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Total Synthesis of Leucascandrolide A

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General methods

All non-aqueous reactions were carried out using oven-dried or flame-dried glassware under a positive pressure of dry nitrogen unless otherwise noted. Tetrahydrofuran, diethyl ether, toluene, acetonitrile and methylene chloride were purified by distillation and dried by passage over activated alumina under an argon atmosphere (H_2O content < 30 ppm, Karl-Fischer titration). Benzene and 1,2-dimethoxyethane were distilled from sodium/benzophenone ketyl under an atmosphere of dry nitrogen. Methanol was distilled from anhydrous magnesium turnings and iodine under an atmosphere of dry nitrogen. Triethylamine, diisopropylamine and pyridine were distilled from KOH. Trimethylchlorosilane (TMSCl) was distilled from calcium hydride. Triethylchlorosilane (TESCl), diethylisopropylamine (Hünig's base), tributyltin hydride (Bu_3SnH), 2,4,6-trichlorobenzoylchloride (Yamaguchi reagent), 2,2,6-Trimethyl-[1,3]dioxin-4-one, 1,1,1,3,3,3-hexamethyldisilazane (HMDS), crotonaldehyde were distilled prior to use. Butyl lithium (*n*BuLi) was titrated with *s*BuOH/phenanthroline. Tetrapropyl ammonium perruthenate (TPAP),[1] (1-Diazo-2-oxo-propyl)-phosphonic acid dimethyl ester,[2] tetrabutylammonium triphenyl difluorosilicate (TBAT),[3] (*R*)-1,2-isopropylidene glyceraldehyde[4] and 2,4,6-tri-*iso*-propylphenylselenium bromide[5] were prepared according to literature procedures. 4-dimethylamino pyridine (DMAP) was recrystallized from toluene. All other commercially available reagents were used without further purification.

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[1] A. J. Bailey, W. P. Griffith, S. I. Mostafa, P. A. Sherwood, *Inorg. Chem.* **1993**, *32*, 268-271.
[2] P. Callant, L. D'Haenens, M. Vandewalle, *Synth. Commun.* **1984**, *14*, 155.
[3] A. S. Pilcher, H. L. Ammon, P. DeShong, *J. Am. Chem. Soc.* **1995**, *117*, 5166-5167.
[4] R. C. Schmid, J. D. Bryant, M. Dowlatzedah, J. L. Phillips, D. E. Prather, R. D. Schantz, N. L. Sear, C. S. Vianco, *J. Org. Chem*. **1991**, *56*, 4056.
[5] B. H. Lipshutz, T. Gross, *J. Org. Chem.* **1995**, *60*, 3572-3573.

Except as indicated otherwise, reactions were magnetically stirred and monitored by thin layer chromatography (TLC) using Merck Silica Gel 60 F^{254} plates and visualized by fluorescence quenching under UV light. In addition, TLC plates were stained using ceric ammonium molybdate or potassium permanganate stain.

Chromatographic purification of products (flash chromatography) was performed on E. Merck Silica Gel 60 (230-400 mesh) using a forced flow of eluant at 0.3-0.5 bar.[6] Concentration under reduced pressure was performed by rotary evaporation at 40 °C at the appropriate pressure. Purified compounds were further dried for 12-72 h under high vacuum (0.01 Torr). Yields refer to chromatographically and spectroscopically pure compounds, unless otherwise stated.

NMR spectra were recorded either on a Varian Mercury 300 spectrometer operating at 300 MHz and 75 MHz for ^{1}H and ^{13}C acquisitions respectively or on a Bruker DRX500 spectrometer operating at 500 MHz and 125 MHz for ^{1}H and ^{13}C acquisitions respectively. Chemical shifts (δ) are reported in ppm with the solvent resonance as the internal standard relative to chloroform (δ 7.26) and benzene (δ 7.15) for ^{1}H, and chloroform (δ 77.0) and benzene (δ 128.0) for ^{13}C. Data are reported as follows: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet; coupling constants in Hz. IR spectra were recorded on a Perkin Elmer Spectrum RXI FT-IR spectrophotometer. Optical rotations were measured on a Jasco DIP-1000 polarimeter operating at the sodium D line with a 100 mm path length cell, and are reported as follows: $[\alpha]_D^T$, concentration (g/100 ml), and solvent.

Buffers were prepared according to the following procedures:
pH 7 phosphate buffer: KH_2PO_4 (6.8 g), NaOH (1.16 g), H_2O (1000 ml)
pH 8.6 carbonate buffer: $NaHCO_3$ (42 g), Na_2CO_3 (0.53 g), H_2O (1000 ml)

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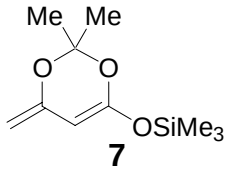
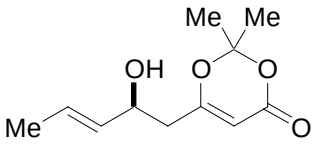
[6] Still, W. C.; Kahn, M.; Mitra, A. *J. Org. Chem.* **1978**, *43*, 2923.



7

TMS-Dienolate 7.[7] To a solution of diisopropylamine (6.70 ml, 48.0 mmol, 1.09 equiv) in anhydrous THF (30 ml) at 0 °C was added *n*BuLi (1.32 M in hexanes, 36.4 ml, 48.0 mmol, 1.09 equiv) over 15 min. The clear, colourless solution was stirred at 0 °C for 20 min, and then cooled to -78 °C. 2,2,6-Trimethyl-[1,3]dioxin-4-one (5.70 ml, 44.0 mmol, 1.00 equiv) was added neat over 10 min and the resulting yellowish solution was stirred at -78 °C for 60 min. TMSCl (6.60 ml, 52.0 mmol, 1.18 equiv) was added via cannula at -78 °C over 15 min and the reaction mixture stirred for an additional 30 min at -78 °C. The thick, orange suspension was allowed to warm to rt over 90 min and was then filtered over anhydrous Na_2SO_4 (dried at 90 °C for 24 h) under argon. The filter cake was rinsed twice with each 7 ml dry pentane and the clear orange filtrate was concentrated under reduced pressure (80 mbar). The remaining red oil was distilled (the oil bath temperature must not exceed 70 °C in order to avoid product decomposition) under reduced pressure (0.5 mbar, 40 °C) to give **7** (8.2 g, 87 % yield) as a colourless liquid, which can be stored at -18 °C under argon for an extended period of time. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 4.64 (s, 1H), 4.07 (s, 1H), 3.87 (s, 1H), 1.54 (s, 6H), 0.26 (s, 9H).



8

Aldol Adduct 8.[8] A mixture of (*R*)-Tol-BINAP (671 mg, 1.07 mmol, 2.1 mol%) and $Cu(OTf)_2$ (371 mg, 1.03 mmol, 2.0 mol%) in anhydrous THF (250 ml) was stirred at rt for 15 min giving a clear, yellow mixture. A solution of $(Bu_4N)Ph_3SiF_2$ (1.11 g, 2.05 mmol, 4.0 mol%) in THF (5 ml) was added at rt and stirring was continued for 10 min. After cooling the mixture to -78 °C, a solution of TMS-dienolate **7** (11.0 g,

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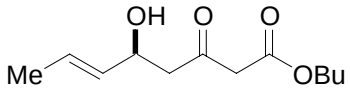
[7] R. A. Singer, E. M. Carreira, *J. Am. Chem. Soc.* **1995**, *117*, 12360-12361.
[8] J. Krüger, E. M. Carreira, *J. Am. Chem. Soc*. **1998**, *120*, 837-838.

51.3 mmol, 1.00 equiv) in THF (5 ml) was added dropwise at -78 °C, followed by the slow addition of crotonaldehyde (8.44 ml, 103 mmol, 2.00 equiv). The resulting dark red solution was stirred at -78 °C for 4 h. Trifluoroacetic acid (10.0 ml, 128 mmol, 2.50 equiv) was added and the cooling bath removed. The solution was allowed to reach rt during which time the desilylation process was monitored by TLC. Upon completion, the solution was diluted with diethyl ether (250 ml) brought to pH 7 by the careful addition of saturated, aqueous $NaHCO_3$. The layers were separated and the aqueous phase was extracted with diethyl ether (3×300 ml) and the combined organic solutions were washed with brine (300 ml), dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 3:1) provided **8** (4.79 g, 44 % yield) as a clear, colourless oil.

R_f = 0.17 (hexanes/Et_2O 1:3). **Optical Rotation:** $[\alpha]_D^{25}$ (c 1.55, $CHCl_3$) = -14.5. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.75 (ddq, 1H, *J* = 15.3, 6.5, 1.0 Hz), 5.50 (ddq, 1H, *J* = 15.3, 7.0, 1.6 Hz), 5.31 (t, 1H, *J* = 0.6 Hz), 4.42-4.31 (m, 1H), 2.47 (ddd, 1H, *J* = 14.5, 7.4, 0.6 Hz), 2.41 (ddd, 1H, *J* = 14.5, 5.8, 0.6 Hz), 1.73-1.67 (m, 9H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 168.7, 161.2, 132.3, 128.2, 106.6, 95.1, 69.7, 41.4, 25.2, 24.8, 17.6. **IR** (thin film) ν 3438, 2999, 2943, 1732, 1715, 1634, 1392, 1275, 1205, 1016, 966, 904, 807 cm^{-1}. **HRMS** (CI) calc'd for $C_{11}H_{16}O_4$ $[M]^+$, 213.1127, found, 213.1131. **HPLC**: Chiralcel OD column. hexanes/isopropanol 95:5, flow rate 0.9 ml/min, minor enantiomer 15.7, major enantiomer 17.1. The enantiomers were obtained in a ratio of 94.1:4.5 (91% *ee*).

