Supporting Information

Synthesis of (D)-*erythro*-Dihydrosphingosine and (D)-*xylo*-Phytosphingosine from a Serine-derived 1,5-Dioxaspiro[3.2]hexane Template

Albert J. Ndakala, Mehrnoosh Hashemzadeh, Regina C. So and Amy R. Howell*

Department of Chemistry, University of Connecticut, Storrs, CT 06269-3060

General Experimental. Toluene was distilled from sodium, tetrahydrofuran (THF) and diethyl ether (Et_2O) were freshly distilled under nitrogen from a dark blue solution of sodium benzophenone ketyl. Deuterated chloroform ($CDCl_3$) was dried over 3Å molecular sieves. Methylene chloride (CH_2Cl_2) and triethylamine (Et_3N) were distilled from CaH_2. Dimethylformamide (DMF) was dried over CaH_2, prior to distillation. Pyridine was dried over KOH, distilled, and stored over molecular sieves. Acetone was dried over $CaSO_4$ and distilled. The concentrations of solutions of MeLi and *n*-BuLi were determined by titrations with *sec*-butyl alcohol using 1,10-phenanthroline as the indicator. Petroleum ether was purchased from JT Baker and distilled from $CaCl_2$. Phosphate buffer (pH 7) capsules were purchased from Fisher scientific. *N-t*-BOC-L-Serine and hexacosanoic acid were purchased from Novabiochem and Sigma, respectively. With the exceptions noted, all starting reagents were purchased from Aldrich and used without further purification. A literature procedure was followed for the preparation of (*S*)-3-(*tert*-butoxycarbonylamino)oxetan-2-one (**4**).[1]

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NMR spectra were obtained on a Bruker Avance DRX-400 (400 MHz ^{1}H, 100 MHz ^{13}C) NMR spectrometer. The ^{1}H and ^{13}C chemical shifts (δ) are reported in units of parts per million (ppm) from TMS. When peak multiplicities are reported, the following abbreviations are used: s (singlet); app s (apparent singlet); d (doublet); t (triplet); q (quartet); quintet (quint); m (multiplet); br (broadened); br s (broadened singlet); dd (doublet of doublets); dt (doublet of triplets); dq (doublet of quartets); ddd (doublet of doublet of doublets). Coupling constants, *J* , are reported in hertz (Hz). Infrared spectra were recorded on a JASCO FT/IR-410 spectrometer as a thin film on a polished NaCl plate and are reported in cm^{-1}. Combustion analyses were performed by NuMega Resonance Labs, Inc., San Diego, California. Melting points were observed in open Pyrex capillary tubes and are uncorrected. Low resolution mass spectra were obtained on an HP 5970 series GC-MSD system and are reported in units of mass/charge (*m/z*). High resolution mass spectra were obtained on a JEOL JMS-AX505HA instrument at the University of Notre Dame. Specific rotations $[\alpha]_D$ were obtained on a JASCO DIP-1000 polarimeter using the sodium D-line as a source, and the concentration (c) is expressed in g per 100 mL. Flash chromatography was performed on Silica Gel, 40 micron, 32-63 flash silica from Scientific Adsorbent Inc. Thin layer chromatography was performed on silica gel (EM Science Silica Gel 60 F_{254}) glass plates, and the compounds were visualized by UV, 5% phosphomolybdic acid in ethanol or 0.5% potassium permanganate in 0.1 M aqueous NaOH.

Procedure for the preparation of dimethyldioxirane. Dimethyldioxirane (DMDO) was prepared as described below, following the procedure of Adam[2] and Murray[3] and concentrated as described by Messegeur.[4] A mixture of $NaHCO_3$ (240 g), H_2O (350 mL) and acetone (260 mL) in a 3 L round-bottomed flask was cooled to 0 °C. Oxone (450 g) was added over 5 min with stirring. After the addition, the mixture was stirred at 0 °C (5 min) and then rapidly at RT (15 min). A vacuum (80 mm Hg) was applied, and the DMDO in acetone (220 mL) was trapped over 1 h in two receiving flasks connected in series and maintained at -78 °C. The combined solutions were diluted with water (220 mL) and extracted with CH_2Cl_2 (3 x 11 mL). The combined organic extracts were washed with phosphate buffer (pH 7, 3 x 200 mL). The organic layer was dried (K_2CO_3) and filtered to give a yellow solution (30 mL), which was stored over activated molecular sieves (4Å). The concentration of DMDO was determined by ^1H NMR. This determination was based on the reaction of DMDO with excess citronellic acid (This determination has been shown to be more than 99% accurate). The concentrations of the DMDO obtained varied from 0.30 - 0.55 M.

(*S*)-3-(*tert*-Butoxycarbonylamino)-1,5-dioxaspiro[3.2]hexane (1). A solution of dimethyldioxirane (~0.35 M in CH_2Cl_2, 1.0-1.2 equiv) was added drop-wise to a solution of (*S*)-3-(*tert*-butoxycarbonylamino)-2-methyleneoxetane (**5**)[1] (0.12 g, 0.63 mmol) in dry CH_2Cl_2 (~0.5 M) at -78 °C. The reaction mixture was stirred for 1 h and then concentrated. A white solid (0.13 g, 100%) was obtained as a mixture of diastereomers (95:5). IR ($CDCl_3$) 3430, 2980,

2934, 1704, 1506, 1394, 1369, 1250, 1167, 1062 cm^{-1}; Major diastereomer: ^1H NMR (400 MHz, $CDCl_3$) δ 5.30 (s, 1H), 5.25 (s, 1H), 4.76 (m, 1H), 4.40 (dd, J = 5.9, 5.9 Hz, 1H), 3.11 (d, J = 3.0 Hz, 1H), 2.86 (d, J = 3.0 Hz, 1H), 1.44 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.7, 93.3, 74.9, 65.3, 61.6, 51.0, 28.2. Minor diastereomer: ^1H NMR (400 MHz, $CDCl_3$) δ 5.11 (s, 2H), 4.64 (s, 1H), 4.27 (dd, J = 5.6, 5.6 Hz, 1H), 2.92 (d, J = 3.5 Hz, 1H), 2.88 (d, J = 3.5 Hz, 1H), 1.45 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.7, 84.6, 80.4, 67.2, 62.6, 50.1, 27.2; Anal. calcd for $C_9H_{15}NO_4$: C, 53.70; H, 7.52; N, 6.96. Found: C, 53.74; H, 7.68; N, 6.93.

Preparation of dimethyltitanocene. Dimethyltitanocene was prepared with some modification of previously described procedures.[5,6] MeLi (1.4 M in Et_2O, 132 mL, 185 mmol) was added drop-wise under N_2 to a stirred slurry of titanocene dichloride (20.0 g, 80.3 mmol) in dry toluene (160 mL) at -5 °C. After 1 h, the reaction mixture was warmed to 0 °C and then quenched carefully with ice-cold 6% aqueous NH_4Cl (50 mL). After separation, the organic layer was washed with water (50 mL) and brine (50 mL), dried ($MgSO_4$) and filtered to provide a red solution. The solution was concentrated to one third the volume. ^1H NMR assay indicated 15.2 g (91%) of dimethyltitanocene. The dimethyltitanocene was generally stored in the freezer and used as a 0.5 M solution in toluene.

