.16 (1H, br s, D_2O exchangeable), 3.43 (1H, br s, D_2O exchangeable), 3.52 (1H, br s, D_2O exchangeable), 3.64 (2H, br s), 3.84-3.89 (2H, m), 3.95 (1H, br t, $J = 2.4$ Hz), 4.30 (1H, br t, $J = 6.4$ Hz), 4.34-4.40 (1H, m), 5.11 (1H, ddd, $J = 1.3, 1.3, 10.4$ Hz), 5.25 (1H, ddd, $J = 1.6, 1.6, 17.2$ Hz), 5.85 (1H, ddd, $J = 6.0, 10.4, 1.2$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ 15.24 (q), 31.09 (t), 35.84 (t), 39.70 (t), 60.95 (t), 69.34 (t), 72.60 (d), 73.56 (d), 74.70 (d), 114.82 (t), 138.56 (d); MS (APCI) m/z 217 ($\text{M}^+ + \text{H}$); HRMS (EI) m/z calcd for $\text{C}_{11}\text{H}_{21}\text{O}_4$ ($\text{M}^+ + \text{H}$): 217.1440 found 217.1434.

To a solution of **21** (215.1 mg, 0.99 mmol) in DMF (4.5 mL) were added 2-methoxypropene (0.11 mL, 1.19 mmol) and *p*-TsOH•H₂O (3.8 mg, 0.020 mmol) at 0 °C. The resulting mixture was stirred for 11 h at 0 °C and H₂O (0.1 mL) was added and the resulting mixture was stirred for additional 10 min and the reaction was quenched by addition of NaHCO₃ (3.2 mg). Evaporation of volatiles gave an oil, which was diluted with AcOEt and washed with water. The aqueous layer was extracted with AcOEt and the combined organic layers were washed with brine, and dried over MgSO₄, filtered and concentrated. The residual colorless oil was purified through silica gel column chromatography (hexane/AcOEt = 60/40) to give the acetone (249.5 mg, 98%) as colorless needles; mp: 51.3-52.9 °C; $[\alpha]_D^{28} = +54.3^\circ$ (*c* 1.29, CHCl₃); IR (CHCl₃) cm⁻¹: 3493, 2997, 2958, 2876, 1647, 1428, 1385, 1229, 1198, 1153, 1091, 1068, 1040, 995, 928; ¹H NMR (400 MHz, CDCl₃): δ 0.80 (3H, s), 1.44 (3H, s), 1.46 (3H, s), 1.58 (1H, ddd, *J* = 2.8, 2.8, 14.0 Hz), 1.65-1.88 (3H, m), 3.05 (1H, br d, *J* = 8.0 Hz, D₂O exchangeable), 3.51 (1H, d, *J* = 12.4 Hz), 3.56 (1H, d, *J* = 12.4 Hz), 3.82 (1H, br s), 3.86-3.92 (2H, m), 4.32-4.38 (1H, m), 4.92 (1H, dd, *J* = 3.6, 10.0 Hz), 5.10 (1H, ddd, *J* = 1.2, 1.2, 10.8 Hz), 5.23 (1H, ddd, *J* = 1.2, 1.2, 17.2 Hz), 5.82 (1H, ddd, *J* = 5.6, 10.8, 17.2 Hz); ¹³C NMR (100 MHz, CDCl₃): δ 14.88 (q), 18.89 (q), 29.89 (q), 31.50 (br t), 33.97 (t), 34.50 (s), 62.30 (br t), 66.15 (t), 72.10 (d), 73.20 (d), 76.21 (br d), 98.55 (s), 114.35 (t), 139.34 (d); MS (EI) *m/z* 256 (M⁺), 59 (base peak); HRMS (EI) *m/z* calcd for C₁₄H₂₄O₄ (M⁺): 256.1675 found 256.1691; Anal. calcd for C₁₄H₂₄O₄: C, 65.60; H, 9.44 found C, 65.31; H, 9.26.

To a solution of **2** (56.9 mg, 0.15 mmol) and **3** (221.9 mg, 0.45 mmol) in degassed CH_2Cl_2 (2 mL) was added **22** (24.6 mg, 0.03 mmol). Ar gas was bubbled through the stirred mixture for 24 h and **23** (12.7 mg, 0.015 mmol) was added. After Ar gas was bubbled through the stirred mixture for 24 h, the mixture was stirred for 1 h under air and concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 85/15 to 50/50) to give **24** (88 mg, 70%) and **25** (10.3 mg, 19%), respectively.

24: a pale yellow oil; $[\alpha]_{\text{D}}^{28} = -2.78^\circ$ (c 0.89, CHCl_3); IR (neat) cm^{-1} : 3469, 3071, 3048, 2929, 2857, 1687, 1590, 1471, 1462, 1428, 1384, 1254, 1196, 1148, 1091, 1007, 967, 938, 909, 836, 774, 736, 703; ^1H NMR (400 MHz, CDCl_3): δ 0.05 (3H, s), 0.06 (3H, s), 0.76 (3H, s), 0.91 (3H, d, $J = 7.2$ Hz), 0.93 (9H, s), 1.31 (1H, br d, $J = 13.6$ Hz), 1.42 (3H, s), 1.46 (3H, s), 1.46-1.76 (8H, m), 1.81 (3H, s), 2.83 (2H, br t, $J = 6.8$ Hz), 2.98 (1H, br s, D_2O exchangeable), 3.53 (1H, d, $J = 12.4$ Hz), 3.58 (1H, d, $J = 12.4$ Hz), 3.75-3.84 (4H, m), 3.86-3.94 (2H, m), 4.05-4.10 (1H, m),