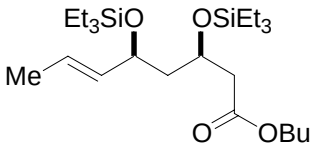


9

Keto ester 9. Dioxinone **8** (4.70 g, 22.1 mmol, 1.00 equiv) was dissolved in anhydrous, degassed (by passing an argon stream through for 1 h) *n*BuOH (1000 ml) and heated to reflux for 1 h. The solution was allowed to cool to rt and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 4:1) gave hydroxyester **9** (3.95 g, 78 % yield) as pale, yellow oil.

R_f = 0.33 (hexanes/EtOAc 2:1). **Optical Rotation:** $[\alpha]_D^{38}$ (c 0.97, $CHCl_3$) = -17.2. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.74 (ddq, 1H, *J* = 15.3, 6.5, 1.1 Hz), 5.49 (ddq, 1H,

J = 15.3, 6.6, 1.6 Hz), 4.59-4.49 (m, 1H), 4.14 (t, 2H, *J* = 6.7 Hz), 3.48 (s, 2H), 2.76 (d, 2H, *J* = 6.1 Hz), 2.61 (d, 1H, *J* = 3.6 Hz), 1.71-1.67 (m, 3H), 1.66-1.57 (m, 2H), 1.44-1.31 (m, 2H), 0.93 (t, 3H, *J* = 7.3 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 202.9, 167.1, 132.5, 131.9, 68.4, 65.3, 49.9, 49.7, 30.4, 19.0, 17.6, 13.6. **IR** (thin film) ν 3446, 2962, 2937, 2876, 1742, 1715, 1651, 1454, 1410, 1384, 1317, 1274, 1152, 1062, 1035, 967 cm^{-1}. **Anal. Calc'd** for $C_{12}H_{20}O_4Si$, C, 63.14; H, 8.83; O, 28.03; found, C, 62.98; H, 8.73. **HRMS** (MALDI) calc'd for $C_{12}H_{20}O_4Na$ $[M+Na]^+$, 251.1259, found, 251.1254.

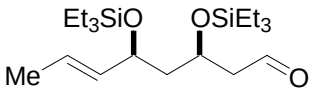


(3*R*,5*S*)-3,5-Bis-triethylsilanyloxy-oct-6-enoic acid butyl ester. To a solution of MeOH (22.5 ml) in THF (110 ml) was added triethylborane (1.0 M in THF, 17.8 ml, 17.8 mmol, 1.10 equiv) dropwise under ice cooling. After stirring for 1 h at rt, the solution was cooled to -78 °C and ketoester **9** (3.70 g, 16.2 mmol, 1.00 equiv) in THF (15 ml) was added via cannula. Stirring was continued for 20 min at -78 °C before $NaBH_4$ (3.68 g, 97.2 mmol, 6.00 equiv) was added in one portion. After 5 h at -78 °C, the reaction was quenched by the careful addition of saturated, aqueous NH_4Cl (10 ml). The solution was warmed to rt, diluted with Et_2O (150 ml), and acidified to pH 1 using HCl 1.0 M. The layers were separated and the aqueous phase was extracted with Et_2O (3 × 150 ml) and the combined organic extracts were washed with brine (200 ml), dried over anhydrous Na_2SO_4 and filtered. Concentration under reduced pressure gave a colourless oil which was azeotroped twice with MeOH (3 × 100 ml) to give crude diol which was used without further purification.

To the crude diol (16.2 mmol, 1.00 equiv) in dry DMF (16 ml) was added imidazole (5.50 g, 81.0 mmol, 5.00 equiv) followed by TESCl (6.80 ml, 40.5 mmol, 2.50 equiv) and DMAP (197 mg, 1.62 mmol, 0.10 equiv). The mixture was stirred at rt for 12 h, poured onto H_2O (30 ml). The layers were separated and the aqueous phase was extracted with pentane (3 × 100 ml). The combined organic solutions were washed with brine (100 ml), dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure to afford the crude bis-silyl ether as a single diastereoisomer (dr > 95:5 by

^{1}H NMR spectroscopy). A small amount was purified by flash chromatography (hexanes/EtOAc 19:1) for characterization purposes.

R_f = 0.53 (hexanes/EtOAc 9:1). **Optical Rotation:** $[\alpha]_D^{22}$ (c 1.1, $CHCl_3$) = -13.0. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.55 (dq, 1H, *J* = 15.3, 6.3 Hz), 5.38 (ddq, 1H, *J* = 15.3, 7.2, 1.4 Hz), 4.25-4.05 (m, 2H), 4.10-3.95 (m, 2H), 2.51 (dd, 1H, *J* = 14.7, 5.2 Hz), 2.41 (dd, 1H, *J* = 14.7, 7.4 Hz), 1.80-1.68 (m, 1H), 1.65 (dd, 3H, *J* = 6.3, 1.2 Hz), 1.63-1.53 (m, 3H), 1.41-1.24 (m, 2H), 0.95-0.86 (m, 21H), 0.60-0.49 (m, 12H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 171.9, 134.5, 126.2, 70.9, 66.9, 64.4, 46.5, 43.2, 30.8, 19.3, 17.7, 13.9, 7.0, 6.9, 5.2. **IR** (thin film) ν 2959, 2914, 2877, 1739, 1459, 1415, 1379, 1312, 1240, 1167, 1085, 1005, 967, 742 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{24}H_{50}O_4Si_2Na$ $[M+Na]^+$, 481.3145, found, 481.3143.

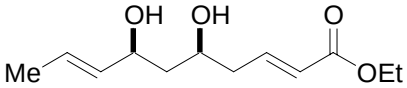


10

Aldehyde 10. To the crude ester (16.2 mmol, 1.00 equiv) in toluene (140 ml) at -78 °C was added DIBAL-H (1.5 M in toluene, 12.8 ml, 19.2 mmol, 1.20 equiv) dropwise over 20 min. The solution was stirred at -78 °C for 30 min. The reaction was quenched with MeOH (2 ml), diluted with diethyl ether (150 ml) and allowed to warm to rt. Saturated, aqueous sodium potassium tartrate (200 ml) was added and the solution was vigorously stirred at rt for 12 h. The layers were separated and the aqueous phase was extracted with Et_2O (3 × 200 ml), and the combined organic solutions were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 9:1) afforded aldehyde **10** (5.76 g, 92 % yield over 3 steps) as a clear colourless oil.

R_f = 0.46 (hexanes/EtOAc 9:1). **Optical Rotation:** $[\alpha]_D^{22}$ (c 0.28, $CHCl_3$) = -3.2. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 9.8 (dd, 1H, *J* = 3.0, 2.0 Hz), 5.58 (ddq, 1H, *J* = 15.3, 6.3, 0.6 Hz), 5.41 (ddq, 1H, *J* = 15.3, 7.2, 1.2 Hz), 4.36-4.27 (m, 1H), 4.19-4.10 (m, 1H), 2.63 (ddd, 1H, *J* = 15.7, 4.7, 2.0 Hz), 2.51 (ddd, 1H, *J* = 15.7, 6.6, 3.0 Hz), 1.84 (ddd, 1H, *J* = 13.7, 7.2, 1.9 Hz), 1.68 (dd, 3H, *J* = 6.3, 1.1 Hz), 1.66-1.60 (m, 1H), 0.94 (m, 18H), 0.57 (m, 12H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 202.4, 134.2, 126.2, 70.7, 65.4, 50.9, 46.3, 17.6, 6.9, 6.8, 5.0. **IR** (thin film) ν 2955, 2914, 2877, 1728, 1458, 1415,

1373, 1220, 1083, 1005, 967, 772, 743, 668 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{20}H_{42}O_3Na$ $[M+Na]^+$, 409.2570, found, 409.2565.



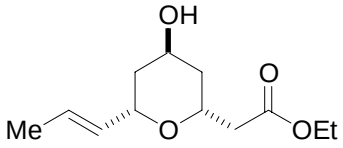
11

Ester 11. To a suspension of flame-dried lithium chloride (560 mg, 13.0 mmol, 1.20 equiv) in dry acetonitrile (100 ml) was added triethylphosphonoacetate (2.62 ml, 13.0 mmol, 1.20 equiv) and DBU (1.63 ml, 10.9 mmol, 1.00 equiv). Aldehyde **10** (4.20 g, 10.9 mmol, 1.00 equiv) in CH_3CN (20 ml) was added via cannula and the cloudy solution was stirred at rt for 2 h. The reaction was quenched with aqueous KH_2PO_4 1.0 M (100 ml). The layers were separated and the aqueous phase was extracted with pentane (3 × 100 ml). The combined pentane layers were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure to afford the crude ester ($\mathbf{R_f}$ = 0.46 (hexanes/EtOAc 9:1)) which was used without further purification.

To the crude bis-triethylsilyl ether in THF (100 ml) was added dropwise at 0 °C a solution of TBAF (1.0 M in THF, 27.3 ml, 27.3 mmol, 2.50 equiv). After stirring at rt for 2 h, the dark red solution was quenched with saturated, aqueous $NaHCO_3$. The layers were separated, the aqueous phase was extracted with Et_2O (3 × 200 ml) and the combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Flash chromatography (hexanes/EtOAc 1:1) afforded diol **11** (1.97g, 80 % yield over 2 steps) as a clear colourless oil.