(*S*)-3-(*tert*-Butoxycarbonylamino)-2-methyleneoxetane (5). A solution of dimethyltitanocene (104 mL of 0.5 M in toluene) and (*S*)-3-(*tert*-butoxycarbonylamino)-oxetan-2-one (**4**)[1] (6.50 g, 34.7 mmol) was stirred for 4 h in the dark at 80 °C under N_2. The cooled reaction

mixture was added to petroleum ether (300 mL) and stirred for 1 h. The yellow precipitate that formed was filtered through a pad of celite using petroleum ether. The filtrate was concentrated and the residue purified by flash chromatography on silica gel (petroleum ether/EtOAc/Et_3N 99.0:0.5:0.5). White needle-like crystals (2.90 g, 45%) were obtained: mp 119-120 °C; $[\alpha]^{25}_D$ = -5.7° (c 1.0, CH_2Cl_2); IR ($CDCl_3$) 2980, 1698, 1507, 1368, 1246, 1165 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 5.22 (br s, 1H), 5.14 (br s, 1H), 4.81 (dd, *J* = 5.8, 5.8 Hz, 1H), 4.44 (dd, *J* = 5.3, 5.3 Hz, 1H), 4.23 (dd, *J* = 4.2, 2.2 Hz, 1H), 4.02 (dd, *J* = 4.2, 1.7 Hz, 1H), 1.46 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.9, 154.6, 80.7, 80.4, 50.4, 29.7, 28.4; MS (EI) *m/z* 155 (M^+ - CH_2O), 129, 112, 99, 87, 57 (100); Anal. calcd for $C_9H_{15}NO_3$: C, 58.35; H, 8.17; N, 7.56. Found: C, 58.38; H, 8.23; N, 7.60.

Lithiumtetradecane. Chlorotetradecane (5.0 mL, 18.5 mmol) was added to a suspension of Li powder (0.28 g, 41 mmol) in anhydrous Et_2O (11.0 mL) and heated to 40 °C for 3 h. The reaction was monitored by GC MS. A small amount of the reaction mixture was quenched with CH_3OD and GCMS indicated a single peak (M^+ = 199), which corresponded to deuteriotetradecane. The organolithium solution was allowed to settle, filtered through glasswool, and transferred to another flame-dried flask under N_2. The clear, yellow solution was titrated according to a literature procedure.[7]

(2*S*)-2-(*tert*-Butoxycarbonylamino)-1-hydroxyoctadecan-3-one (7). Copper (I) cyanide (0.045 g, 0.5 mmol) was placed in a two-neck 25 mL round-bottomed flask equipped with a

magnetic stirring bar. The salt was dried azeotropically with toluene (1 mL) under vacuum at 40 °C and then purged with N_2. Dry THF (2 mL) was added to the flask, and the mixture was cooled to -78 °C. MeLi (0.36 mL, 0.5 mmol, 1.4 M in Et_2O) was added drop-wise, producing a light yellow-tan solution after 10 min. The pre-formed lithiumtetradecane at -78 °C was then added, followed by stirring for 1 h. The cuprate was warmed to -40 °C and maintained at this temperature for 30 min. The mixture was cooled to -78 °C, and (*S*)-3-(tert-butoxycarbonylamino)-1,5-dioxaspiro[3.2]hexane (**1**) (0.10 g, 0.5 mmol) in THF (2 mL) was introduced drop-wise via syringe. Stirring was continued for 2 h. The reaction was quenched with 90% saturated NH_4Cl / 10% concentrated NH_4OH (5 mL) at -78 °C. After stirring was continued for 30 min the two-phase blue mixture was transferred to a separatory funnel and extracted with Et_2O (3 x 10 mL). The combined organic extracts were washed with brine (10 mL) and dried ($MgSO_4$). Purification by flash chromatography on silica gel (dry loaded CH_2Cl_2) (petroleum ether/ EtOAc 80:20) afforded ketone **7** as a white solid (65%): mp = 48-50 °C; $[\alpha]^{25}_D$ = +7.05 (c 1.0, $CHCl_3$); IR (neat) 3420, 2923, 2853, 1710, 1169, 736 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 5.63 (broad, 1H), 4.34 (s, 1H), 3.90-3.97 (m, 2H), 2.48-2.63 (m, 2H), 1.57 (m, 2H), 1.45 (s, 9H), 1.22-1.27 (m, 24H), 0.88 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 208.1, 164.0, 80.3, 70.1, 68.9, 63.3, 61.6, 52.3, 49.8, 39.9, 31.9, 29.7, 29.6, 29.4, 29.3, 29.2, 28.3, 23.5, 22.7, 14.1; Anal. calcd for $C_{23}H_{45}NO_4$: C, 69.13; H, 11.35; N, 3.51. Found: C, 69.12; H, 11.06; N, 3.60.

(2*S*, 3*R*)-2-(*tert*-Butoxycarbonylamino)-1,3-octadecanediol (8). $LiAl(O\text{-}t\text{-}Bu)_3H$

(0.40 g, 1.56 mmol) was added to dry EtOH (3.0 mL) at -78 °C under N_2. Then, a solution of (2*S*)-2-(*tert*-butoxycarbonylamino)-1-hydroxyoctadecan-3-one (**7**) (0.10 g, 0.26 mmol) in EtOH (4.0 mL) was added drop-wise. After stirring for 3 h the reaction was quenched at -78 °C with 10% citric acid (2 mL), extracted with EtOAc (3 x 20 mL), washed with H_2O (20 mL) and brine (2 x 20 mL), dried ($MgSO_4$) and concentrated to provide a white solid as a single diastereomer (based on ^{1}H NMR). Purification by flash chromatography on silica gel (dry loaded CH_2Cl_2) (petroleum ether/EtOAc 80:20) afforded **8** (0.099 g, 98%) as a white solid: mp 67-69 °C; $[\alpha]^{25}_D$ +4.32 (c 1.0, $CHCl_3$); IR (film) 3342, 2916, 2849, 1687, 1173, 913 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.37 (bs, 1H), 3.99 (m, 1H), 3.75 (m, 2H), 3.50 (m, 1H), 2.58 (bs, 1H), 2.49 (bs, 1H), 1.19-1.47 (m, 37H), 0.88 (t, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 186.3, 74.8, 70.1, 62.9, 34.8, 32.2, 30.0, 30.0, 29.7, 29.7, 29.6, 29.6, 29.5, 29.3, 23.0, 14.4; Anal. calcd for $C_{23}H_{47}NO_4$: C, 68.78; H, 11.79; N, 3.49. Found: C, 68.87; H, 11.55; N, 3.83.

(2*S*,3*R*)-2-Amino-1,3-octadecanediol (D-*erythro*-Dihydrosphingosine). Trifluoroacetic acid (1.84 mL) in H_2O (0.085 mL) was added to (2*S*,3*R*)-2-(*tert*-butoxycarbonylamino)-1,3-octadecanediol (**8**) (0.16 g, 0.406 mmol), and the solution was stirred at RT for 30 min. Saturated aqueous $NaHCO_3$ (~100 mL) was then added until an off-white precipitate was observed. The precipitate was filtered and washed with water. Recrystallization from acetonitrile afforded D-*erythro*-dihydrosphingosine as a white solid (0.114 g, 94%):[8] ^{1}H NMR (400 MHz, pyridine-d_5) δ 6.05 (br s, 1H), 5.88 (m, 1H), 4.27 (m, 1H), 4.10 (m, 1H), 4.00 (m, 1H), 3.30 (broad s, 1H), 1.83

(m, 3H), 1.60 (s, 1H), 1.28 (br, 24H), 0.87 (t, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, pyridine-d_5) δ 70.7, 60.9, 58.2, 34.9, 32.1, 29.9, 29.8, 29.8, 29.6, 26.4, 26.3, 22.9, 14.3.