4.24 (1H, dd, $J = 5.3, 10.6$ Hz), 4.48 (1H, d, $J = 10.4$ Hz), 4.94 (1H, br d, $J = 7.6$ Hz), 5.27 (1H, d, $J = 7.6$ Hz), 5.47 (1H, dd, $J = 5.6, 15.6$ Hz), 5.60-5.69 (2H, m), 6.35 (1H, d, $J = 15.6$ Hz), 7.34-7.40 (6H, m), 7.67-7.69 (4H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -4.91 (q), -4.76 (q), 11.12 (q), 14.92 (q), 18.03 (s), 18.96 (q), 19.24 (s), 20.38 (q), 25.83 (q), 26.89 (q), 29.29 (q), 31.99 (t), 33.72 (t), 34.31 (t), 36.35 (t), 37.79 (t), 40.36 (d), 60.33 (t), 61.57 (t), 66.10 (t), 70.63 (d), 70.97 (d), 71.00 (d), 71.99 (d), 72.22 (d), 73.14 (d), 98.33 (s), 127.39 (d), 127.43 (d), 127.93 (d), 128.02 (d), 129.22 (d), 131.50 (d), 132.40 (s), 133.84 (s), 134.06 (s), 135.40 (d), 135.43 (d); MS (FAB) m/z 869 ($\text{M}^+\text{+Na}$); HRMS (FAB) m/z calcd for $\text{C}_{50}\text{H}_{78}\text{O}_7\text{Si}_2\text{Na}$ ($\text{M}^+\text{+Na}$): 869.5184 found 869.5195.

25: a colorless oil; $[\alpha]_{\text{D}}^{25} = -53.4^\circ$ (c 0.27, CHCl_3); IR (neat) cm^{-1} : 3392, 2938, 2857, 1651, 1471, 1428, 1387, 1254, 1079, 1059, 965, 836, 774; ^1H NMR (400 MHz, CDCl_3): δ 0.06 (6H, s), 0.07 (6H, s), 0.91 (6H, d, $J = 7.6$ Hz), 0.94 (9H, s), 1.31 (2H, br d, $J = 13.6$ Hz), 1.52-1.78 (8H, m), 1.82 (6H, s), 2.81 (4H, br t, $J = 6.4$ Hz), 2.97 (2H, br s, D_2O exchangeable), 3.75-3.85 (6H, m), 4.04-4.10 (2H, m), 4.94 (2H, dd, $J = 1.8, 7.6$ Hz), 5.26 (2H, d, $J = 7.6$ Hz), 5.44-5.46 (2H, m), 5.67 (2H, dt, $J = 6.4, 15.6$ Hz), 6.35 (2H, d, $J = 15.6$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -4.83 (q), -4.73 (q), 11.20 (q), 18.14 (s), 20.49 (q), 25.92 (q), 29.76 (t), 34.35 (t), 36.51 (t), 37.81 (t), 40.44 (d), 61.89 (t), 70.71 (d), 71.09 (d), 73.47 (d), 127.69 (d), 129.85 (d), 132.44 (s); MS (FAB) m/z 755 ($\text{M}^+\text{+Na}$); HRMS (FAB) m/z calcd for $\text{C}_{42}\text{H}_{76}\text{O}_6\text{Si}_2\text{Na}$ ($\text{M}^+\text{+Na}$): 755.5078 found 775.5037.

To a solution of **24** (131.5 mg, 0.155 mmol), NEt_3 (0.30 mL, 2.17 mmol) in $\text{DMSO}/\text{CH}_2\text{Cl}_2$ (2.6 mL, 1/1, v/v) was added $\text{SO}_3 \cdot \text{pyridine}$ (172.8 mg, 1.09 mmol) at 0°C . After being stirred for 30 min at rt, the reaction was quenched by addition of sat NH_4Cl aq. and the aqueous layer was extracted with CH_2Cl_2 and the extracts were washed with brine, and dried over MgSO_4 , filtered and concentrated. The residue was purified through silica gel column chromatography (hexane/ AcOEt = 95/5 to 90/10) to give the aldehyde (114.9 mg, 88%) as a pale yellow oil; $[\alpha]_{\text{D}}^{26} = -9.70^\circ$ (c 1.25, CHCl_3); IR (neat) cm^{-1} : 3071, 2929, 2857, 2736, 1729, 1589, 1471, 1428, 1384, 1254, 1196, 1110, 1007, 965, 937, 836, 758, 703, 667, 614; ^1H NMR (400 MHz, CDCl_3): δ 0.07 (6H, s), 0.76 (3H, s), 0.93 (3H, d, $J = 7.6$ Hz), 0.94 (9H, s), 1.06 (9H, s), 1.38-1.80 (7H, m), 1.42 (3H, s), 1.46 (3H, s), 1.82 (3H, s), 2.44 (1H, ddd, $J = 2.0, 4.8, 16.0$ Hz), 2.56 (1H, ddd, $J = 2.8, 7.6, 16.0$ Hz), 2.84 (1H, br t, $J = 6.4$ Hz), 3.53 (1H, d, $J = 12.4$ Hz), 3.58 (1H, d, $J = 12.4$ Hz), 3.78 (1H, ddd, $J = 3.2, 6.4, 12.8$ Hz), 3.84-3.94 (3H, m), 4.40 (1H, dd, $J = 5.3, 10.6$ Hz), 4.34-4.41 (1H, m), 4.48 (1H, d, $J = 10.0$ Hz), 4.97 (1H, dd, $J = 1.8, 7.6$ Hz), 5.29 (1H, d, $J = 10.0$ Hz), 5.47 (1H, dd, $J = 5.6, 15.2$ Hz), 5.90-5.70 (2H, m), 6.37 (1H, d, $J = 15.2$ Hz), 7.34-7.40 (6H, m), 7.67-7.69 (4H, m), 9.79 (1H, dd, $J = 2.0, 2.8$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -4.84 (q), -4.74 (q), 11.18 (q), 15.00 (q), 18.12 (s), 19.04 (q), 19.32 (s), 20.52 (q), 25.90 (q), 26.96 (q), 29.37 (q), 32.09 (t), 33.80 (t), 34.11 (t), 34.40 (t), 36.42 (t), 40.25 (t), 60.43 (t), 66.19 (t), 68.05 (d), 70.63 (d), 71.06 (d), 71.18 (d), 72.08 (d), 72.29 (d), 98.42 (s), 127.46 (d), 127.50 (d), 127.82