$\mathbf{R_f}$ = 0.31 (hexanes/EtOAc 1:1). **Optical Rotation:** $[\alpha]_D^{29}$ (c 1.06, $CHCl_3$) = -12.2. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 6.97 (dt, 1H, *J* = 15.4, 7.4 Hz), 5.90 (dt, 1H, *J* = 15.7, 1.5 Hz), 5.70 (ddq, 1H, *J* = 15.3, 6.4, 0.9 Hz), 5.50 (ddq, 1H, *J* = 15.3, 7.0, 1.2 Hz), 4.37-4.29 (m, 1H), 4.19 (q, 2H, *J* = 7.1 Hz), 4.09-3.98 (m, 1H), 3.35 (br. s, 1H), 2.45-2.32 (m, 2H), 2.26 (br. s, 1H), 1.72-1.68 (m, 3H), 1.66-1.60 (m, 2H), 1.28 (t, 3H, *J* = 7.1 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 166.4, 144.9, 133.5, 127.0, 123.9, 73.6, 70.8, 60.4, 42.7, 40.6, 17.6, 14.2. **IR** (thin film) ν 3395, 2979, 2939, 1719, 1655, 1446, 1370, 1319, 1271, 1194, 1164, 1095, 1044, 969, 924, 852 cm^{-1}. **Anal. Calc'd** for

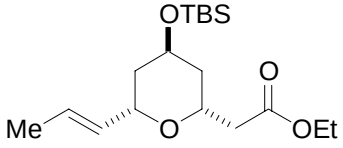
$C_{12}H_{20}O_4$, C, 63.14; H, 8.83; O, 28.03; found, C, 63.11; H, 8.88. **HRMS** (MALDI) calc'd for $C_{12}H_{20}O_4Na$ $[M+Na]^+$, 251.1259, found, 251.1252.



12

Tetrahydropyran 12. To a solution of diol **11** (1.80 g, 8.10 mmol, 1.00 equiv) in THF (160 ml) at 0 °C was added *t*BuOK (91.0 mg, 0.81 mmol, 10 mol%) in one portion. After stirring at 0 °C for 30 min, the reaction was quenched with pH 7 phosphate buffer, the layers were separated, and the aqueous phase was extracted with Et_2O (3 × 200 ml). The combined organic layers were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 3:2) provided tetrahydropyran **12** (1.13 g, 63 % yield) as a clear colourless oil (diastereoselectivity 10:1 by 1H NMR spectroscopy by integration of the signals at 2.39 and 2.81 ppm resp.).

R_f = 0.43 (hexanes/EtOAc 1:1). **Optical Rotation:** $[\alpha]_D^{38}$ (c 1.02, $CHCl_3$) = -4.3. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.69 (ddq, 1H, *J* = 15.4, 6.2, 1.6 Hz), 5.45 (ddq, 1H, *J* = 15.4, 6.5, 1.1 Hz), 4.34-4.22 (m, 3H), 4.14 (q, 2H, *J* = 7.1 Hz), 2.59 (dd, 1H, *J* = 15.2, 7.0 Hz), 2.38 (dd, 1H, *J* = 15.2, 6.4 Hz), 1.78-1.46 (m, 4H), 1.68 (ddd, 3H, *J* = 6.5, 1.0, 1.5 Hz), 1.25 (t, 3H, *J* = 7.1 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 171.4, 131.8, 127.0, 72.3, 68.3, 64.1, 60.4, 41.3, 38.0, 37.9, 17.8, 14.1. **IR** (thin film) ν 3453, 2978, 2918, 1737, 1376, 1344, 1300, 1197, 1165, 1070, 1045, 968, 930 cm^{-1}. **Anal. Calc'd** for $C_{12}H_{20}O_4$, C, 63.14; H, 8.83; O, 28.03; found, C, 63.17; H, 8.76. **HRMS** (MALDI) calc'd for $C_{12}H_{20}O_4Na$ $[M+Na]^+$, 251.1259, found, 251.1254.

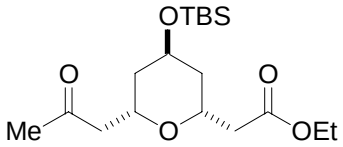


13

Silyl ether 13. To a solution of alcohol **12** (1.12 g, 4.90 mmol, 1.00 equiv) in anhydrous DMF (5 ml) at rt were added imidazole (1.33 g, 19.6 mmol, 4.00 equiv), TBSCl (1.48 g,

9.80 mmol, 2.00 equiv) and DMAP (60.0 mg, 0.49 mmol, 10 mol%). To the resulting clear solution was added H_2O (50 ml) after stirring for 20 h. The layers were separated, the aqueous phase was extracted with pentane (3 × 100 ml) and the combined organic layers were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 9:1) gave **13** (1.61 g, 96 % yield) as a colourless oil.

R_f = 0.34 (hexanes/EtOAc 9:1). **Optical Rotation:** $[\alpha]_D^{22}$ (c 1.05, $CHCl_3$) = -1.4. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.66 (ddq, 1H, *J* = 15.4, 6.4, 1.1 Hz), 5.46 (ddq, 1H, *J* = 15.4, 6.2, 1.5 Hz), 4.31-4.21 (m, 2H), 4.21-4.16 (m, 1H), 4.13 (q, 2H, *J* = 7.1 Hz), 2.59 (dd, 1H, *J* = 14.9, 6.9 Hz), 2.35 (dd, 1H, *J* = 14.9, 6.6 Hz), 1.69-1.66 (m, 3H), 1.65-1.38 (m, 4H), 1.25 (t, 3H, *J* = 7.1 Hz), 0.9 (s, 9H), 0.05 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 171.2, 132.1, 126.8, 72.3, 68.5, 64.7, 60.3, 41.6, 39.0, 38.6, 25.8, 18.0, 17.8, 14.2, -4.9. **IR** (thin film) ν 2954, 2928, 2857, 1740, 1472, 1346, 1298, 1254, 1194, 1163, 1049, 965, 940, 837 cm^{-1}. **Anal. Calc'd** for $C_{18}H_{34}O_4Si$, C, 63.11; H, 10.00; O, 18.68; Si, 8.20; found, C, 63.26; H, 9.90. **HRMS** (MALDI) calc'd for $C_{12}H_{20}O_4Na$ $[M+Na+H-TBS]^+$, 251.1259, found, 251.1255.

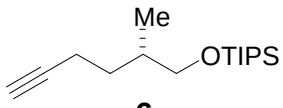


14

Methyl ketone 14. To a solution of olefin **13** (1.61 g, 4.70 mmol, 1.00 equiv) in DMF/H_2O 7:1 (64 ml) were added $PdCl_2$ (170 mg, 0.90 mmol, 20 mol%) and CuCl (560 mg, 5.60 mmol, 1.20 equiv). The reaction mixture was stirred at rt for 48 h and air was bubbled through the solution during this time via a Pasteur pipette. The solution was diluted with H_2O (100 ml), the layers were separated and the aqueous phase was extracted with Et_2O (5 × 150 ml). The combined diethyl ether layers were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 4:1) provided methyl ketone **14** (1.46 g, 86 % yield) as a clear colourless oil.

R_f = 0.42 (hexanes/EtOAc 4:1). **Optical Rotation:** $[\alpha]_D^{26}$ (c 0.99, $CHCl_3$) = -0.2. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 4.30-4.20 (m, 2H), 4.19-4.15 (m, 1H), 4.11 (q, 2H,

J = 7.1 Hz), 2.56 (dd, 1H, *J* = 14.9, 8.5 Hz), 2.45 (dd, 1H, *J* = 14.8, 8.2 Hz), 2.35 (dd, 1H, *J* = 14.9, 4.7 Hz), 2.32 (dd, 1H, *J* = 14.8, 5.4 Hz), 2.16 (s, 3H), 1.66-1.52 (m, 2H), 1.46-1.32 (m, 2H), 1.24 (t, 3H, *J* = 7.1 Hz), 0.9 (s, 9H), 0.05 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 207.4, 171.0, 68.8, 64.5, 60.3, 50.0, 41.4, 38.8, 38.5, 30.5, 30.4, 25.7, 18.0, 14.1, -5.0. **IR** (thin film) ν 2954, 2929, 2857, 1738, 1717, 1472, 1418, 1385, 1360, 1281, 1254, 1178, 1157, 1097, 1061, 1039, 942, 887, 836 cm^{-1}. **Anal. Calc'd** for $C_{18}H_{34}O_5Si$, C, 60.30; H, 9.56; O, 22.31; Si, 7.83; found, C, 60.34; H, 9.50. **HRMS** (MALDI) calc'd for $C_{18}H_{34}O_5SiNa$ $[M+Na]^+$, 381.2073, found, 381.2068.



6

Alkyne 6. To a solution of alcohol **15**[9] (7.15 g, 26.0 mmol, 1.00 equiv) in CH_2Cl_2 (150 ml) were added TEMPO (78.0 mg, 0.52 mmol, 2.0 mol%) and KBr (310 mg, 2.60 mmol, 10 mol%) at rt and the resulting solution was cooled to 0 °C. Aqueous sodium hypochlorite (13%, 30.0 ml, 52.0 mmol, 2.00 equiv) in pH 8.6 phosphate buffer (110 ml) were added portionwise and the biphasic solution vigorously stirred at 0 °C for 15 min. The reaction was quenched with MeOH (10 ml), the layers were separated and the aqueous solution was extracted with CH_2Cl_2 (3 × 150 ml). The combined organic solutions were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure to yield the aldehyde as a clear liquid which was used without further purification.

To a solution of aldehyde (26.0 mmol, 1.00 equiv) in MeOH (300 ml) were added K_2CO_3 (7.20 g, 54.0 mmol, 2.00 equiv) and (1-Diazo-2-oxo-propyl)-phosphonic acid dimethyl ester (6.50 g, 33.8 mmol, 1.30 equiv). The cloudy solution was stirred at rt for 16 h before being diluted with hexanes (300 ml) and washed with sat. aq. $NaHCO_3$. The aqueous layer was extracted with hexanes (3 × 200 ml), washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure to afford alkyne **6** (6.13 g, 87 % yield over 2 steps).