***(2S, 3R)-N,O,O*-Triacetyl-2-amino-1,3-octadecanediol (9).** Acetic anhydride (1.2 mL, 1.26 mmol) was added to D-*erythro*-dihydrosphingosine (0.10 g, 0.33 mmol) in dry pyridine (1 mL) at RT under N_2. The reaction mixture was stirred for 18 h, and the solvent was evaporated *in vacuo*. The resulting white residue was dissolved in Et_2O and washed with H_2O (10 mL) and brine (10 mL). The organic layer was dried ($MgSO_4$) and concentrated. The white solid was purified by flash chromatography on silica gel (CH_2Cl_2/MeOH 19:1). Recrystallization from hexane gave **9** as a white powder (0.10 g, 80%): $[\alpha]^{27.5}_D$ = 13.8° (c 1.0, $CHCl_3$) {lit.[8] $[\alpha]^{24}_D$ = 16° (c 1.0, $CHCl_3$)}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.82 (dd, J = 9.1 Hz, 1H), 4.91 (ddd, J = 7.5, 5.3, 5.3 Hz, 1H), 4.39 (m, 1H), 4.25 (dd, J = 11.6, 6.1 Hz, 1H), 4.06 (dd, J = 11.6, 3.9 Hz, 1H), 2.1 (s, 1H), 2.07 (s, 1H), 1.99 (s, 1H), 1.59 (m, 2H), 1.25 (br, 26H), 0.87 (t, J = 6.7 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.2, 171.1, 169.9, 74.3, 62.8, 50.7, 32.1, 31.7, 29.9, 29.8, 29.7, 29.6, 29.5, 25.6, 23.6, 22.9, 21.2, 21.0, 14.3.

(2*S*)-1-Hydroxy-2-(*tert*-butoxycarbonylamino)octan-3-one (11). Copper (I) cyanide (0.046 g, 0.5 mmol) was placed in a two-neck 25 mL round-bottomed flask equipped with a magnetic stirring bar. The salt was dried azeotropically with toluene (1 mL) under vacuum at 40 °C and then purged with N_2. Dry THF (2 mL) was added to the flask, and the solution was cooled to -78 °C. MeLi (0.36 mL, 0.50 mmol, 1.4 M in Et_2O) was added drop-wise, producing a

light yellow-tan solution after 10 min. Subsequent addition of *n*-BuLi (0.32 mL, 0.50 mmol, 1.6 M) produced no visible change. The cuprate was warmed to -40 °C and maintained at this temperature for 30 min. The mixture was cooled to -78 °C, and (*S*)-3-(*tert*-butoxycarbonylamino)-1,5-dioxaspiro[3.2]hexane (**1**) (0.10 g, 0.5 mmol) in THF (2 mL) was introduced drop-wise via syringe. Stirring was continued for 2 h. The reaction was quenched with 90% saturated aqueous NH_4Cl / 10% concentrated NH_4OH (5 mL) at -78 °C. Further stirring was continued at RT for 30 min; then the two-phase blue mixture was transferred to a separatory funnel and extracted with Et_2O (3 x 10 mL). The combined organic extracts were washed with brine (10 mL) and dried ($MgSO_4$), and the solvent was removed *in vacuo*. The residue was purified by flash chromatography on silica gel (dry loaded CH_2Cl_2) (petroleum ether/ EtOAc 80: 20), and ketone **11** was isolated as a colorless oil (0.056 g, 45%): ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.56 (br s, 1H), 4.27 (br s, 1H), 3.86 (m 2H), 2.50 (m, 2H), 1.53 (m, 2H), 1.40 (s, 9H), 1.18-1.30 (m, 4H), 0.88 (t, J = 9.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 208.2, 156.4, 80.7, 63.6, 62.0, 40.3, 31.7, 28.7, 23.5, 22.8, 14.2; Anal. calcd for $C_{13}H_{25}NO_4$: C, 60.21; H, 9.72; Found: C, 59.81; H, 9.35.

(*S*)-1-Acetoxy-3-(*tert*-butoxycarbonylamino)-4-hydroxybutan-2-one (13). A solution of glacial acetic acid (0.54 g, 8.91 mmol) in dry CH_2Cl_2 (5 mL) was added drop-wise to a solution of (*S*)-3-(*tert*-butoxycarbonylamino)-1,5-dioxaspiro[3.2]hexane (**1**) (1.30 g, 6.48 mmol) in dry CH_2Cl_2 (10 mL) at -78 °C. After 1 h, the reaction mixture was left to warm to RT over 12

h. It was concentrated and purified by flash chromatography on silica gel (petroleum ether/EtOAc 5:2) to provide a white solid (1.63 g, 96%). Recrystallization from toluene/hexane provided **13** as white prisms: mp 64-65 °C; $[\alpha]^{25}_D$ = -1.6° (c 2.0, $CHCl_3$); IR ($CDCl_3$) 3345, 2982, 2888, 1735, 1686, 1515, 1368, 1229, 1162, 1072 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 5.61 (d, *J* = 6.5 Hz, 1H), 4.86 (d, *J* = 20.0 Hz, 1H), 4.81 (d, *J* = 20.0 Hz, 1H), 4.35 (br s, 1H), 4.01 (d, *J* = 10.6 Hz, 1H), 3.78 (m, 1H), 2.97 (br s, 1H), 2.14 (s, 3H), 1.43 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 202.4, 170.7, 155.7, 80.5, 67.2, 62.6, 59.5, 28.2, 20.3; MS (EI) *m/z* 231 (M^+ - CH_2O), 202 (M^+-OAc), 188 (M^+ - CH_2OAc), 175, 160 (M^+ - BOC), 146, 104, 60, 57 (*t*-Bu^+) (100); Anal. calcd for $C_{11}H_{19}NO_6$: C, 50.57; H, 7.33; N, 5.36. Found: C, 50.79; H, 7.36; N, 5.28.

(*S*)-4-(Acetoxyacetyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (14). A mixture of (*S*)-1-acetoxy-3-(*tert*-butoxycarbonylamino)-4-hydroxybutan-2-one (**13**) (1.10 g, 4.21 mmol), 2,2-dimethoxypropane (2.78 g, 26.8 mmol) and 10-camphorsulfonic acid (100 mg) in dry CH_2Cl_2 (25 mL) was stirred at RT under N_2 for 4 d. The reaction mixture was concentrated, and the residue was purified by flash chromatography on silica gel (petroleum ether/EtOAc 4:1) to provide **14** as a colorless oil (1.11 g, 88%): $[\alpha]^{28}_D$ = -72.2° (c 1.15, $CHCl_3$); IR (film) 2979, 2937, 1741, 1707, 1365, 1227, 1168, 1090, 1053 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6, 60 °C) δ 4.90 (d, *J* = 17.2 Hz, 1H), 4.80 (d, *J* = 17.2 Hz, 1H), 4.58 (dd, *J* = 7.5, 2.9 Hz, 1H), 4.17 (dd, *J* = 9.1, 7.6 Hz, 1H), 3.97 (dd, *J* = 9.5, 2.9 Hz, 1H), 2.11 (s, 3H), 1.57 (s, 3H), 1.47 (s, 3H), 1.41 (s, 9H); ^{13}C NMR (100 MHz, DMSO-d_6, 60 °C) δ 201.5, 169.9, 151.4, 94.4,

80.5, 66.6, 65.1, 62.7, 28.3, 25.7, 24.3, 20.4; MS (EI) *m/z* 286 (M^+ - CH_3), 228 (M^+ - CH_2OAc), 200 (M^+ - $COCH_2OAc$ or M^+ - BOC), 186, 170, 144, 100, 83, 57 (100) (*t*-Bu^+); Anal. calcd for $C_{14}H_{23}NO_6$: C, 55.80; H, 7.69; N, 4.65. Found: C, 55.77; H, 7.89; N, 4.58.