(d), 127.93 (d), 129.30 (d), 129.32 (d), 129.48 (d), 131.59 (d), 132.70 (s), 133.95 (s), 134.15 (s), 135.49 (d), 135.52 (d), 201.54 (d); MS (FAB) m/z 867 ($M^+ + Na$); HRMS (FAB) m/z calcd for $C_{50}H_{76}O_7Si_2Na$ ($M^+ + Na$): 867.5027 found 867.4987.

To a solution of aldehyde (15.7 mg, 0.019 mmol) and trimethyl phosphonocrotonate (11.6 mg, 0.056 mmol) in THF (1 mL) were added $LiOH \cdot H_2O$ (2.3 mg, 0.056 mmol) and $MS4\text{\AA}$ (62.8 mg) at rt. After being stirred at reflux for 12 h, the resulting mixture was filtered through a pad of Celite and the filtrate was diluted with Et_2O and washed with water. The aqueous layer was extracted with Et_2O and the combined organic layers were washed with brine, and dried over $MgSO_4$, filtered and concentrated. The residue was purified through silica gel column chromatography (hexane/ $AcOEt$ = 90/10) to give the ester **26** (14.8 mg, 86%) as a colorless oil; $[\alpha]_D^{27} = -23.6^\circ$ (c 0.90, $CHCl_3$); IR (neat) cm^{-1} : 3071, 2929, 2857, 1720, 1646, 1617, 1471, 1428, 1382, 1256, 1196, 1140, 1004, 968, 836, 773, 758, 703, 614; 1H NMR (400 MHz, $CDCl_3$): δ 0.04 (3H, s), 0.05 (3H, s), 0.76 (3H, s), 0.90 (3H, d, J = 8.0 Hz), 0.92 (9H, s), 1.06 (9H, s), 1.32 (1H, br d, J = 13.6 Hz), 1.42 (3H, s), 1.46 (3H, s), 1.46-1.80 (6H, m), 1.82 (3H, s), 2.31 (1H, ddd, J = 6.4, 6.4, 14.4 Hz), 2.40 (1H, ddd, J = 6.0, 6.0, 14.4 Hz), 2.83 (2H, br t, J = 6.8 Hz), 3.53 (1H, d, J = 12.4 Hz), 3.58 (1H, d, J = 12.4 Hz), 3.73 (3H, s), 3.75-3.84 (2H, m), 3.86-3.95 (3H, m), 4.23

(1H, dd, $J = 5.1, 11.1$ Hz), 4.48 (1H, d, $J = 10.8$ Hz), 4.93 (1H, dd, $J = 1.6, 8.0$ Hz), 5.32 (1H, d, $J = 8.0$ Hz), 5.47 (1H, dd, $J = 5.6, 15.6$ Hz), 5.59-5.69 (2H, m), 5.79 (1H, d, $J = 15.2$ Hz), 6.12-6.25 (2H, m), 6.38 (1H, d, $J = 15.2$ Hz), 7.26 (1H, dd, $J = 9.6, 15.2$ Hz), 7.33-7.42 (6H, m), 7.67-7.69 (4H, m); ^{13}C NMR (100 MHz, C_6D_6): δ -4.51 (q), -4.37 (q), 11.69 (q), 15.10 (q), 18.53 (s), 19.21 (q), 19.86 (s), 20.83 (q), 26.30 (q), 27.51 (q), 30.06 (q), 32.81 (t), 34.53 (t), 34.82 (t), 37.11 (t), 40.21 (t), 41.19 (d), 51.11 (q), 61.05 (t), 66.41 (t), 71.25 (d), 71.65 (d), 71.71 (d), 71.86 (d), 72.57 (d), 72.68 (d), 98.53 (s), 119.92 (d), 128.00 (d), 128.05 (d), 128.41 (d), 128.71 (d), 129.53 (d), 129.66 (d), 129.74 (d), 129.78 (d), 130.55 (d), 132.02 (s), 132.84 (d), 134.44 (d), 134.69 (s), 136.04 (d), 136.06 (d), 140.39 (d), 145.00 (d), 166.91 (s); MS (FAB) m/z 949 (M^+Na); HRMS (FAB) m/z calcd for $\text{C}_{55}\text{H}_{82}\text{O}_8\text{Si}_2\text{Na}$ (M^+Na): 949.5446 found 949.5486.