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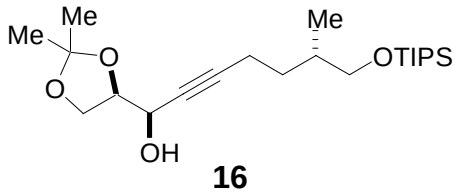
[9] J. W. Bode, E.M. Carreira, *J. Am. Chem. Soc.* **2001**, *123*, 3611-3612.

R_f = 0.26 (hexanes). **Optical Rotation:** $[\alpha]_D^{22}$ (c 0.96, $CHCl_3$) = -0.2. **^{1}H-NMR** (300 MHz, $CDCl_3$) 3.54-3.47 (m, 2H), 2.32-2.11 (m, 2H), 1.90 (t, 1H, *J* = 2.8 Hz), 1.82-1.62 (m, 2H), 1.40-1.26 (m, 1H), 1.10-1.00 (m, 21H), 0.89 (d, 3H, *J* = 6.5 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 84.6, 68.1, 68.0, 35.0, 32.1, 18.0, 16.4, 16.2, 12.0. **IR** (thin film) ν 2944, 2867, 2120, 1463, 1389, 1367, 1246, 1149, 1102, 1070, 1048, 1014, 996, 918, 882, 791, 681, 630. cm^{-1}.

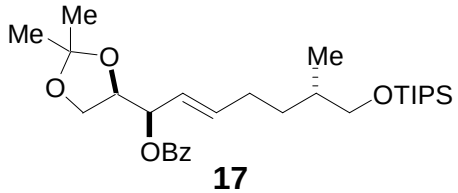


16

Propargylic Alcohol 16. Zinc (II) triflate (2.23 g, 6.14 mmol, 1.10 equiv) and (-)-Methyl ephedrine (1.10 g, 6.14 mmol, 1.10 equiv) were suspended in anhydrous toluene (15 ml) and purged with N_2 for 15 min. Et_3N (0.940 ml, 6.70 mmol, 1.20 equiv) was added in one portion and the white slurry stirred at rt for 3 h. Alkyne **6** (1.50 g, 5.59 mmol, 1.00 equiv) was added in one portion, followed after 30 min by (*R*)-1,2-isopropylidene glyceraldehyde (**5**) (1.16 g, 8.94 mmol, 1.60 equiv) (added in **one portion**). The cloudy mixture was stirred for 48 h and then quenched with sat. aq. NH_4Cl (50 ml). The layers were separated and the aqueous phase extracted with Et_2O (3 × 200 ml), washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by gradient flash chromatography (hexanes/EtOAc 9:1 4:1) provided propargylic alcohol **16** (1.66 g, 75 % yield, dr 94:6 by 1H NMR by integration of the signals at 4.28 and 4.49 ppm resp.) as a clear colourless oil.

R_f = 0.52 (hexanes/EtOAc 2:1). **Optical Rotation:** $[\alpha]_D^{27}$ (c 1.00, $CHCl_3$) = +12.4. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 4.31-4.25 (m, 1H), 4.17-4.05 (m, 2H), 3.89-3.83 (m, 1H), 3.51 (d, 2H, *J* = 5.6 Hz), 2.29-2.20 (m, 2H), 1.76-1.63 (m, 2H), 1.45 (s, 3H), 1.37 (s, 3H), 1.36-1.22 (m, 1H), 1.09-1.03 (m, 21H), 0.90 (d, 3H, *J* = 6.7 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 110.4, 87.4, 79.3, 77.0, 68.1, 66.3, 64.7, 35.1, 32.0, 26.9, 25.3, 18.0, 16.5, 16.4, 12.0. **IR** (thin film) ν 3448, 2943, 2892, 2866, 2231, 1463, 1382, 1255, 1215, 1152, 1101, 1071, 918, 882, 855, 798, 682, 659 cm^{-1}. **Anal. Calc'd** for

$C_{22}H_{42}O_4Si$, C, 66.28; H, 10.62; O, 16.05; Si, 7.05; found, C, 66.09; H, 10.74. **HRMS** (MALDI) calc'd for $C_{22}H_{42}O_4SiNa$ $[M+Na]^+$, 421.2750, found, 421.2745.



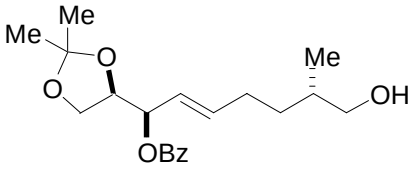
17

Benzoate 17. To a solution of propargylic alcohol **16** (1.65 g, 4.14 mmol, 1.00 equiv) in anhydrous THF (40 ml) at rt was added LAH (785 mg, 20.7 mmol, 5.00 equiv) and the suspension was stirred for 5 h. The reaction was carefully quenched with ethyl acetate (15 ml). Sodium sulfate decahydrate was added and the suspension stirred for 12 h. The solids were filtered off and the filtrate was concentrated under reduced pressure. The resulting colourless oil was used without further purification.

To a solution of crude alcohol (1.67 g, 4.14 mmol, 1.00 equiv) in dry CH_2Cl_2 (40 ml) were added Et_3N (1.12 ml, 8.00 mmol, 2.00 equiv), benzoyl chloride (0.930 ml, 8.00 mmol, 2.00 equiv) and DMAP (97.0 mg, 0.80 mmol, 20 mol%) at 0 °C. The solution was stirred at rt for 15 h before being quenched with saturated, aqueous $NaHCO_3$ (40 ml). The aqueous layer was extracted with Et_2O (3×50 ml). The combined organic solutions were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 9:1) afforded benzoate **17** (1.89 g, 90 % yield over 2 steps) as a clear colourless oil.

R_f = 0.26 (hexanes/EtOAc 9:1). **Optical Rotation:** $[\alpha]_D^{22}$ (c 1.00, $CHCl_3$) = +10.4. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 8.10-8.04 (m, 2H), 7.59-7.52 (m, 1H), 7.47-7.40 (m, 2H), 6.00-5.83 (m, 1H), 5.60-5.45 (m, 2H), 4.36-4.28 (m, 1H), 4.04 (dd, 1H, *J* = 8.6, 6.6 Hz), 3.83 (dd, 1H, *J* = 8.6, 6.0 Hz), 3.54-3.43 (m, 2H), 2.15-1.98 (m, 2H), 1.64-1.49 (m, 2H), 1.45 (s, 3H), 1.37 (s, 3H), 1.25-1.00 (m, 22H), 0.88 (d, 3H, *J* = 6.6 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 165.7, 137.8, 132.9, 130.4, 129.8, 128.3, 123.7, 110.0, 76.8, 75.7, 68.3, 65.8, 35.6, 32.3, 29.9, 26.5, 25.5, 18.0, 16.6, 12.0. **IR** (thin film) ν 2942, 2866, 1723, 1462, 1452, 1381, 1370, 1315, 1269, 1215, 1155, 1110, 1070, 1026, 972, 882, 851, 794, 711, 682 cm^{-1}. **Anal. Calc'd** for $C_{29}H_{48}O_5Si$, C, 69.00; H, 9.58; O, 15.85; Si,

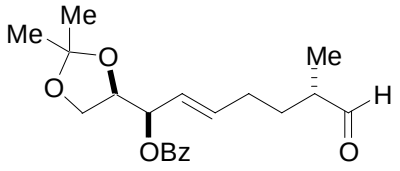
5.56; found, C, 69.17; H, 9.43. **HRMS** (MALDI) calc'd for $C_{29}H_{48}O_5SiNa$ $[M+Na]^+$, 527.3169, found, 527.3164.



18

Alcohol 18. To a solution of **17** (1.87 g, 3.70 mmol, 1.00 equiv) in dry THF (40 ml) was added TBAF (1.0 M in THF, 4.07 ml, 4.07 mmol, 1.10 equiv) at 0 °C. The solution was stirred at 0 °C for 12 h, then at rt for another 12 h. Saturated aqueous $NaHCO_3$ (40 ml) was added and the aqueous layer was extracted with Et_2O (3×50 ml). The combined organic solutions were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 2:1) gave alcohol **18** (1.24 g, 96 % yield) as clear colourless oil.

R_f = 0.68 (hexanes/EtOAc 1:1). **Optical Rotation:** $[\alpha]_D^{22}$ (c 0.98, $CHCl_3$) = +15.6. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 8.09-8.04 (m, 2H), 7.60-7.52 (m, 1H), 7.48-7.40 (m, 2H), 6.00-5.86 (m, 1H), 5.57-5.47 (m, 2H), 4.33 (ddd, 1H, *J* = 6.1, 6.1, 6.0 Hz), 4.05 (dd, 1H, *J* = 8.6, 6.1 Hz), 3.82 (dd, 1H, *J* = 8.6, 6.0 Hz), 3.51-3.37 (m, 2H), 2.22-1.98 (m, 2H), 1.67-1.47 (m, 2H), 1.45 (s, 3H), 1.37 (s, 3H), 1.29-1.13 (m, 1H), 0.90 (d, 3H, *J* = 6.6 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 165.7, 137.3, 133.0, 130.3, 129.7, 128.4, 124.1, 110.1, 76.8, 75.6, 68.0, 65.8, 35.3, 32.1, 29.8, 26.5, 25.4, 16.5. **IR** (thin film) ν 3436, 2985, 2930, 1720, 1452, 1371, 1316, 1270, 1215, 1177, 1156, 1112, 1069, 1026, 974, 848 cm^{-1}. **Anal. Calc'd** for $C_{20}H_{28}O_5$, C, 68.94; H, 8.10; O, 22.96; found, C, 69.11; H, 8.11. **HRMS** (MALDI) calc'd for $C_{20}H_{28}O_5Na$ $[M+Na]^+$, 371.1835, found, 371.1829.