(4*S*,1'*R*)-4-(1',2'-Dihydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (15a). $NaBH_4$ (0.19 g, 4.97 mmol) was added to a solution of (*S*)-4-(acetoxyacetyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**14**) (1.00 g, 3.32 mmol) in absolute MeOH (20 mL) at -78 °C. After 3 h, the reaction was quenched with brine (5 mL) and then left to warm to RT over 12 h. The resultant white suspension was concentrated and then diluted with water (10 mL) and EtOAc (40 ml). The organic layer was separated and the aqueous layer extracted further with EtOAc (3 x 15 mL). The combined organic extracts were dried (Na_2SO_4), filtered, and concentrated to provide a mixture of diastereomeric alcohols (9:1). The oil was purified by flash chromatography on silica gel (petroleum ether/EtOAc 7:3 to 1:1) to provide a pale yellow oil (0.74 g, 85%) of a major diastereomer **15a**, which formed a white solid on standing. Recrystallization from toluene/hexane provided white needles: mp 71-72 °C, $[\alpha]^{29}_D$ = -33.5° (c 1.0, $CHCl_3$); IR (film) 3447, 3057, 2976, 2933, 1705, 1581, 1480, 1439, 1374, 1272, 1022 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6, 60 °C) δ 4.44 (d, *J* = 4.9 Hz, 1H), 4.13 (dd, *J* = 5.7, 5.7 Hz, 1H), 3.97 (dd, *J* = 8.8, 1.4 Hz, 1H), 3.92 (dd, *J* = 6.2, 6.2 Hz, 1H), 3.86 (dd, *J* = 8.8, 6.3 Hz, 1H), 3.80 (m, 1H), 3.47 (ddd, *J* = 11.2, 6.1, 3.6 Hz, 1H), 3.34 (ddd, *J* = 11.3, 7.4, 5.5 Hz, 1H), 1.51 (s, 3H), 1.45 (s, 9H), 1.42 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6, 60 °C)[9] δ 151.8,

93.0, 78.9, 70.9, 70.8, 63.2, 62.0, 61.9, 58.8, 27.7, 25.9, 23.0; MS (EI) *m/z* 246 (M^+-CH_3), 230 (M^+ - CH_2OH), 200 (M^+ - $C_2H_5O_2$), 100, 57 (100) (*t*-Bu^+); Anal. calcd for $C_{12}H_{23}NO_5$: C, 55.16; H, 8.87; N, 5.36. Found: C, 54.88; H, 8.51; N, 5.40. A minor diastereomer **15b** (26 mg, 3%) was also obtained as a colorless oil.

(4S,1'S)-4-(1',2'-Dihydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (15b). DIBAL (1 M in CH_2Cl_2, 4.6 mL, 4.6 mmol) was added drop-wise to a stirred solution of (*S*)-4-(acetoxyacetyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**14**) (0.35 g, 1.16 mmol) in dry CH_2Cl_2 (8 mL) at -78 °C. After 3 h the reaction mixture was warmed to 0 °C and diluted with Et_2O (20 mL). The reaction was quenched with water (0.18 mL), 15% NaOH (0.18 mL) and water (0.46 mL). After stirring at 0 °C for 20 min, the mixture was left to warm to RT over 12 h. The organic layer was decanted, dried (Na_2SO_4), filtered and concentrated to provide a mixture of diastereomeric alcohols (2:1). The oil was purified by flash chromatography on silica gel (petroleum ether/EtOAc 4:1 to 1:1) to provide a colorless oil (0.16 g, 53%) of a major diastereomer **15b**. $[\alpha]^{26}_D$ = -6.1° (c 1.0, $CHCl_3$); IR (film) 3431, 2978, 1696, 1666, 1394, 1365, 1243, 1170, 1088, 1051 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6, 60 °C) δ 4.45 (d, *J* = 5.6 Hz, 1H), 4.14 (dd, *J* = 5.7, 5.7 Hz, 1H), 4.02 (dd, *J* = 8.3, 1.7 Hz, 1H), 3.83 (dd, *J* = 8.3, 6.2 Hz, 1H), 3.77 (ddd, *J* = 5.9, 5.9, 1.7 Hz, 1H), 3.63 (m, 1H), 3.39 (m, 1H), 3.33 (dd, *J* = 11.3, 6.3 Hz, 1H), 1.49 (s, 3H), 1.45 (s, 12H); ^{13}C NMR (100 MHz, DMSO-d_6, 60 °C)[9] δ 152.0, 93.0, 79.3, 71.3, 71.2, 63.7, 63.6, 58.8, 28.2, 28.1, 27.3, 26.7, 24.1; MS (EI) *m/z* 246 (M^+ -

CH_3), 230 (M^+ - CH_2OH), 200 (M^+ - $C_2H_5O_2$), 100, 57 (100) (*t*-Bu^+). A minor diastereomer **15a** (93 mg, 31%) was also obtained as a pale yellow oil.

(4*S*,1'*R*)-4-(2'-*tert*-Butyldimethylsilanyloxy-1'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester. TBDMSCl (0.38 g, 2.52 mmol) was added to a solution of (4*S*,1'*R*)-4-(1',2'-dihydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**15a**) (0.58 g, 2.22 mmol), Et_3N (0.33 g, 0.46 mL, 3.30 mmol) and DMAP (0.029 g, 0.24 mmol) in dry CH_2Cl_2 (30 mL) at 0 °C. After 2 h, the reaction mixture was left to warm to RT over 18 h. The reaction mixture was dissolved in CH_2Cl_2, preloaded on silica and purified by flash chromatography on silica gel (petroleum ether/EtOAc 19:1 to 9:1) to provide (4*S*,1'*R*)-4-(2'-*tert*-butyldimethylsilanyloxy-1'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester as a pale yellow oil (0.79 g, 94%): $[\alpha]^{27}_D$ = -18.0° (c 1.0, $CHCl_3$); IR (film) 3491, 2931, 2858, 1700, 1666, 1472, 1365, 1253, 1173, 1106, 1064 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$, 60 °C) δ 4.10 (dd, *J* = 6.3, 6.3 Hz, 1H), 4.06 (dd, *J* = 9.4, 1.5 Hz, 1H), 3.92 (dd, *J* = 9.3, 6.2 Hz, 1H), 3.85 (m, 1H), 3.72 (dd, *J* = 9.2, 4.7 Hz, 1H), 3.67 (dd, *J* = 10.6, 5.9 Hz, 1H), 3.31 (br, 1H), 1.60 (s, 3H), 1.51 (s, 12H), 0.93 (s, 9H), 0.10 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, 60 °C) δ 153.8, 94.1, 80.7, 73.2, 65.3, 64.6, 59.9, 28.5, 26.9, 26.0, 23.9, 18.3, -5.4, -5.4; MS (EI) *m/z* 360 (M^+ - CH_3), 302 (M^+ - O-*t*-Bu), 260 (M^+ - TBDMS), 244 (M^+ - OTBDMS), 218, 204, 143, 100, 75, 57 (100) (*t*-Bu^+); HRMS (FAB) calcd for $C_{18}H_{38}NO_5Si$ (M^+ + H) *m/z*: 376.2519. Found: 376.2518.