To a solution of **26** (38.1 mg, 0.041 mmol) and ethylene glycol (0.23 mL, 4.11 mmol) in $\text{CH}_2\text{Cl}_2/\text{THF}$ (1 mL, 2/1, v/v) were added CSA (1.9 mg, 8.2 μmol) and $n\text{Bu}_4\text{NI}$ (3.0 mg, 8.2 μmol) at rt, successively. After being stirred for 16 h at same temperature, the reaction was quenched by addition of NEt_3 and extracted with AcOEt. The extracts were washed with brine, and dried over MgSO_4 , filtered and concentrated. The residual yellow oil was purified through silica gel column chromatography (hexane/AcOEt = 85/15 to 70/30) to give the recovered **26** (8.7 mg) and the diol (25.4 mg, 70%) as a colorless oil; $[\alpha]_{\text{D}}^{27} = -19.3^\circ$ (c 1.04, CHCl_3); IR (neat) cm^{-1} : 3392, 2953,

2929, 2884, 2857, 1720, 1645, 1617, 1471, 1428, 1388, 1257, 1139, 1110, 1006, 966, 836, 774, 739, 703; ^1H NMR (400 MHz, CDCl_3): δ 0.04 (3H, s), 0.05 (3H, s), 0.79 (3H, s), 0.89 (3H, d, J = 8.0 Hz), 0.92 (9H, s), 1.05 (9H, s), 1.32 (1H, br d, J = 13.2 Hz), 1.52-1.78 (6H, m), 1.83 (3H, s), 2.30 (1H, ddd, J = 6.4, 6.4, 14.4 Hz), 2.39 (1H, ddd, J = 6.0, 6.0, 14.4 Hz), 2.78 (1H, br s, D_2O exchangeable), 2.83 (2H, br t, J = 6.8 Hz), 3.43 (1H, br s, D_2O exchangeable), 3.60 (1H, br d, J = 11.6 Hz), 3.71 (br d, J = 11.6 Hz), 3.73 (3H, s), 3.73-3.92 (5H, m), 4.23-4.31 (2H, m), 4.92 (1H, br d, J = 8.0 Hz), 5.32 (1H, d, J = 8.0 Hz), 5.48 (1H, dd, J = 5.6, 15.6 Hz), 5.60-5.70 (2H, m), 5.79 (1H, d, J = 15.2 Hz), 6.12-6.25 (2H, m), 6.39 (1H, br d, J = 15.6 Hz), 7.26 (1H, dd, J = 10.0, 15.2 Hz), 7.34-7.41 (6H, m), 7.65-7.67 (4H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -4.84 (q), -4.72 (q), 11.19 (q), 15.36 (q), 18.08 (s), 19.25 (s), 20.55 (q), 25.88 (q), 26.93 (q), 32.45 (t), 33.87 (t), 36.26 (t), 36.37 (t), 39.61 (t), 39.91 (s), 40.56 (d), 51.45 (q), 61.42 (t), 69.89 (t), 70.85 (d), 70.97 (d), 71.18 (d), 71.51 (d), 72.35 (d), 74.70 (d), 119.05 (d), 127.55 (d), 127.56 (d), 128.09 (d), 128.14 (d), 129.15 (d), 129.48 (d), 129.55 (d), 130.06 (d), 131.36 (d), 132.71 (s), 133.56 (s), 133.71 (s), 135.42 (d), 135.48 (d), 140.48 (d), 145.03 (d), 167.57 (s); MS (FAB) m/z 909 ($\text{M}^+\text{+Na}$); HRMS (FAB) m/z calcd for $\text{C}_{52}\text{H}_{78}\text{O}_8\text{Si}_2\text{Na}$ ($\text{M}^+\text{+Na}$): 909.5133 found 909.5159.

To a solution of ester (6.8 mg, 7.7 μmol) in THF/MeOH/ H_2O (0.6 mL, 1/1/1, v/v/v) was added $\text{LiOH}\cdot\text{H}_2\text{O}$ (1.6 mg, 38.3 μmol). The mixture was stirred for 27 h at rt and acidified by 1

M HCl and extracted with AcOEt. The extracts were washed with brine, and dried over MgSO_4 , filtered and concentrated. The residual oil was purified through silica gel column chromatography ($\text{MeOH}/\text{CHCl}_3 = 3/97$) to give the carboxylic acid (5.6 mg, 84%) as a colorless oil; $[\alpha]_{\text{D}}^{25} = -13.3^\circ$ (c 0.98, CHCl_3); IR (neat) cm^{-1} : 3364, 2929, 2857, 1687, 1641, 1471, 1427, 1256, 1109, 965, 836, 758, 703; ^1H NMR (400 MHz, CDCl_3): δ 0.046 (3H, s), 0.051 (3H, s), 0.79 (3H, s), 0.89 (3H, d, $J = 10.2$ Hz), 0.92 (9H, s), 1.05 (9H, s), 1.33 (1H, br d, $J = 13.2$ Hz), 1.56-1.79 (6H, m), 1.83 (3H, s), 2.31 (1H, ddd, $J = 5.6, 5.6, 14.4$ Hz), 2.35-2.42 (1H, m), 2.83 (2H, br t, $J = 6.4$ Hz), 3.58 (1H, d, $J = 12.0$ Hz), 3.70 (1H, d, $J = 12.0$ Hz), 3.78-3.96 (6H, m), 4.20-4.30 (2H, m), 4.90 (1H, br d, $J = 7.2$ Hz), 5.32 (1H, d, $J = 7.2$ Hz), 5.48 (1H, dd, $J = 6.0, 15.6$ Hz), 5.60-5.70 (2H, m), 5.77 (1H, d, $J = 15.2$ Hz), 6.17-6.28 (2H, m), 6.41 (1H, d, $J = 15.6$ Hz), 7.30-7.41 (7H, m), 7.65-7.67 (4H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -4.83 (q), -4.70 (q), 11.22 (q), 15.35 (q), 18.11 (s), 19.25 (s), 20.59 (q), 26.95 (q), 32.45 (t), 33.98 (t), 36.17 (t), 36.42 (t), 39.65 (t), 39.92 (s), 40.30 (d), 61.44 (t), 69.80 (t), 70.85 (d), 70.98 (d), 71.20 (d), 71.54 (d), 72.39 (d), 74.69 (d), 118.77 (d), 127.57 (d), 127.59 (d), 127.94 (d), 128.20 (d), 129.21 (d), 129.50 (d), 129.62 (d), 129.99 (d), 131.35 (d), 133.04 (s), 133.56 (s), 133.71 (s), 135.45 (d), 135.50 (d), 141.59 (d), 146.85 (d), 171.53 (s); MS (FAB) m/z 873 (M^+H); HRMS (FAB) m/z calcd for $\text{C}_{51}\text{H}_{77}\text{O}_8\text{Si}_2$ (M^+H): 873.5157 found 873.5219.