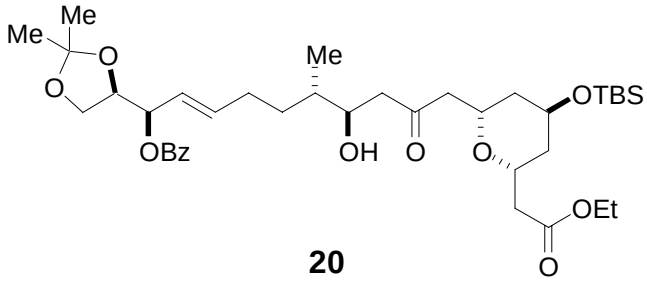


19

Aldehyde 19. To a solution of alcohol **18** (700 mg, 2.01 mmol, 1.00 equiv) in anhydrous CH_2Cl_2 were added 4 Å molecular sieves (1.00 g), NMO (353 mg,

3.00 mmol, 1.50 equiv) and the mixture was stirred at rt for 30 min. TPAP (35.0 mg, 0.10 mmol, 5.0 mol%) was added in one portion and the dark green mixture was stirred at rt for 10 min. The crude reaction mixture was filtered over silica gel using hexanes/EtOAc 1:1 as eluant and the filtrate was concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 2:1) provided aldehyde **19** (600 mg, 87 % yield) as a clear, colourless oil.

R_f = 0.54 (hexanes/EtOAc 2:1). **Optical Rotation:** $[\alpha]_D^{25}$ (c 1.03, $CHCl_3$) = +29.3. **^{1}H-NMR** (300 MHz, C_6D_6) δ 9.19 (d, 1H, *J* = 1.6 Hz), 8.26-8.20 (m, 2H), 7.12-7.00 (m, 3H), 5.75-5.68 (m, 1H), 5.65 (dd, 1H, *J* = 6.7, 6.6 Hz), 5.44 (ddt, 1H, *J* = 15.4, 7.6, 1.4 Hz), 4.17 (ddd, 1H, *J* = 6.2, 6.2, 6.2 Hz), 3.80-3.71 (m, 2H), 1.82-1.64 (m, 3H), 1.48 (s, 3H), 1.44-1.31 (m, 1H), 1.29 (s, 3H), 1.04-0.96 (m, 1H), 0.66 (d, 3H, *J* = 7.0 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 204.6, 165.6, 135.9, 133.0, 130.2, 129.7, 128.4, 125.1, 110.0, 76.7, 75.2, 65.7, 45.6, 29.6, 29.4, 26.4, 25.4, 13.2. **IR** (thin film) ν 2985, 2934, 1720, 1452, 1372, 1315, 1269, 1215, 1177, 1156, 1112, 1069, 1026, 972, 849, 713 cm^{-1}. **Anal. Calc'd** for $C_{20}H_{26}O_5$, C, 69.34; H, 7.56; O, 23.09; found, C, 69.29; H, 7.60. **HRMS** (MALDI) calc'd for $C_{20}H_{26}O_5Na$ $[M+Na]^+$, 369.1678, found, 369.1672.

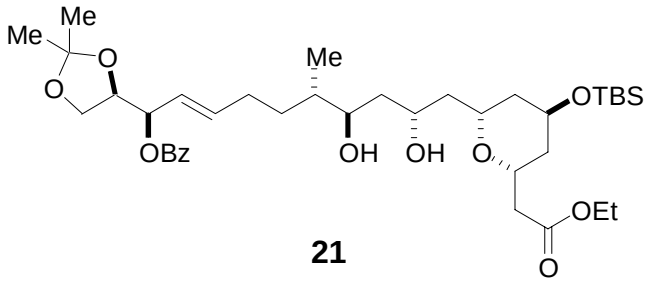


20

Hydroxyketone 20. To a solution of methylketone **14** (25.8 mg, 0.0722 mmol, 1.00 equiv) in dry ether (1 ml) was added Hünigs base (19 µl, 0.108 mmol, 1.50 equiv). The solution was cooled to -78 °C and Bu_2BOTf (1M in CH_2Cl_2, 108µl, 0.108 mmol, 1.50 equiv) was added dropwise. The resulting white slurry was stirred at -78° C for 30 min, whereupon aldehyde **19** (30 mg, 0.0866 mmol, 1.20 equiv) in Et_2O (0.7 ml) was added slowly over 5 min. The mixture was stirred at -78 °C for 5 h. The reaction was quenched by the addition of MeOH (0.6 ml) and pH 7 phosphate buffer (0.1 ml). The resulting solution was placed at 0 °C followed by the addition of 30 % H_2O_2/MeOH (1:2, 0.3 ml) and stirred at rt for 12 h. The mixture was diluted with H_2O (5 ml) and the

aqueous phase was extracted with Et_2O (3×5 ml). The combined organic solutions were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. The crude product was purified by flash chromatography (hexanes/EtOAc 3:1) to give aldol adduct **20** (40.6 mg, 80 % yield) as a colourless oil and as a single diastereoisomer (dr > 95:5 by ^{1}H NMR spectroscopy).

R_f = 0.30 (hexanes/EtOAc 2:1). **Optical Rotation:** $[\alpha]_D^{22}$ (c 1.12, $CHCl_3$) = +16.0. **^{1}H-NMR** (500 MHz, C_6D_6) δ 8.34-8.30 (m, 2H), 7.25-7.11 (m, 3H), 5.97 (ddt, 1H, *J* = 15.4, 6.7, 1.2 Hz), 5.87 (t, 1H, *J* = 7.33 Hz), 5.65 (ddt, 1H, *J* = 15.5, 7.6, 1.5 Hz), 4.56-4.49 (m, 2H), 4.32 (ddd, 1H, *J* = 6.4, 6.4, 6.4 Hz), 4.10-4.04 (m, 2H), 4.00-3.94 (m, 2H), 3.91-3.88 (m, 2H), 3.17 (d, 1H, *J* = 3.4 Hz), 2.54 (dd, 1H, *J* = 15.1, 7.8 Hz), 2.50 (dd, 1H, *J* = 15.0, 8.0 Hz), 2.45 (dd, 1H, *J* = 17.0, 9.7 Hz), 2.36 (dd, 1H, *J* = 17.0, 2.5 Hz), 2,27 (dd, 1H, *J* = 15.1, 5.48 Hz), 2.16 (dd, 1H, *J* = 15.0, 4.9 Hz), 2.13-2.06 (m, 1H), 1.98-1.89 (m, 1H), 1.70-1.60 (m, 1H), 1.59-1.48 (m, 3H), 1.58 (d, 3H, *J* = 0.3 Hz), 1.39 (d, 3H, *J* = 0.5 Hz), 1.30-1.21 (m, 3H), 1.08 (t, 3H, *J* = 7.1 Hz), 1.05 (s, 9H), 0.91 (d, 3H, *J* = 6.8 Hz), 0.12 (s, 3H), 0.11 (s, 3H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 210.9, 171.0, 165.7, 137.3, 133.0, 130.4, 129.8, 128.3, 124.1, 110.0, 76.8, 75.6, 71.1, 68.9, 68.8, 65.8, 64.5, 60.4, 49.7, 47.0, 41.3, 38.8, 38.5, 37.6, 31.2, 30.0, 26.5, 25.8, 25.5, 18.1, 15.0, 14.2, -4.9. **IR** (thin film) ν 3518, 2930, 2857, 1722, 1602, 1585, 1472, 1452, 1371, 1315, 1269, 1159, 1111, 1069, 972, 942, 837, 806, 775, 714 cm^{-1}. **Anal. Calc'd** for $C_{38}H_{60}O_{10}Si$, C, 64.74; H, 8.58; O, 22.70; Si, 3.98; found, C, 64.92; H, 8.38. **HRMS** (MALDI) calc'd for $C_{38}H_{60}O_{10}SiNa$ $[M+Na]^+$, 727.3853, found, 727.3748.

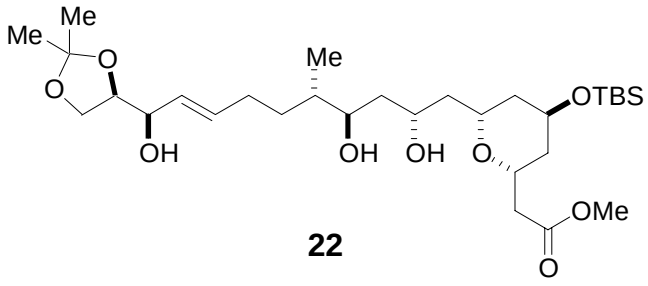


21

Diol 21. A solution of tetramethylammonium triacetoxy borohydride (1.36 g, 5.18 mmol, 5.00 equiv) in acetonitrile/acetic acid 1:1 (5 ml) was stirred for 20 min at rt and then added dropwise over 10 min to a solution of aldol adduct **20** (730 mg, 1.03 mmol, 1.00 equiv) in dry acetonitrile (10 ml) at -40 °C. After 70 h at -40 °C and 1 h at 0 °C, the reaction was quenched by the addition of saturated, aqueous sodium

potassium tartrate (10 ml) and stirred at 0 °C for 4 h. The aqueous layer was extracted with ethyl acetate (3 × 50 ml). The combined organic solutions were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 2:1), followed by azeotropic drying with benzene provided 1,3-*anti*-diol **21** (544 mg, 97 % yield) as a single diastereoisomer (dr > 95:5 by ^{1}H NMR spectroscopy).