(4*S*,1'*S*)-4-(2'-*tert*-Butyldimethylsilanyloxy-1'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester. TBDMSCl (0.46 g, 3.05 mmol) was added to a solution of (4*S*,1'*S*)-4-(1',2'-dihydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**15b**) (0.70 g, 2.68 mmol), Et_3N (0.40 g, 0.55 mL, 3.95 mmol) and DMAP (0.035 g, 0.29 mmol) in dry CH_2Cl_2 (30 mL) at 0 °C. After 2 h, the reaction mixture was left to warm to RT over 18 h. The reaction mixture was dissolved in CH_2Cl_2, preloaded on silica and purified by flash chromatography on silica gel (petroleum ether/EtOAc 19:1 to 9:1) to provide (4*S*,1'*S*)-4-(2'-*tert*-butyldimethylsilanyloxy-1'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester as a pale yellow oil (0.43 g, 74%): $[\alpha]^{25}_D$ = -12.2° (c 1.0, $CHCl_3$); IR (film) 3481, 2933, 2859, 1699, 1472, 1365, 1253, 1173, 1067 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$, 60 °C) δ 4.16 (m, 1H), 3.88 (m, 2H), 3.82 (m, 1H), 3.70 (dd, *J* = 10.4, 3.9 Hz, 1H), 3.59 (dd, *J* = 10.4, 7.3 Hz, 1H), 2.71 (br s, 1H), 1.57 (s, 3H), 1.50 (s, 3H), 1.48 (s, 9H), 0.91 (s, 9H), 0.08 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, 60 °C) δ 152.8, 94.0, 80.3, 72.6, 65.7, 64.5, 59.5, 28.5, 27.1, 25.9, 24.0, 18.3, -5.1, -5.4; MS (EI) *m/z* 360 (M^+ - CH_3), 302 (M^+ - O-*t*-Bu), 260 (M^+ - TBDMS), 244 (M^+ - OTBDMS), 218, 204, 186, 160, 143, 117, 100, 75, 57 (100) (*t*-Bu^+); HRMS (FAB) calcd for $C_{18}H_{38}NO_5Si$ (M^+ + H) *m/z*: 376.2519. Found: 376.2525.

(4*S*,1'*R*)-4-(1'-Benzyloxy-2'-*tert*-butyldimethylsilanyloxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (16a). NaH (60% dispersion in mineral oil, 32 mg, 0.80

mmol) was added to a solution of (4*S*,1'*R*)-4-(2'-*tert*-butyldimethylsilanyloxy-1'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (0.10 g, 0.28 mmol) and benzyl bromide (0.14 g, 0.84 mmol) in dry DMF (5 mL) at -5 °C. The reaction mixture was left to warm gradually to RT over 18 h. The reaction mixture was quenched with MeOH (1 mL) and then concentrated. The residue was dissolved in CH_2Cl_2, preloaded on silica and then purified by flash chromatography on silica gel (petroleum ether/EtOAc 49:1 to 19:1) to provide **16a** as a colorless oil (0.12 g, 95%): $[\alpha]^{27}_D$ = -4.3° (c 1.0, $CHCl_3$); IR (film) 2952, 2883, 1700, 1376, 1364, 1254, 1085 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$, 60 °C)[10] δ 7.31 (m, 5H), 4.80 (d, *J* = 11.9 Hz, 1H), 4.67 (d, *J* = 11.9 Hz, 1H), 4.11 (m, 2H), 3.89 (m, 3H), 3.77 (dd, *J* = 11.2, 7.8 Hz, 1H), 1.60 (s, 3H), 1.47 (s, 12H), 0.92 (s, 9H), 0.08 (s, 6H); ^{13}C NMR (100 MHz, DMSO-d_6, 60 °C) δ 151.4, 138.8, 138.6, 127.7, 127.7, 127.0, 126.9, 126.8, 93.1, 79.6, 79.2, 79.0, 71.7, 71.6, 63.3, 63.1, 62.8, 60.6, 56.7, 27.9, 27.7, 27.7, 25.8, 25.5, 25.4, 22.9, 17.6, 17.3, -3.6, -5.7, -5.8; MS (EI) *m/z* 392 (M^+ - O-*t*-Bu), 364 (M^+- BOC), 350 (M^+ - TBDMS), 308, 294, 250, 228, 190, 170, 142, 100, 91 (100), 57 (*t*-Bu^+); HRMS (FAB) calcd for $C_{25}H_{44}NO_5Si$ (M^+ + H) *m/z*: 466.2979. Found: 466.2989.

(4*S*,1'*S*)-4-(1'-Benzyloxy-2'-*tert*-butyldimethylsilanyloxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (16b). NaH (60% dispersion in mineral oil, 0.020 g, 0.50 mmol) was added to a solution of (4*S*,1'*S*)-4-(2'-*tert*-butyldimethylsilanyloxy-1'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (0.065 g, 0.17 mmol)

and benzyl bromide (0.086 g, 0.50 mmol) in dry THF (5 mL) at -5 °C. The reaction mixture was left to warm gradually to RT over 18 h. The reaction mixture was quenched with MeOH (1 mL) and then concentrated. The residue was dissolved in CH_2Cl_2, preloaded on silica and then purified by flash chromatography on silica gel (petroleum ether/EtOAc 49:1 to 19:1) to provide **16b** as a colorless oil (0.079 g, 99%): $[\alpha]^{27}_D$ = -47.7° (c 1.0, $CHCl_3$); IR (film) 2929, 2857, 1693, 1363, 1252, 1076 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$, 60 °C)[10] δ 7.35, (m, 5H), 4.82 (d, *J* = 11.7 Hz, 0.6H), 4.69 (d, *J* = 11.7 Hz, 0.6H), 4.57 (d, *J* = 12.1 Hz, 0.4H), 4.51 (d, *J* = 12.1 Hz, 0.4H), 4.39 (br s, 0.4H), 4.19-4.02 (m, 2.4H), 3.93 (m, 1.2H), 3.76 (m, 1.2H), 3.50 (dd, *J* = 10.2, 5.8 Hz, 0.4H), 3.47 (dd, *J* = 10.2, 5.1 Hz, 0.4H), 1.57 (five s, 15H), 0.96 (two s, 9H), 0.12 (three s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, 60 °C) δ 152.8, 152.5, 139.1, 138.5, 128.3, 128.3, 127.8, 127.6, 127.5, 127.4, 94.1, 80.0, 79.4, 73.8, 73.5, 73.4, 70.6, 64.9, 64.3, 63.7, 60.1, 59.0, 28.6, 28.5, 26.8, 26.6, 26.0, 26.0, 24.7, 18.3, 18.2, -4.2, -4.5, -5.4, -5.5; MS (EI) *m/z* 450 (M^+ - CH_3), 392 (M^+ - O-*t*-Bu), 352, 350 (M^+ - TBDMS), 308, 91 (100), 73 (*t*-BuO^+), 57 (*t*-Bu^+); HRMS (FAB) calcd for $C_{25}H_{44}NO_5Si$ (M^+ + H) *m/z*: 466.2989. Found: 466.3006.

(4S,1'R)-4-(1'-Benzyloxy-2'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester. TBAF (1 M in THF, 0.26 mL, 0.26 mmol) was added to a solution of (4*S*,1'*R*)-4-(1'-benzyloxy-2'-*tert*-butyldimethylsilanyloxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**16a**) (0.060 g, 0.13 mmol) in dry THF (5 mL) at 0 °C. The reaction mixture was left to warm gradually to RT over 12 h. The reaction mixture was then

concentrated,dissolved in CH_2Cl_2 and preloaded on silica. The residue was purified by flash chromatography on silica gel (petroleum ether/EtOAc 49:1 to 19:1 to 9:1) to provide (4*S*,1'*R*)-4-(1'-benzyloxy-2'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester as a colorless oil (0.041 g, 91%): $[\alpha]^{27}_D$ = -5.4° (c 1.0, $CHCl_3$); IR (film) 3478, 2978, 2935, 2880, 1697, 1455, 1365, 1256, 1171, 1092, 1069 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6, 80 °C) δ 7.32 (m, 5H), 4.71 (d, *J* = 12.1 Hz, 1H), 4.63 (d, *J* = 12.1 Hz, 1H), 4.10 (m, 2H), 3.99 (d, *J* = 9.3 Hz, 1H), 3.90 (dd, *J* = 9.0, 6.9 Hz, 1H), 3.79 (m, 1H), 3.66 (m, 1H), 3.55 (ddd, *J* = 11.4, 5.5, 5.5 Hz, 1H), 1.52 (s, 3H), 1.42 (2s, 12H); ^{13}C NMR (100 MHz, DMSO-d_6, 80 °C) δ 152.3, 139.7, 128.5, 127.8, 127.5, 94.0, 80.5, 79.8, 72.5, 64.2, 61.5, 57.7, 28.5, 26.7, 23.9; MS (EI) *m/z* 336 (M^+ - CH_3), 320 (M^+ - CH_2OH), 295, 278 (M^+ - O-*t*-Bu), 250 (M^+ - *t*-BOC), 236, 220, 200 (M^+ - $BnOCHCH_2OH$),131, 100, 91, 57 (100) (*t*-Bu^+); HRMS (FAB) calcd for $C_{19}H_{30}NO_5$ (M^+ + H) *m/z*: 352.2124. Found: 352.2135.