To a solution of diol (22.3 mg, 0.026 mmol) in DMF (0.5 mL) were added imidazole (13.9 mg, 0.20 mmol) and TBSCl (15.4 mg, 0.10 mmol) successively at rt. The mixture was stirred for 2.5 h and H₂O (2 mL) was added at rt and the resulting mixture was stirred for additional 1 h and acidified by 1N HCl aq. and extracted with AcOEt. The extracts were washed with brine, and dried over MgSO₄, filtered and concentrated. The residual oil was purified through silica gel column chromatography (hexane/AcOEt = 80/20) to give the hydroxycarboxylic acid **27** (23.7 mg, 94%) as a colorless oil; $[\alpha]_D^{26} = -20.4^\circ$ (*c* 0.87, CHCl₃); IR (neat) cm⁻¹: 3462, 3071, 2929, 2857, 1687, 1640, 1617, 1471, 1428, 1389, 1362, 1304, 1256, 1137, 1077, 1005, 964, 911, 836, 774, 736, 703; ¹H NMR (400 MHz, CDCl₃): δ 0.04 (3H, s), 0.05 (3H, s), 0.08 (3H, s), 0.11 (3H, s), 0.79 (3H, s), 0.89 (9H, s), 0.90 (3H, d, *J* = 6.8 Hz), 0.92 (9H, s), 1.04 (9H, s), 1.33 (1H, br d, *J* = 13.6 Hz), 1.55-1.76 (6H, m), 1.82 (3H, s), 2.28-2.35 (1H, m), 2.36-2.45 (1H, m), 2.83 (2H, br t, *J* = 5.0 Hz), 3.54 (1H, d, *J* = 10.0 Hz), 3.66 (1H, d, *J* = 10.0 Hz), 3.76-3.87 (3H, m), 3.88-3.96 (2H, m), 4.21 (1H, d, *J* = 10.4 Hz), 4.25-4.31 (1H, m), 4.92 (1H, br d, *J* = 8.0 Hz), 5.32 (1H, d, *J* = 8.0 Hz), 5.48 (1H, dd, *J* = 5.2, 15.2 Hz), 5.57-5.69 (2H, m), 5.77 (1H, d, *J* = 15.2 Hz), 6.17-6.28 (2H, m), 6.39 (1H, d, *J* = 15.2 Hz), 7.29-7.40 (7H, m), 7.64-7.67 (4H, m); ¹³C NMR (100 MHz, CDCl₃): δ -5.73 (q), -5.59 (q), -4.83 (q), -4.71 (q), 11.21 (q), 15.58 (q), 18.06 (s), 18.10 (s), 19.28 (s), 20.57 (q), 25.82 (q), 25.89 (q), 26.95 (q), 32.12 (t), 33.90 (t), 35.65 (t), 36.47 (t), 39.66 (t), 39.96 (s), 40.37 (d), 69.97 (t), 70.80 (d), 70.85 (d), 71.03 (d), 71.47 (d), 72.26 (d), 74.41 (d), 118.76 (d), 127.50 (d), 128.02 (d), 129.19 (d), 129.34 (d), 130.03 (d), 131.61 (d), 132.72 (s), 133.82 (s), 134.04 (s), 135.44 (d), 135.50 (d), 141.53 (d), 146.86 (d), 171.70 (s); MS (FAB) *m/z* 1009 (M⁺+Na); HRMS (FAB) *m/z* calcd for C₅₇H₉₀O₈Si₃Na (M⁺+Na): 1009.5841 found 1009.5791.