R_f = 0.28 (hexanes/EtOAc 2:1). **Optical Rotation:** $[\alpha]_D^{27}$ (c 1.07, $CHCl_3$) = +3.8. **^{1}H-NMR** (500 MHz, C_6D_6) δ 8.25-8.21 (m, 2H), 7.12-7.01 (m, 3H), 5.91 (dt, 1H, *J* = 15.4, 6.8 Hz), 5.79 (dd, 1H, *J* = 7.4, 6.9 Hz), 5.56 (dd, 1H, *J* = 15.4, 7.5 Hz), 4.40-4,35 (m, 1H), 4.24-4.10 (m, 4H), 4.02-3.95 (m, 2H), 3.86-3.77 (m, 2H), 3.79-3.77 (m, 2H), 3.35 (d, 1H, *J* = 3.0 Hz), 2.25 (dd, 1H, *J* = 15.0, 8.8 Hz), 2.09 (dd, 1H, *J* = 15.0, 4.4 Hz), 2.12-2.05 (m, 1H), 1.96-1.89 (m, 1H), 1.76-1.69 (m, 2H), 1.64-1.53 (m, 2H), 1.49 (s, 3H), 1.42-1.36 (m, 2H), 1.30 (s, 3H), 1.32-1.22 (m, 2H), 1.20-1.10 (m, 3H), 0.99 (t, 3H, *J* = 7.1 Hz), 0.94 (s, 9H), 0.87 (d, 3H, *J* = 6.8), 0.01 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 171.2, 165.6, 137.6, 132.9, 130.4, 129.7, 128.3, 123.8, 110.0, 76.8, 75.6, 73.7, 72.2, 70.7, 68.8, 65.8, 64.3, 60.7, 41.9, 41.1, 39.5, 38.7, 38.2, 31.4, 30.1, 26.5, 25.8, 25.4, 18.0, 15.0, 14.2, 14.1, -4.9. **IR** (thin film) ν 3468, 2930, 2858, 1721, 1368, 1311, 1269, 1160, 1109, 1068, 1038, 837, 774, 712 cm^{-1}. **Anal. Calc'd** for $C_{38}H_{62}O_{10}Si$, C, 64.56; H, 8.84; O, 22.63; Si, 3.97; found, C, 64.34; H, 9.08. **HRMS** (MALDI) calc'd for $C_{38}H_{62}O_{10}SiNa$ $[M+Na]^+$, 729.4010, found, 729.4021.

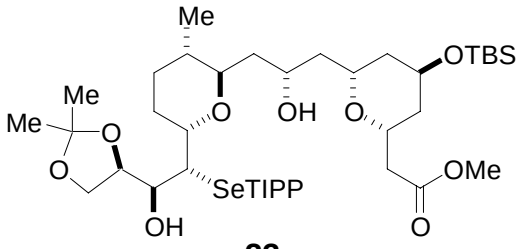


22

Triol 22. To a solution of benzoate **21** (400 mg, 0.566 mmol, 1.00 equiv) in anhydrous methanol (6 ml) was added solid potassium carbonate (391 mg, 2.83 mmol, 5.00 equiv) in one portion. The solution was stirred at rt for 40 h before being diluted with CH_2Cl_2 (20 ml) and washed with HCl 1.0 M (20 ml). The aqueous phase was extracted with CH_2Cl_2 (4 × 20 ml). The combined organic solutions were washed with brine, dried

over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 2:3) followed by azeotropic drying with benzene provided triol **22** (305 mg, 92 % yield) as a clear, colourless oil.

R_f = 0.37 (hexanes/EtOAc 1:2). **Optical Rotation:** $[\alpha]_D^{23}$ (c 1.05, $CHCl_3$) = +0.4. **^{1}H-NMR** (500 MHz, C_6D_6) δ 5.73 (ddt, 1H, *J* = 15.5, 6.3, 1.0 Hz), 5.46 (ddt, 1H, *J* = 15.4, 6.6, 1.4 Hz), 4.37-4.32 (m, 1H), 4.19 (br. s, 1H), 4.14-4.09 (m, 2H), 3.97-3.88 (m, 3H), 3.82 (t, 1H, *J* = 2.7 Hz), 3.74-3.68 (m, 2H), 3.38 (s, 3H), 3.31 (br. s, 1H), 2.25 (dd, 1H, *J* = 15.0, 8.9 Hz), 2.19 (br. s, 1H), 2.18-2.10 (m, 1H), 2.05 (dd, 1H, *J* = 15.0, 4.3 Hz), 2.02-1.94 (m, 1H), 1.80-1.71 (m, 2H), 1.69-1.58 (m, 2H), 1.45-1.40 (m, 1H), 1.38 (d, 3H, *J* = 0.5 Hz), 1.38-1.27 (m, 6H), 1.19-1.08 (m, 3H), 0.94 (s, 9H), 0.92 (d, 3H, *J* = 6.8 Hz), 0.00 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 171.7, 135.4, 127.7, 109.7, 79.0, 74.3, 73.6, 72.1, 70.5, 68.7, 65.9, 64.3, 51.8, 41.2, 40.8, 39.4, 38.8, 38.7, 38.1, 31.6, 30.0, 26.8, 25.8, 25.3, 18.0, 15.0, -4.9. **IR** (thin film) ν 3468, 2929, 2858, 1741, 1462, 1439, 1377, 1254, 1207, 1160, 1064, 1033, 837, 774 cm^{-1}. **Anal. Calc'd** for $C_{30}H_{56}O_9Si$, C, 61.19; H, 9.59; O, 24.45; Si, 4.77; found, C, 61.01; H, 9.64. **HRMS** (MALDI) calc'd for $C_{30}H_{56}O_9SiNa$ $[M+Na]^+$, 611.3591, found, 611.3586.



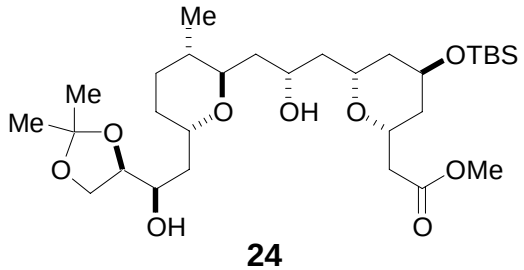
23

Selenide 23. To a solution of $(TIPPSe)_2$ (20.1 mg, 0.0357 mmol, 2.10 equiv) in dry CH_2Cl_2 (0.3 ml) was added bromine (0.113 M in CH_2Cl_2, 0.3 ml, 2.0 equiv) at -78 °C in 3 portions over 2 min. The resulting yellow mixture was stirred at -78 °C for 10 min and was then allowed to warm to rt.

To a solution of allylic alcohol **22** (10 mg, 0.0170 mmol, 1.00 equiv) and 2,6-di-*tert*-butyl-4-methylpyridine (17.4 mg, 0.0849 mmol, 5.00 equiv) in CH_2Cl_2 (1.8 ml) at -78 °C was added dropwise over 60 min the solution of 2,4,6-tri-*iso*-propylphenylselenylbromide. After 2 h at -78 °C, the reaction was quenched by addition of saturated, aqueous $NaHCO_3$ (2 ml). The mixture was allowed to warm to rt. The aqueous phase was extracted with Et_2O (3 × 5 ml). The combined organic solutions

were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 3:1) followed by azeotropic drying with benzene afforded selenide **23** (10.9 mg, 74 % yield, dr = 88:12 by 1H NMR spectroscopy by integration of the signals at 3.45 and 3.48 ppm resp.).

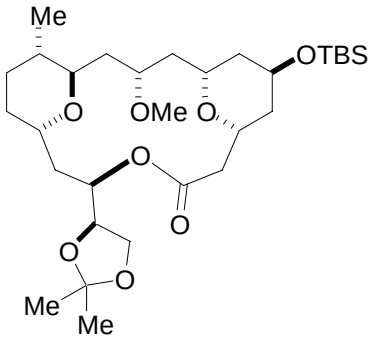
R_f = 0.29 (hexanes/EtOAc 3:1). **Optical Rotation:** $[\alpha]_D^{23}$ (c 0.5, $CHCl_3$) = -1.6. **^{1}H-NMR** (500 MHz, C_6D_6) δ 7.09 (s, 2H), 4.93 (q, 1H, *J* = 6.7 Hz), 4.65-4.61 (m, 1H), 4.41-4.33 (m, 3H), 4.20-4.09 (m, 4H), 4.00-3.93 (m, 2H), 3.84-3.85 (m, 1H), 3.76-3.72 (m, 1H), 3.55 (br.s, 1H), 3.45 (s, 3H), 1.71 (q, 1H, *J* = 6.9 Hz), 2.47 (dd, 1H, *J* = 15.0, 7.5 Hz), 2.17 (dd, 1H, *J* = 15.0, 5.8 Hz), 2.01-1.97 (m, 1H), 1.79-1.72 (m, 2H), 1.68-1.60 (m, 4H), 1.54-1.43 (m, 4H), 1.42 (s, 3H), 1.38-1.19 (m, 17 H), 1.18-1.16 (m, 6H), 0.97-0.93 (m, 10H), 0.75 (d, 3H, *J* = 6.4 Hz), 0.00 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 171.1, 152.6, 149.6, 126.2, 121.8, 109.4, 76.8, 73.3, 73.2, 72.9, 72.0, 68.4, 67.9, 66.5, 64.4, 51.8, 49.5, 43.2, 41.1, 39.5, 38.7, 34.4, 34.2, 27.1, 26.8, 26.6, 25.8, 25.7, 24.9, 24.6, 24.1, 24.0, 18.3, 18.1, -4.8. **IR** (thin film) ν 2957, 2928, 2870, 1742, 1462, 1436, 1382, 1362, 1309, 1253, 1213, 1159, 1098, 1062, 1038, 1002, 913, 875, 837, 803, 774, 742 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{45}H_{78}O_9SeSiNa$ $[M+Na]^+$, 893.4477, found, 893.4464.