(4*S*,1'*S*)-4-(1'-Benzyloxy-2'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester. TBAF (1 M in THF, 0.34 mL, 0.34 mmol) was added to a solution of (4*S*,1'*S*)-4-(1'-benzyloxy-2'-*tert*-butyldimethylsilanyloxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**16b**) (0.080 g, 0.17 mmol) in dry THF (5 mL) at 0 °C. The reaction mixture was left to warm gradually to RT over 12 h. The reaction mixture was then concentrated, dissolved in CH_2Cl_2 and preloaded on silica. The residue was purified by flash chromatography on silica gel (petroleum ether/EtOAc 49:1 to 19:1 to 9:1) to provide (4*S*,1'*S*)-4-(1'-benzyloxy-2'-

hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester as a colorless oil (0.058 g, 97%): $[\alpha]^{27}_{D}$ = -27.0 ° (c 1.0, $CHCl_3$); IR (film) 3461, 2979, 2935, 2875, 1695, 1365, 1171, 1069 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6, 120 °C)[10] δ 7.32 (m, 5H), 4.71 (d, *J* = 11.9 Hz, 0.6H), 4.59 (d, *J* = 11.9 Hz, 0.6H), 4.55 (d, *J* = 12.2 Hz, 0.4H), 4.51 (d, *J* = 12.3 Hz, 0.4H), 4.25 (br s, 0.4H), 4.05 (m, 1.2H), 3.98 (m, 0.8H), 3.91 (m, 1.6H), 3.86 (m, 0.8H), 3.56 (m, 1.2H), 3.51 (dd, *J* = 10.5, 4.7 Hz, 0.6H), 3.45 (dd, *J* = 10.3, 6.6 Hz, 0.4H), 1.50 (two s, 3H), 1.47 (s, 9H), 1.44 (s, 3H); ^{13}C NMR (100 MHz, DMSO-d_6) δ 152.4, 151.8, 139.3, 138.9, 128.6, 128.5, 127.9, 127.8, 127.7, 93.6, 79.7, 78.4, 72.9, 72.6, 63.9, 61.7, 59.4, 58.4, 28.5, 28.4, 26.8, 26.3, 25.4, 25.1, 23.7, 23.4; MS (EI) *m/z* 336 (M^+ - CH_3), 295, 278 (M^+ - O-*t*-Bu), 236, 200 (M^+ - $BnOCHCH_2OH$), 174, 144, 100, 91, 57 (100) (*t*-Bu^+); HRMS (FAB) calcd for $C_{19}H_{30}NO_5$ (M^+ + H) *m/z*: 352.2124. Found: 352.2129.

(4*S*,1'*R*)-4-(1'-Benzyloxy-2'-oxoethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (17a). Oxalyl chloride (0.087 g, 0.059 mL, 0.69 mmol) was added drop-wise to a solution of dry DMSO (0.11 g, 0.10 mL, 1.41 mmol) in dry CH_2Cl_2 (5 mL) at -78 °C. After 20 min, a solution of (4*S*,1'*R*)-4-(1'-benzyloxy-2'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (0.040 g, 0.11 mmol) in dry CH_2Cl_2 (3 mL) was added drop-wise. After 1 h, the reaction was raised to -40 °C and maintained for 30 min. The solution was cooled to -78 °C and Et_3N (0.22 g, 0.30 mL, 1.69 mmol) was added drop-wise. After stirring for 30 min, the reaction mixture was allowed to warm to RT over 1.5 h. It was diluted with Et_2O (15

mL) and then washed with saturated $NaHCO_3$ (2 x 3 mL). The organic layer was dried (Na_2SO_4), filtered and concentrated to provide a yellow oil. The oil was purified by flash chromatography on silica gel (petroleum ether/EtOAc 49:1 to 19:1 to 9:1) to provide **17a** as a colorless oil (0.030 g, 75%): $[\alpha]^{26}_D$ = -10.1° (c 0.6, $CHCl_3$) {lit.[11] $[\alpha]^{22}_D$ = -6.9° (c 0.6, $CHCl_3$)}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.65 (d, *J* = 1.7 Hz, 1H), 7.22 (m, 5H), 4.64 (d, *J* = 11.8 Hz, 1H), 4.48 (d, *J* = 11.8 Hz, 1H), 4.07 (m, 3H), 3.91 (dd, *J* = 9.6, 6.3 Hz, 1H), 1.45 (s, 3H), 1.39 (s, 12H).

(4*S*,1'*S*)-4-(1'-Benzyloxy-2'-oxoethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (17b). Oxalyl chloride (0.34 g, 0.23 mL, 2.64 mmol) was added drop-wise to a solution of dry DMSO (0.42 g, 0.38 mL, 5.35 mmol) in dry CH_2Cl_2 (10 mL) at -78 °C. After 20 min, a solution of (4*S*,1'*S*)-4-(1'-benzyloxy-2'-hydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (0.15 g, 0.43 mmol) in dry CH_2Cl_2 (5 mL) was added drop-wise. After 1 h, the reaction was raised to -40 °C and maintained for 30 min. The solution was cooled to -78 °C and Et_3N (0.80 g, 1.1 mL, 6.81 mmol) was added drop-wise. After stirring for 30 min, the reaction mixture was allowed to warm to RT over 1.5 h. It was diluted with Et_2O (30 mL) and then washed with saturated $NaHCO_3$ (2 x 5 mL). The organic layer was dried (Na_2SO_4), filtered and concentrated to provide a yellow oil. The oil was purified by flash chromatography on silica gel (petroleum ether/EtOAc 49:1 to 19:1 to 9:1) to provide **17b** as a colorless oil (0.14 g, 94%): $[\alpha]^{26}_D$ = -55.1° (c 0.6, $CHCl_3$) {lit.[11] $[\alpha]^{22}_D$ = -46° (c 0.6, $CHCl_3$)}; ^{1}H NMR (400 MHz,

DMSO-d_6)[12] δ 9.55 (two s, 1H), 7.36 (m, 5H), 4.63 (m, 1H), 4.52 (m, 1.5H), 4.31 (m, 1H), 4.14 (m, 0.5H), 4.03 (m, 0.5H), 3.95 (m, 1H), 3.82 (m, 1H), 1.45 (two s, 3H), 1.42-1.29 (five s, 12H).