To a solution of **27d** (22.7 mg, 0.023 mmol) in THF (0.5 mL) were added NEt₃ (0.011 mL, 0.080 mmol) and 2,4,6-trichlorobenzoyl chloride (0.011 mL, 0.067 mmol) successively at rt. The resulting mixture was stirred for 1 h and filtered off. The filtrate was concentrated. The residue was dissolved in PhH (7 mL) and the solution was added dropwise to a solution of 4-DMAP in PhH (4.5 mL) over 2 h at reflux. After stirred for 1 h, the resulting mixture was diluted with Et₂O and washed with water. The aqueous layer was extracted with Et₂O and the extracts were washed with brine, and dried over MgSO₄, filtered and concentrated. The residue was purified through silica gel column chromatography (hexane/AcOEt = 93/7) to give the macrolide **28** (12.9 mg, 58%) as a colorless oil; $[\alpha]_D^{27} = +11.9^\circ$ (*c* 0.72, CHCl₃); IR (neat) cm⁻¹: 2953, 2928, 2856, 1710, 1647, 1471, 1428, 1387, 1254, 1110, 1092, 1054, 1008, 973, 837, 775, 702; ¹H NMR (400 MHz, CDCl₃): δ 0.01 (3H, s), 0.02 (3H, s), 0.08 (6H, s), 0.90 (9H, s), 0.91 (9H, s), 1.02 (3H, d, *J* = 7.2 Hz), 1.04 (3H, s), 1.07 (9H, s), 1.30-1.83 (7H, m), 2.17 (1H, br d, *J* = 14.0 Hz), 2.22-2.31 (1H, m), 2.70-2.77 (1H, m), 2.88 (1H, dd, *J* = 7.2, 12.8 Hz), 3.38 (1H, d, *J* = 9.6 Hz), 3.50 (1H, d, *J* = 9.6 Hz), 3.79 (1H, ddd, *J* = 3.4, 6.8, 10.3 Hz), 3.86-3.96 (3H, m), 4.09 (1H, d, *J* = 9.2 Hz), 4.20-4.27 (1H, m), 4.78 (1H, dd, *J* = 2.2, 9.6 Hz), 5.12 (1H, br s), 5.43-5.47 (3H, m), 5.74 (1H, d, *J* = 15.2 Hz), 5.82 (1H, ddd, *J* = 7.2, 7.2, 16.0 Hz), 5.95 (1H, ddd, *J* = 4.8, 9.6, 14.4 Hz), 6.22 (1H, dd, *J* = 11.2, 14.4 Hz), 6.53 (1H, d, *J* = 15.6 Hz), 7.16 (1H, dd, *J* = 11.2, 15.6 Hz), 7.36-7.47

(6H, m), 7.67-7.72 (4H, m); ^{13}C NMR (100 MHz, CDCl_3): δ -5.64 (q), -5.62 (q), -4.71 (q), 1.11 (q), 11.52 (q), 15.00 (q), 18.21 (s), 18.30 (s), 19.38 (s), 21.11 (q), 25.94 (q), 26.94 (q), 33.39 (t), 33.88 (t), 34.13 (t), 34.90 (t), 38.73 (d), 39.58 (t), 40.30 (s), 60.56 (t), 66.02 (t), 68.95 (d), 71.28 (d), 73.03 (d), 73.53 (d), 75.24 (d), 77.32 (d), 120.34 (d), 125.01 (d), 127.55 (d), 128.86 (d), 129.12 (d), 129.25 (d), 129.33 (d), 129.43 (d), 129.45 (d), 133.96 (s), 134.06 (s), 134.71 (d), 135.41 (d), 135.50 (d), 138.09 (s), 142.90 (d), 145.34 (d), 166.75 (s); MS (FAB) m/z 969 (M^+H); HRMS (FAB) m/z calcd for $\text{C}_{57}\text{H}_{89}\text{O}_7\text{Si}_3$ (M^+H): 969.5916 found 969.5886.

To a solution of **28** (10.9 mg, 0.011 mmol) in THF (0.2 mL) was added a solution of AcOH (0.8 mg, 0.013 mmol) and TBAF (0.013 mL, 1.0 M in THF, 0.013 mmol) in THF (0.3 mL) at rt. After being stirred for 18 h at 40 °C, the mixture was concentrated. The residual yellow oil was purified through silica gel column chromatography (hexane/AcOEt = 90/10) to give the recovered **28** (2.5 mg) and the alcohol (3.7 mg, 45%) as a colorless oil; $[\alpha]_{\text{D}}^{26} = +63.0^\circ$ (c 0.03, CHCl_3) (for the enantiomer, $[\alpha]_{\text{D}}^{26} = -62.0^\circ$ (c 0.50, CHCl_3)) ; IR (neat) cm^{-1} : 3417, 2953, 2928, 2856, 1711, 1645, 1470, 1432, 1387, 1362, 1321, 1255, 1170, 1056, 1007, 973, 922, 890, 837, 775, 758; ^1H NMR (400 MHz, CDCl_3): δ -0.026 (3H, s), -0.022 (3H, s), 0.06 (3H, s), 0.08 (3H, s), 0.86 (9H, s), 0.94 (9H, s), 1.01 (3H, d, $J = 6.8$ Hz), 1.06 (3H, s), 1.35-1.45 (2H, m), 1.57-1.83

(5H, m), 1.81 (3H, s), 2.28-2.36 (2H, m), 2.68 (1H, ddd, $J = 6.2, 10.1, 12.3$ Hz), 2.81-2.90 (1H, m), 3.38 (1H, d, $J = 9.6$ Hz), 3.45 (1H, d, $J = 9.6$ Hz), 3.75-3.82 (3H, m), 3.96-4.05 (2H, m), 4.30 (1H, br t, $J = 9.6$ Hz), 5.06 (1H, br s), 5.40-5.45 (2H, m), 5.51 (1H, ddd, $J = 3.9, 10.0, 15.6$ Hz), 5.74 (1H, d, $J = 15.6$ Hz), 5.79 (1H, dt, $J = 7.2, 15.2$ Hz), 6.14 (1H, ddd, $J = 4.9, 10., 15.3$ Hz), 6.25 (1H, dd, $J = 10.8, 15.6$ Hz), 6.51 (1H, d, $J = 15.6$ Hz), 7.16 (1H, dd, $J = 10.0, 15.6$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ -5.68 (q), -5.64 (q), -4.72 (q), 11.53 (q), 15.23 (q), 18.21 (s), 18.22 (s), 21.11 (q), 25.87 (q), 25.95 (q), 32.21 (t), 33.76 (t), 34.09 (t), 34.89 (t), 38.68 (d), 39.49 (t), 40.51 (s), 68.77 (t), 66.21 (t), 68.93 (d), 71.20 (d), 73.04 (d), 73.54 (d), 77.32 (d), 80.91 (d), 120.10 (d), 125.09 (d), 128.29 (d), 128.94 (d), 129.29 (d), 135.38 (d), 138.11 (s), 143.43 (d), 125.53 (d), 166.61 (s); MS (FAB) m/z 731 (M^+H); HRMS (FAB) m/z calcd for $\text{C}_{41}\text{H}_{71}\text{O}_7\text{Si}_2$ (M^+H): 731.4738 found 731.4783.