24

Bis-tetrahydropyran 24. To a solution of selenide **23** (5.4 mg, 6.2 μmol, 1.00 equiv) in hexane (1 ml) was added 2,4-dimethoxy-3-methyl-3-(*tert*-butyldimethyl)silylcyclohexa-1,4-diene (6.6 mg, 24.8 μmol, 4.00 equiv) and a minimum amount of 2,2'-azoisobutyronitrile. After refluxing the mixture for 1 h, TLC showed full conversion. The reaction was allowed to cool to rt and concentrated under reduced pressure. Purification by flash chromatography (hexanes:EtOAc 1:1) followed by azeotropic drying with benzene afforded **24** (2.9 mg, 80 % yield) as a clear colourless oil.

R_f = 0.38 (hexanes/EtOAc 1:1). **Optical Rotation:** $[\alpha]_D^{22}$ (c 0.72, $CHCl_3$) = +23.5. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 4.42-4.24 (m, 3H), 4.23-4.13 (m, 1H), 4.07-3.98 (m, 1H), 3.97-3.71 (m, 7H), 3.44 (s, 3H), 2.42-2.33 (m, 2H), 2.12 (dd, 1H, *J* = 14.9, 5.0 Hz), 1.86 (ddd, 1H, *J* = 13.5, 10.9, 1.7 Hz), 1.76-1.49 (m, 4H), 1.48 (s, 3H), 1.45-1.06 (m, 12H), 0.94 (s, 9H), 0.89 (d, 3H, *J* = 6.8 Hz), 0.00 (s, 3H), -0.01 (s, 3H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 171.5, 109.2, 79.5, 73.3, 72.1, 68.5, 68.4, 68.2, 67.8, 66.1, 64.5, 51.7, 43.2, 40.9, 40.5, 39.5, 38.7, 35.5, 34.5, 28.5, 27.8, 26.6, 25.8, 25.5, 18.2, 18.0, -4.9. **IR** (thin film) ν 2954, 2930, 2858, 1743, 1462, 1437, 1381, 1254, 1205, 1160, 1098, 1062, 1035, 940, 838, 807, 775, 733 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{30}H_{56}O_9SiNa$ $[M+Na]^+$, 611.3591, found, 611.3601.



27

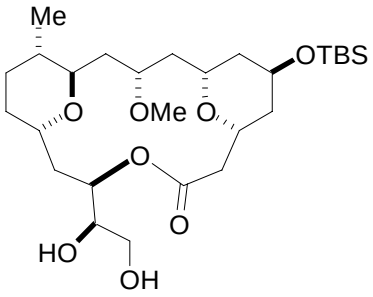
Macrolide 27. To a solution of methyl ester **24** (10.0 mg, 17.0 μmol, 1.00 equiv, azeotropically dried with benzene) in dry diethyl ether (0.5 ml) was added potassium trimethylsilanolate (4.4 mg, 34.0 μmol, 2.00 equiv) in 1 portion. The slightly yellowish solution was stirred at rt for 24 h and then quenched by the addition of $NaHSO_4$ 0.1 M (4 ml). The layers were separated and the aqueous layer was extracted with CH_2Cl_2 (6 × 4 ml), dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure to give seco-acid **25** which was azeotroped to dryness with benzene (2 × 3 ml) and used without further purification.

To a solution of seco-acid **25** (10.0 mg, 17.0 μmol, 1.00 equiv) in anhydrous THF (2.2 ml) at rt were added sequentially triethylamine (14.5 μl, 102 μmol, 6.00 equiv) and 2,4,6-trichlorobenzoylchloride (13.5 μl, 85.0 μmol, 5.00 equiv). The solution was stirred at rt for 60 min, diluted with anhydrous DMF (5 ml) and then added dropwise via syringe pump over 3 h to a solution of DMAP (21.0 mg, 170 μmol, 10.0 equiv) in dry

DMF (11 ml). After the end of the addition, the cloudy solution was stirred for an additional 2 h and then concentrated to dryness. Purification by flash chromatography (hexanes/EtOAc 1:1) afforded macrolactone **26** (4.8 mg, 51 % yield) as a clear colourless oil ($\mathbf{R_f}$ = 0.27 (hexanes/EtOAc 1:1)) which was used without further purification.

To a solution of macrolactone **26** (3.5 mg, 6.30 μmol, 1.00 equiv) in anhydrous CH_2Cl_2 (1 ml) were added sequentially at rt 4 Å molecular sieves (30 mg), proton sponge® (13.5 mg, 63.0 μmol, 10.0 equiv) and trimethyloxonium tetrafluoroborate (8.4 mg, 56.6 μmol, 9.00 equiv). After stirring at rt for 30 min, the reaction was quenched by adding H_2O (2 ml). The layers were separated and the aqueous phase was extracted with diethyl ether (3 × 10 ml). The combined organic solutions were washed with saturated, aqueous copper sulfate (2 × 3 ml) and brine. The diethyl ether solution was dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. The crude product was purified by flash chromatography (hexanes/EtOAc 2:1) to give **27** (3.4 mg, 95 % yield).

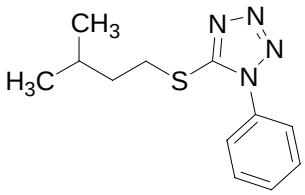
$\mathbf{R_f}$ = 0.34 (hexanes/EtOAc 2:1). **Optical Rotation:** $[\alpha]_D^{27.9}$ (c 0.21, $CHCl_3$) = +58.7. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.25 (ddd, 1H, *J* = 11.1, 1.8, 1.2 Hz), 4.31 (dt, 1H, *J* = 6.5, 3.4 Hz), 4.24-4.19 (m, 1H), 4.18-4.06 (m, 1H), 3.95-3.82 (m, 3H), 3.81-3.70 (m, 1H), 3.56-3.44 (m, 2H), 3.35 (s, 3H), 2.51 (dd, 1H, *J* = 12.4, 4.0 Hz), 2.43-2.27 (m, 2H), 1.98-1.80 (m, 3H), 1.78-1.58 (m, 2H), 1.54-1.24 (m, 12H), 1.15 (d, 3H, *J* = 7.1 Hz), 1.12-0.95 (m, 3H), 0.91 (s, 9H), 0.06 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 170.2, 108.9, 77.2, 73.6, 73.5, 69.3, 69.1, 68.9, 65.3, 65.0, 62.7, 57.3, 43.0, 39.3, 39.2, 38.0, 35.7, 31.1, 27.5, 26.3, 25.9, 25.3, 24.0, 22.8, 18.2, 18.1, -4.5, -4.7. **IR** (thin film) ν 2927, 2849, 1741, 1457, 1436, 1370, 1274, 1257, 1190, 1165, 1057 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{30}H_{54}O_8SiNa$ $[M+Na]^+$, 593.3486, found, 593.3491.



28

Diol 28. A solution of acetonide **27** (4.0 mg, 7.00 μmol, 1.00 equiv) in AcOH/THF/H_2O 2:1:1 (1 ml) was heated to 45 °C for 5 h. The solution was allowed to cool to rt and was then quenched by the addition of aqueous, saturated $NaHCO_3$ (10 ml). The layers were separated, the aqueous phase was extracted with CH_2Cl_2 (5 × 5 ml) and the combined organic solutions were washed with brine, dried aver anhydrous Na_2SO_4, filtered and then concentrated under reduced pressure. Purification by flash chromatography (EtOAc) afforded diol **28** (2.9 mg, 80 % yield) as a white solid.

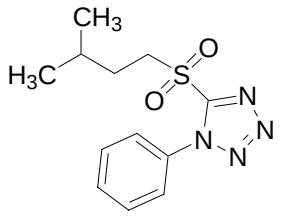
R_f = 0.39 (EtOAc). **Optical Rotation:** $[\alpha]_D^{25.4}$ (c 0.15, $CHCl_3$) = +42.9. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.26-5.18 (m, 1H), 4.22 (t, 1H, *J* = 2.4 Hz), 4.19-4.08 (m, 1H), 3.85 (dd, 1H, *J* = 10.5, 0.6 Hz), 3.80-3.71 (m, 2H), 3.62-3.43 (m, 4H), 3.35 (s, 3H), 2.68 (t, 1H, *J* = 6.6 Hz), 2.58 (dd, 1H, *J* = 12.0, 3.6 Hz), 2.44-2.31 (m, 2H), 2.26-2.22 (m, 1H), 2.02-1.80 (m, 3H), 1.72-1.23 (m, 11H), 1.15 (d, 3H, *J* = 7.1 Hz), 0.91 (s, 9H), 0.06 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 172.1, 77.2, 74.2, 73.5, 73.5, 70.5, 69.4, 69.1, 64.8, 63.2, 62.8, 57.2, 42.9, 39.2, 39.1, 39.0, 35.7, 31.0, 27.4, 25.8, 23.8, 18.2, 18.1, -4.6, -4.8. **IR** (thin film) ν 3401, 2928, 2859, 1742, 1723, 1460, 1432, 1388, 1343, 1277, 1234, 1189, 1167, 1112, 1075, 1039, 881, 834, 804, 772 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{27}H_{50}O_8SiNa$ $[M+Na]^+$, 553.3172, found, 553.3167.



5-(3-Methyl-butylsulfanyl)-1-phenyl-1*H*-tetrazole. To a mixture of 3-methyl-butan-1-ol (270 μl, 2.50 mmol, 1.00 equiv), triphenylphosphine (720 mg, 2.75 mmol, 1.10 equiv) and 2-phenyl-2*H*-tetrazole-5-thiol (490 mg, 2.75 mmol, 1.10 equiv) in

anhydrous THF (30 ml) was added at rt a solution of DEAD (430 µl, 2.75 mmol, 1.10 equiv) in THF (2 ml) dropwise over 10 min. The yellow solution was stirred at rt for 16 h and then concentrated under reduced pressure. Pentane/EtOAc 9:1 (40 ml) was added, the white precipitate filtered off over celite and the filtrate concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 3:1) provided 5-(3-Methyl-butylsulfanyl)-1-phenyl-1*H*-tetrazole (532 mg, 86 % yield) as a colourless oil.