(4*S*,1'*R*)-4-(1',2'-Bis(triethylsilanyloxy)ethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (18). Distilled TESOTf (3.04 g, 2.60 mL, 11.5 mmol) was added drop-wise to a solution of (4*S*,1'*R*)-4-(1',2'-dihydroxyethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**15a**) (1.00 g, 3.83 mmol) and pyridine (1.52 g, 1.55 mL, 19.16 mmol) in dry CH_2Cl_2 (30 mL) at 0 °C. After 6 h at 0 °C, the reaction mixture was diluted with Et_2O (100 mL) and then washed with saturated $NaHCO_3$ (2 x 10 mL). The organic layer was dried (Na_2SO_4), filtered, and concentrated to give a pale yellow oil. The oil was purified by flash chromatography on silica gel (petroleum ether/EtOAc 99:1 to 19:1) to provide **18** as a colorless oil (1.84 g, 98%): $[\alpha]^{28}_D$ = -22.4° (c 1.0, $CHCl_3$); IR (film) 2954, 2912, 2877, 1702, 1458, 1383, 1365, 1254, 1174, 1125, 1085, 1006 cm^{-1}; ^1H NMR (400 MHz, pyridine-d_5, 80 °C) δ 4.34 (br s, 1H), 4.17 (d, J = 8.7 Hz, 1H), 4.00 (br s, 1H), 3.88 (m, 2H), 3.65 (dd, J = 10.6, 8.1 Hz, 1H), 1.64 (s, 3H), 1.43 (s, 12H), 0.96 (t, J = 7.9 Hz, 9H), 0.93 (t, J = 8.0 Hz, 9H), 0.66 (m, 6H), 0.58 (q, J = 7.9 Hz, 6H); ^{13}C NMR (100 MHz, pyridine-d_5, 80 °C) δ 152.5, 94.4, 79.7, 73.3, 64.4, 63.6, 60.3, 28.3, 26.3, 23.2, 6.7, 6.6, 5.4, 4.7; MS (EI) *m/z* 474 (M^+ - CH_3), 404, 374 (M^+ - TES), 360, 189, 158, 129, 100, 87, 57 (100) (*t*-Bu^+); Anal. calcd for $C_{24}H_{51}NO_5Si_2$: C, 58.85; H, 10.49; N, 2.86. Found: C, 58.46; H, 10.10; N, 2.89.

(4*S*,1'*R*)-2,2-Dimethyl-4-(2'-oxo-1'-triethylsilanyloxyethyl)oxazolidine-3-carboxylic acid *tert*-butyl ester (19). Oxalyl chloride (2.07 g, 1.42 mL, 16.3 mmol) was added drop-wise to a solution of dry DMSO (2.86 g, 2.6 mL, 36.6 mmol) in dry CH_2Cl_2 (20 mL) at -78 °C. After 20 min, (4*S*,1'*R*)-4-(1',2'-bis(triethylsilanyloxy)ethyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester (**18**) (1.00 g, 2.04 mmol) in dry CH_2Cl_2 (10 mL) was added drop-wise, and stirring was continued for 20 min. The reaction was raised to -40 °C and maintained for 20 min. The solution was cooled to -78 °C and Et_3N (6.21 g, 8.6 mL, 61.4 mmol) was added drop-wise. After stirring for 20 min the reaction mixture was allowed to warm to RT over 2 h. It was diluted with Et_2O (100 mL) and then washed with saturated $NaHCO_3$ (2 x 10 mL). The organic layer was dried (Na_2SO_4), filtered and concentrated to provide a yellow oil. The oil was purified by flash chromatography on silica gel (petroleum ether/EtOAc 99:1 to 49:1) to provide **19** as a colorless oil (0.63 g, 83%): $[\alpha]^{26}_D$ = -48.5° (c 1.0, $CHCl_3$) IR (film) 2958, 2879, 1734, 1706, 1458, 1377, 1366, 1250, 1171, 1093, 1005 cm^{-1}; ^1H NMR (400 MHz, DMSO-d_6, 80 °C) δ 9.57 (d, *J* = 1.6 Hz, 1H), 4.28 (m, 1H), 4.05 (m, 3H), 1.46 (s, 9H), 1.45 (s, 3H), 1.43 (s, 3H), 0.95 (t, *J* = 7.9 Hz, 9H), 0.62 (q, *J* = 7.9 Hz, 6H); ^{13}C NMR (100 MHz, DMSO-d_6)[9] δ 201.4, 200.8, 151.7, 151.1, 94.1, 93.6, 79.9, 79.9, 75.9, 75.8, 63.7, 63.4, 59.6, 59.3, 28.0, 27.9, 25.6, 25.1, 24.3, 22.4, 6.8, 6.5, 5.7, 4.3, 4.2; MS (EI) *m/z* 300 (M^+ - *t*-BuO), 288 (M^+ - *t*-Bu-Et), 258 (M^+ - TES), 242 (M^+ - OTES), 200 (M^+ - $TESOCH_2CHO$), 145, 115, 100, 87, 57 (100) (*t*-Bu^+); HRMS (FAB) calcd for $C_{18}H_{35}NO_5Si$ *m/z*: 373.2285. Found: 373.2277.

(2*S*,3*R*,4*R*)-2-(*tert*-Butoxycarbonylamino)-1,2-*O*,*N*-isopropylideneoctadecane-1,3,4-triol [(4*S*,1'*R*,2'*R*)-4-(1,2-Dihydroxyhexadecyl)-2,2-dimethyloxazolidine-3-carboxylic acid *tert*-butyl ester] (20a).[13] Tetradecylmagnesium chloride (1 M in THF, 11.2 mL, 11.2 mmol) was added drop-wise to a solution of (4*S*,1'*R*)-2,2-dimethyl-4-(2'-oxo-1'-triethylsilanyloxyethyl)oxazolidine-3-carboxylic acid *tert*-butyl ester (**19**) (1.40 g, 3.75 mmol) in dry THF (30 mL) at -10 °C. After 1 h, the reaction mixture was diluted with Et_2O (100 mL) and brine (10 mL) and then stirred at RT (1 h). The organic layer was decanted and the residue washed with Et_2O (25 mL). The combined organic extracts were dried ($MgSO_4$), filtered and concentrated to provide a yellow oil. The oil was dissolved in dry THF (30 mL), cooled to -5 °C and then treated with TBAF (1 M in THF, 7.5 mL, 7.50 mmol). The mixture was left to warm slowly to RT over 7 h. It was diluted with Et_2O (100 mL) and brine (10 mL). The organic layer was separated, and the aqueous layer was extracted with Et_2O (3 x 20 mL). The combined organic extracts were dried (Na_2SO_4), filtered, concentrated and then purified by flash chromatography on silica gel (petroleum ether/EtOAc 19:1 to 9:1) to provide **20a** as a yellow oil (1.22 g, 71%) as a mixture of diastereomers (7:2). Major diastereomer: $[\alpha]^{28}_D$ = -33.7° (c 1.1, $CHCl_3$) {lit.[14] $[\alpha]^{23}_D$ = -25.8° (c 1.145, $CHCl_3$)}; IR (film) 3439, 2924, 2853, 1702, 1664, 1458, 1394, 1366, 1255, 1173, 1107, 1058 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$, 60 °C) δ 4.20 (dd, *J* = 7.3, 7.3 Hz, 1H), 3.98 (dd, *J* = 9.2, 6.2 Hz, 1H), 3.91 (d, *J* = 9.5 Hz, 1H), 3.59 (d, *J* = 7.6 Hz, 1H), 3.51 (br s, 1H), 2.20 (br s, 1H), 1.62 (s, 3H), 1.56 (s, 3H), 1.52 (s, 9H), 1.47 (br s, 1H), 1.44

(br s, 2H), 1.29 (s, 24H), 0.90 (t, J = 6.3 Hz, 3H); HRMS (FAB) calcd for $C_{26}H_{51}NO_2$ (M^+ + H) *m/z*: 458.3845. Found: 458.3858.