To a solution of alcohol (7.0 mg, 9.54 μmol) and NEt_3 (0.019 mL, 0.134 mmol) in $\text{DMSO}/\text{CH}_2\text{Cl}_2$ (1 mL, 1/1, v/v) was added $\text{SO}_3 \cdot \text{pyridine}$ (10.7 mg, 0.067 mmol) at 0 °C. After being stirred for 3.5 h at same temperature, the mixture was poured into sat. NH_4Cl aq. and the aqueous layer was extracted with CH_2Cl_2 . The extracts were washed with brine, and dried over MgSO_4 , filtered and concentrated. The residue was purified through silica gel column chromatography (hexane/AcOEt = 90/10) to give the aldehyde **29** (6.0 mg, 86%) as a colorless

oil; $[\alpha]_D^{26} = +62.6^\circ$ (c 0.05, CHCl_3) (for the enantiomer, $[\alpha]_D^{26} = -69^\circ$ (c 0.57, CHCl_3)) ; IR (neat) cm^{-1} : 2926, 2855, 1717, 1708, 1646, 1459, 1386, 1256, 1092, 1056, 972, 837, 804, 774; ^1H NMR (400 MHz, CDCl_3): δ -0.013 (3H, s), -0.006 (3H, s), 0.05 (3H, s), 0.08 (3H, s), 0.86 (9H, s), 0.93 (9H, s), 1.01 (3H, d, $J = 7.2$ Hz), 1.07 (3H, s), 1.38 (1H, br d, $J = 14.0$ Hz), 1.50-1.66 (4H, m), 1.83 (3H, s), 1.80-1.87 (1H, m), 2.24-2.37 (2H, m), 2.54 (1H, ddd, $J = 2.4, 10.0, 17.2$ Hz), 2.65-2.75 (2H, m), 2.81-2.89 (1H, m), 3.43 (1H, d, $J = 10.0$ Hz), 3.47 (1H, d, $J = 10.0$ Hz), 3.86 (1H, br d, $J = 2.4$ Hz), 3.96-4.03 (1H, m), 4.31 (1H, br t, $J = 9.2$ Hz), 4.40 (1H, dd, $J = 2.4, 10.0$ Hz), 4.77 (1H, dd, $J = 2.4, 9.2$ Hz), 5.00 (1H, br s), 5.39-5.54 (3H, m), 5.74 (1H, d, $J = 15.2$ Hz), 5.79 (1H, dt, $J = 7.2$ Hz), 6.11-6.18 (1H, m), 6.25 (1H, dd, $J = 10.4, 15.6$ Hz), 6.51 (1H, d, $J = 16.0$ Hz), 7.19 (1H, dd, $J = 10.4, 15.2$ Hz), 9.80 (1H, m); MS (APCI) m/z 729 (M^+H); HRMS (APCI) m/z calcd for $\text{C}_{41}\text{H}_{69}\text{O}_7\text{Si}_2$ (M^+H): 729.4582 found 729.4568.

To a solution of **4** (73.1 mg, 0.102 mmol) in THF (0.3 mL) was added dropwise freshly prepared KHMDS (0.10 mL, 0.92 M in THF, 0.094 mmol) at -78°C . After being stirred for 15 min, a solution of **29** (6.0 mg, 8.22 μmol) in THF (0.7 mL) was added dropwise and the resulting mixture was warmed to rt over 1 h and stirred at rt for 39 h. The reaction was quenched by addition of acetone and poured into water. The aqueous layer was extracted with Et_2O and the extracts were washed with brine, and dried over MgSO_4 , filtered and concentrated. The residue