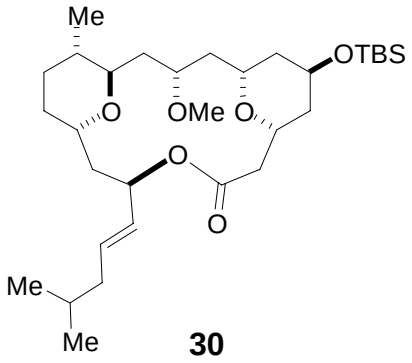
R_f = 0.56 (hexanes/EtOAc 2:1). **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 7.61-7.54 (m, 5H), 3.44-3.38 (m, 2H), 1.80-1.61 (m, 3H), 0.96 (d, 6H, J = 6.2 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 154.7, 133.9, 130.2, 129.9, 124.0, 37.9, 31.7, 27.6, 22.3. **IR** (thin film) ν 2957, 2871, 1597, 1500, 1466, 1411, 1386, 1278, 1243, 1088, 1074, 1055, 1015, 978, 914, 761, 694, 668 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{12}H_{17}N_4S$ $[M+H]^+$, 249.1174, found, 249.1161.



29

Sulfone 29. To a solution of 5-(3-Methyl-butylsulfanyl)-1-phenyl-1*H*-tetrazole (532 mg, 2.14 mmol, 1.00 equiv) in methanol (20 ml) was added an aqueous solution (20 ml) of oxone® (4.00 g, 6.42 mmol, 3.00 equiv) at rt. After stirring at rt for 20 h, at 50 °C for 1 h, the mixture was diluted with diethyl ether (50 ml), washed with H_2O. The layers were separated and the aqueous phase extracted with diethyl ether (3 × 50 ml). The combined organic solutions were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. Purification by flash chromatography (hexanes/EtOAc 4:1) provided sulfone **29** (540 mg, 90 % yield) as a colourless oil.

R_f = 0.61 (hexanes/EtOAc 2:1). **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 7.69-7.54 (m, 5H), 3.74-3.68 (m, 2H), 1.85-1.74 (m, 3H), 0.96 (d, 6H, J = 6.5 Hz). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 153.3, 132.9, 131.3, 129.6, 125.0, 54.5, 30.2, 27.3, 22.1. **IR** (thin film) ν 2961, 2874, 1596, 1498, 1469, 1390, 1336, 1242, 1153, 1100, 1046, 1016, 922 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{12}H_{16}N_4O_2SNa$ $[M+Na]^+$, 303.0892, found, 303.0892.



30

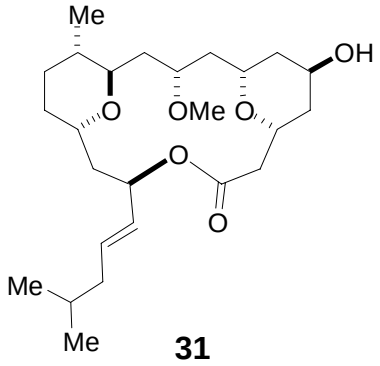
Olefin 30. To a solution of diol **28** (6.5 mg, 12.2 μmol, 1.00 equiv) in ethyl acetate (1 ml) was added at 0 °C lead tetracetate (8.0 mg, 18.3 μmol, 1.50 equiv) in one portion. The resulting orange solution was stirred at 0 °C for 15 min, then filtered over silica gel (using diethyl ether as eluant) and concentrated under reduced pressure to give the crude aldehyde ($\mathbf{R_f}$ = 0.19 (hexanes/EtOAc 4:1)) which was azeotroped to dryness with benzene and used immediately without further purification.

To a suspension of freshly washed potassium hydride in anhydrous DME (4 ml) was added HMDS (1.04 ml, 5.00 mmol, 1.00 equiv) at rt over 5 min. The suspension was stirred at rt for 72 h to give a clear, colourless solution of KHMDS in DME.

To a solution of sulfone **29** (90.0 mg, 320 μmol) in dry DME (0.2 ml) was added KHMDS (350 μl, 350 μmol) dropwise over 5 min at -78 °C to give a bright yellow solution which was allowed to stir at -55 °C for 2 h. 8 drops of this solution were added via cannula to a solution of the crude aldehyde in anhydrous DME (0.2 ml) at -78 °C. The resulting solution was stirred at -55 °C for 2 h and at 0 °C for 3 h. The reaction was quenched by the addition of H_2O (0.3 ml) and stirred at rt for 15 h. The solution was diluted with ether and washed with HCl 1.0 M (3 ml). The layers were separated and the aqueous phase was extracted with diethyl ether (4×5 ml), washed with brine, dried over anhydrous Na_2SO_4 and filtered. Purification by flash chromatography (hexanes/EtOAc 6:1) afforded olefin **30** (4.9 mg, 73 % yield over 2 steps) as a clear colourless oil (*E*:*Z* > 95:5 by 1H NMR spectroscopy).

$\mathbf{R_f}$ = 0.24 (CH_2Cl_2/EtOAc 9:1). **Optical Rotation:** $[\alpha]_D^{28.5}$ (c 0.225, $CHCl_3$) = +60.9. **^{1}H-NMR** (300 MHz, $CDCl_3$) δ 5.76-5.66 (m, 1H), 5.43-5.28 (m, 2H), 4.22(t, 1H, *J* = 2.7 Hz), 4.21-4.11 (m, 1H), 3.92-3.85 (m, 1H), 3.82-3.71 (m, 1H), 3.64-3.54 (m, 1H), 3.52 (t, 1H, *J* = 10.2 Hz), 3.36 (s, 3H), 2.48 (dd, 1H, *J* = 13.2, 3.9 Hz), 2.45-2.24

(m, 2H), 1.99-1.82 (m, 4H), 1.76-1.25 (m, 14H), 1.17 (d, 3H, *J* = 6.9 Hz), 1.14-1.08 (m, 1H), 1.03 (m, 1H), 0.92 (s, 9H), 0.85 (d, 3H, *J* = 6.6 Hz), 0.06 (s, 6H). **^{13}C-NMR** (75 MHz, $CDCl_3$) δ 169.7, 131.9, 130.0, 73.6, 73.5, 70.6, 69.4, 69.2, 65.0, 63.1, 57.3, 43.3, 43.1, 41.7, 39.3, 39.2, 35.7, 30.9, 28.2, 27.2, 25.8, 24.1, 22.3, 18.3, 18.1, -4.6, -4.7. **IR** (thin film) ν 2948, 2928, 2864, 1744, 1459, 1261, 1190, 1169, 1110, 1078, 962, 836, 773 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{31}H_{56}O_6SiNa$ $[M+Na]^+$, 575.3744, found, 575.3752.



31

Leucascandrolide A macrolide 31. To a solution of silyl ether **30** (4.5 mg, 8.10 μmol, 1.00 equiv) in anhydrous THF (0.5 ml) was added TBAF (1.0 M in THF, 41.0 μl, 40.7 μmol, 5.00 equiv) at 0 °C. The solution was stirred at 0 °C for 45 min and at rt for 4 h. Additional TBAF (1.0 M in THF, 41.0 μl, 40.7 μmol, 5.00 equiv) was added and stirring continued for 3 h. The reaction mixture was washed with saturated, aqueous ammonium chloride (2 ml). The layers were separated and the aqueous phase was extracted with diethyl ether (4 × 5 ml), washed with brine, dried over anhydrous Na_2SO_4 and filtered. Purification by flash chromatography (hexanes/EtOAc 1:1) provided the Leucascandrolide A macrolide **31** (3.5 mg, 98 % yield) as a white solid.

R_f = 0.16 (hexanes/EtOAc 1:1). **Optical Rotation:** $[\alpha]_D^{22.5}$ (c 0.175, EtOH) = +32.3. **^{1}H-NMR** (500 MHz, C_5D_5N) δ 6.39 (d, 1H, *J* = 3.4 Hz), 5.81 (ddt, 1H, *J* = 14.9, 7.2, 0.8 Hz), 5.77 (dd, 1H, *J* = 11.0, 6.9 Hz), 5.58 (ddt, 1H, *J* = 15.4, 6.9, 1.3 Hz), 4.67 (dddd, 1H, *J* = 10.6, 10.5, 3.5, 2.0 Hz), 4.45 (m, 1H), 4.22 (m, 1H, *J* = 11.6 Hz), 4.10 (br. d, 1H, *J* = 11.1 Hz), 3.96 (m, 1H, *J* = 10.8 Hz), 3.79 (m, 1H, *J* = 10.9 Hz), 3.41 (s, 3H), 2.72 (dd, 1H, *J* = 13.0, 3.7 Hz), 2.53 (m, 1H), 2.52 (dd, 1H, *J* = 13.0, 11.6 Hz), 2.54 (m, 1H, *J* = 14.3 Hz), 2.15 (m, 1H), 1.97-1.21 (m, 14H), 1.11 (d, 2H, *J* = 7.1 Hz), 1.15-1.05 (m, 2H), 0.82 (d, 3H, *J* = 6.6 Hz), 0.81 (d, 3H, *J* = 6.6 Hz). **^{13}C-NMR**

(75 MHz, C_5D_5N) δ 170.0, 131.7, 131.3, 73.8, 73.7, 70.1, 69.8, 69.6, 63.7, 63.0, 56.6, 43.9, 43.3, 41.7, 39.9, 39.6, 39.4, 35.8, 31.4, 28.3, 27.4, 24.2, 22.3, 22.2, 18.4. **IR** (thin film) ν 3433, 2927, 2866, 1740, 1457, 1386, 1272, 1195, 1167, 1077, 1003, 961 cm^{-1}. **HRMS** (MALDI) calc'd for $C_{25}H_{42}O_6Na$ $[M+Na]^+$, 461.2879, found, 491.2889.