was purified by preparative TLC (hexane/AcOEt = 80/20) to give the TBS protected lasonolide A (2.7 mg, 45%) as a pale yellow oil; $[\alpha]_D^{27} = +46.7^\circ$ (c 0.18, CHCl_3) (for the enantiomer, $[\alpha]_D^{23} = -54.5^\circ$ (c 0.584, CHCl_3)) ; IR (neat) cm^{-1} : 2954, 2928, 2856, 1732, 1714, 1651, 1470, 1386, 1254, 1095, 1052, 837, 775; ^1H NMR (400 MHz, CDCl_3): δ -0.02 (3H, s), -0.10 (3H, s), 0.05 (3H, s), 0.06 (3H, s), 0.07 (3H, s), 0.08 (3H, s), 0.87 (9H, s), 0.90 (6H, d, $J = 6.4$ Hz), 0.90 (9H, s), 0.93 (9H, s), 1.00 (3 H, d, $J = 7.2$ Hz), 1.03 (3H, s), 1.31-1.38 (4H, m), 1.50-1.67 (3H, m), 1.81 (3H, s), 1.74-1.84 (1H, m), 2.05 (2H, br t, $J = 8.0$ Hz), 2.03-2.10 (2H, m), 2.26-2.35 (3H, m), 2.45-2.5 (2H, m), 2.65-2.73 (1H, m), 2.83-2.90 (1H, m), 3.4 (1H, d, $J = 9.2$ Hz), 3.47 (1H, d, $J = 9.2$ Hz), 3.68 (1H, dd, $J = 2.0, 9.8$ Hz), 3.86 (1H, br d, $J = 2.6$ Hz), 3.97 (1H, br t, $J = 10.6$ Hz), 4.17-4.25 (1H, m), 4.24 (1H, dd, $J = 5.2, 6.8$ Hz), 4.55 (2H, br s), 4.76 (1H, dd, $J = 2.8, 9.2$ Hz), 4.93 (1H, br s), 5.02 (1H, br s), 5.08 (1H, br s), 5.41-5.51 (4H, m), 5.65-5.71 (1H, m), 5.73 (1H, d, $J = 15.2$ Hz), 5.79 (1H, dt, $J = 7.7, 15.6$ Hz), 6.07-6.14 (1H, m), 6.23 (1H, dd, $J = 10.8, 14.7$ Hz), 6.50 (1H, d, $J = 16.4$ Hz), 7.15 (1H, dd, $J = 10.8, 15.6$ Hz); MS (FAB) m/z 1061 ($\text{M}^+ + \text{Na}$); HRMS (FAB) m/z calcd for $\text{C}_{59}\text{H}_{102}\text{O}_9\text{Si}_3\text{Na}$ ($\text{M}^+ + \text{Na}$): 1061.6729 found 1061.6719.

To a solution of TBS protected lasonolide A (1.6 mg, 1.73 mmol) in THF/pyridine (0.5 mL, 1/1, v/v) was added HF•pyridine (0.04 mL) at rt. The mixture was stirred for 45 h and poured into sat. NaHCO₃ aq. The aqueous layer was extracted with AcOEt and the extracts were dried over MgSO₄, filtered and concentrated. The residue was purified by preparative TLC (hexane/AcOEt = 30/70) to give the lasonolide A (**1**) (0.7 mg, 70%) as a pale yellow oil; $[\alpha]_D^{27} = +21.9^\circ$ (*c* 0.07, CDCl₃) (lit. $[\alpha]_D = +24.4^\circ$ (*c* 0.045, CDCl₃); for the enantiomer, $[\alpha]_D^{23} = -24.1^\circ$ (*c* 0.055, CDCl₃)) ; IR (neat) cm⁻¹: 3436, 2925, 2854, 1736, 1687, 1643, 1384, 1260, 1202, 1092, 971. 891, 802, 757; ¹H NMR (400 MHz, CDCl₃): δ 0.90 (6H, d, *J* = 6.4 Hz), 1.06 (2H, d, *J* = 6.8 Hz), 1.11 (3H, s), 1.32-1.37 (2H, m), 1.38-1.44 (1H, m), 1.64-1.72 (2H, m), 1.82 (3H, s), 1.86-1.92 (1H, m), 2.00-2.21 (1H, m), 2.06 (2H, br t, *J* = 8.0 Hz), 2.18-2.26 (1H, m), 2.31-2.37 (3H, m), 2.50-2.57 (2H, m), 2.70-2.77 (1H, m), 2.88 (1H, dd, *J* = 9.0, 12.9 Hz), 3.12 (1H, d, *J* = 5.2 Hz), 3.25-3.35 (2H, m), 3.41 (1H, dd, *J* = 3.0, 10.5 Hz), 3.56 (1H, dd, *J* = 3.0, 9.0 Hz), 3.64 (1H, s), 3.99 (1H, br d, *J* = 2.0 Hz), 4.02-4.10 (1H, m), 4.23-4.27 (1H, m), 4.30-4.35 (1H, m), 4.62 (2H, s), 4.81 (1H,

dd, $J = 2.0, 9.0$ Hz), 4.96 (1H, br s), 5.03 (1H, br s), 5.45-5.57 (4H, m), 5.66-5.76 (1H, m), 5.70 (1H, d, $J = 15.6$ Hz), 5.82 (1H, dt, $J = 8.0, 15.6$ Hz), 6.14 (1H, ddd, $J = 6.0, 6.0, 15.2$ Hz), 6.26 (1H, dd, $J = 10.8, 15.6$ Hz), 7.24 (1H, dd, $J = 10.9, 15.6$ Hz); ^{13}C NMR (100 MHz, CDCl_3): δ 11.49 (q), 15.29 (q), 21.18 (q), 22.55 (q), 27.80 (d), 28.09 (t), 29.76 (t), 31.08 (t), 32.61 (t), 33.72 (t), 33.84 (t), 35.05 (t), 36.69 (t), 38.37 (d), 38.57 (d), 41.30 (s), 67.67 (t), 68.92 (d), 70.29 (d), 70.77 (d), 72.46 (d), 74.68 (d), 77.20 (d), 77.92 (d), 112.41 (t), 118.26 (d), 124.48 (d), 125.10 (d), 128.87 (d), 128.97 (d), 129.05 (d), 129.63 (d), 130.83 (s), 138.87 (s), 143.68 (s), 145.00 (d), 148.23 (d), 168.42 (s), 173.84 (s); MS (APCI) m/z 697 ($\text{M}^+\text{+H}$); HRMS (APCI) m/z calcd for $\text{C}_{41}\text{H}_{61}\text{O}_9$ ($\text{M}^+\text{+H}$): 697.4316 found 697.4343.