(2*S*,3*R*,4*R*)-2-Amino-1,3,4-octadecanetriol (D-*xylo*-phytosphingosine). A solution of trifluoroacetic acid (2 mL) and water (0.1 mL) was added to a solution of (2*S*,3*R*,4*R*)-2-(*tert*-butoxycarbonylamino)-1,2-*O*,*N*-isopropylideneoctadecane-1,3,4-triol (**20a**) (0.50 g, 1.09 mmol) in CH_2Cl_2 (10 mL) at 0 °C. After 2 h, the reaction mixture was left to warm to RT over 6h. It was concentrated and then taken-up in mixture of 95% EtOH (10 ml) and 2 M KOH (4 mL). The mixture was heated at 80 °C for 12 h. After concentration, the residue was dissoved in EtOH (3 mL) and water (3 mL) and then stored in the freezer for 30 min. A white solid formed and was filtered under suction and washed with water and a small amount of ice-cold EtOH. *xylo*-Phytosphingosine was obtained as a white fluffy solid (0.27 g, 79%): mp 98-99 °C; $[\alpha]^{27}_D$ = 11.8° (c 0.45, pyridine){lit.[14] $[\alpha]^{21}_D$ = 11.9° (c 0.89, pyridine)}; ^{1}H NMR (400 MHz, pyridine-d_5) δ 6.32 (br s, 2H), 5.74 (br, 1H), 4.16 (m, 2H), 4.05 (s, 2H), 3.45 (m, 1H), 2.00 (m, 1H), 1.90 (m, 1H), 1.77 (m, 1H), 1.60 (m, 1H), 1.27 (m, 24H), 0.88 (t, J = 6.3 Hz, 3H); ^{13}C NMR (100 MHz, pyridine-d_5) δ 75.2, 73.3, 66.4, 57.8, 35.2, 32.6, 30.7, 30.5, 30.4, 30.1, 27.0, 23.4, 14.7; HRMS (FAB) calcd for $C_{18}H_{40}NO_3$ (M^+ + H) *m/z*: 318.3010. Found: 318.3014.

***N,O,O,O*-Tetraacetyl-D-*xylo*-phytosphingosine (21).** A solution of trifluoroacetic acid (1 mL) and water (0.05 mL) was added to a solution of the (2*S*,3*R*,4*R*)-2-(*tert*-butoxycarbonylamino)-1,2-*O*,*N*-isopropylideneoctadecane-1,3,4-triol (**20a**) (0.15 g, 0.33 mmol)

in CH_2Cl_2 (5 mL) at 0 °C. After 1 h at 0 °C, the reaction mixture was concentrated and then dried azeotropically with toluene to provide a white residue. DMAP (0.040 g, 0.33 mmol) and acetic anhydride (0.20 g, 1.96 mmol) were added to a solution of the residue in dry pyridine (5 mL). After 24 h at RT, the reaction mixture was concentrated, dissolved in Et_2O and preloaded on silica. Purification by flash chromatography on silica gel (petroleum ether/Et_2O 7:3 to 1:1 to 0:1) provided **21** as a white solid (99 mg, 62%): mp 45-46 °C; $[\alpha]^{27}_D$ = 6.3° (c 0.86, $CHCl_3$){lit.[14] $[\alpha]^{21}_D$ = 7.0° (c 0.86, $CHCl_3$)}; IR ($CHCl_3$) 3309, 2924, 2854, 1744, 1662, 1534, 1465, 1370, 1221, 1044, 953 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 5.72 (d, *J* = 9.4 Hz, 1H), 5.16 (dd, *J* = 6.5, 4.4 Hz, 1H), 5.05 (dd, *J* = 12.8, 6.5 Hz, 1H), 4.53 (m, 1H), 4.02 (m, 2H), 2.08 (s, 3H), 2.06 (s, 3H), 2.05 (s, 3H), 1.60 (br s, 3H), 1.24 (s, 26H), 0.87 (t, *J* = 6.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 170.1, 169.8, 72.2, 71.9, 62.9, 47.9, 31.9, 30.5, 29.7, 29.6, 29.5, 29.4, 29.3, 29.2, 24.8, 23.2, 22.7, 20.9, 20.7, 20.6, 14.1; MS (EI) *m/z* 442 (M^+ - OAc), 412 (M^+ - CH_2OAc), 352, 310, 292, 268, 144 ($AcOCH_2CH_2NHAc^+$), 102, 84 (100), 60 ($AcOH^+$).

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(10) Due to conformational isomerism brought about by the presence of the BOC group on the oxazolidine, the ^{1}H NMR peaks were broad and indicated the presence of two conformers, and there was some doubling of ^{13}C NMR peaks.

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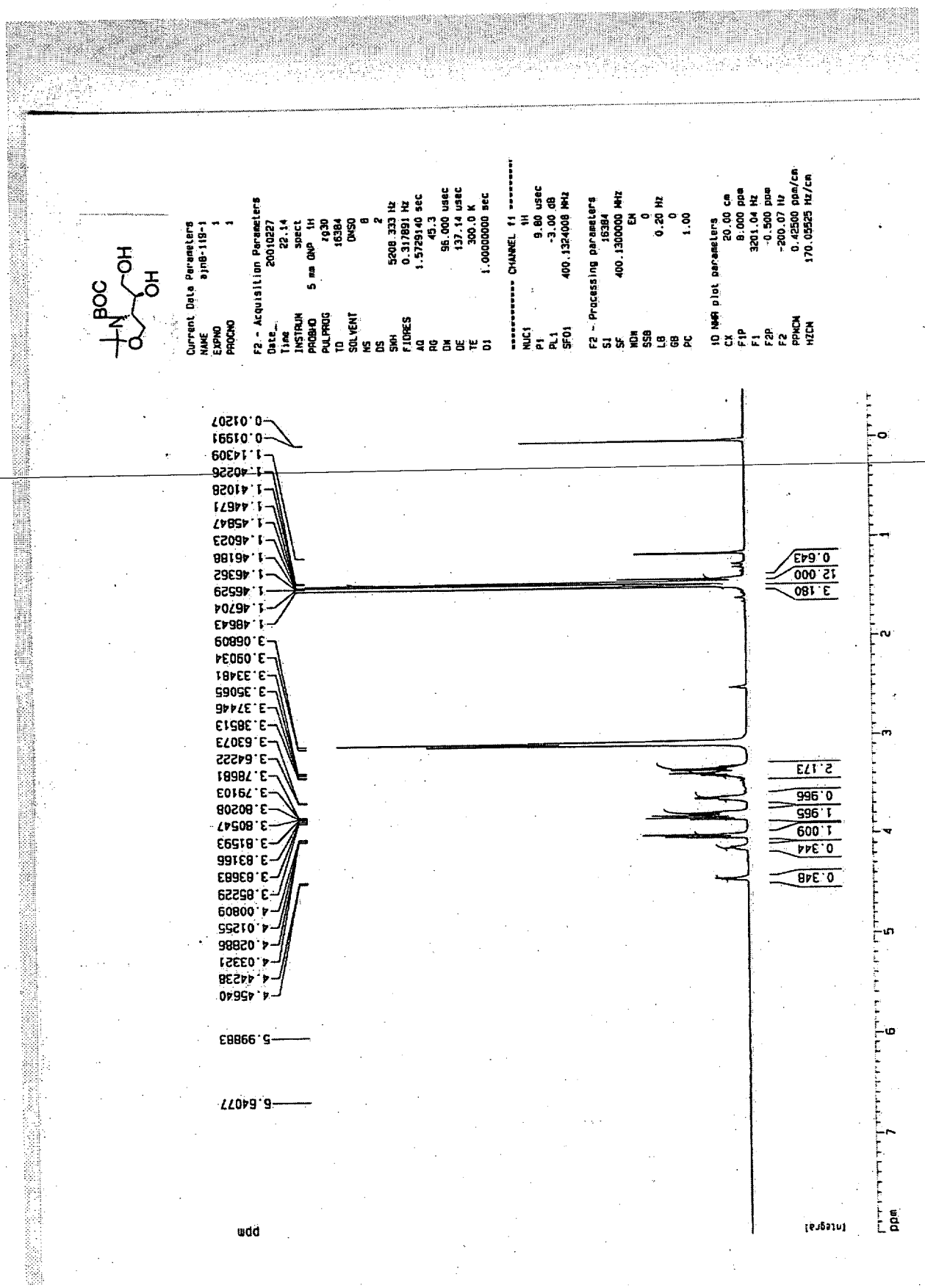

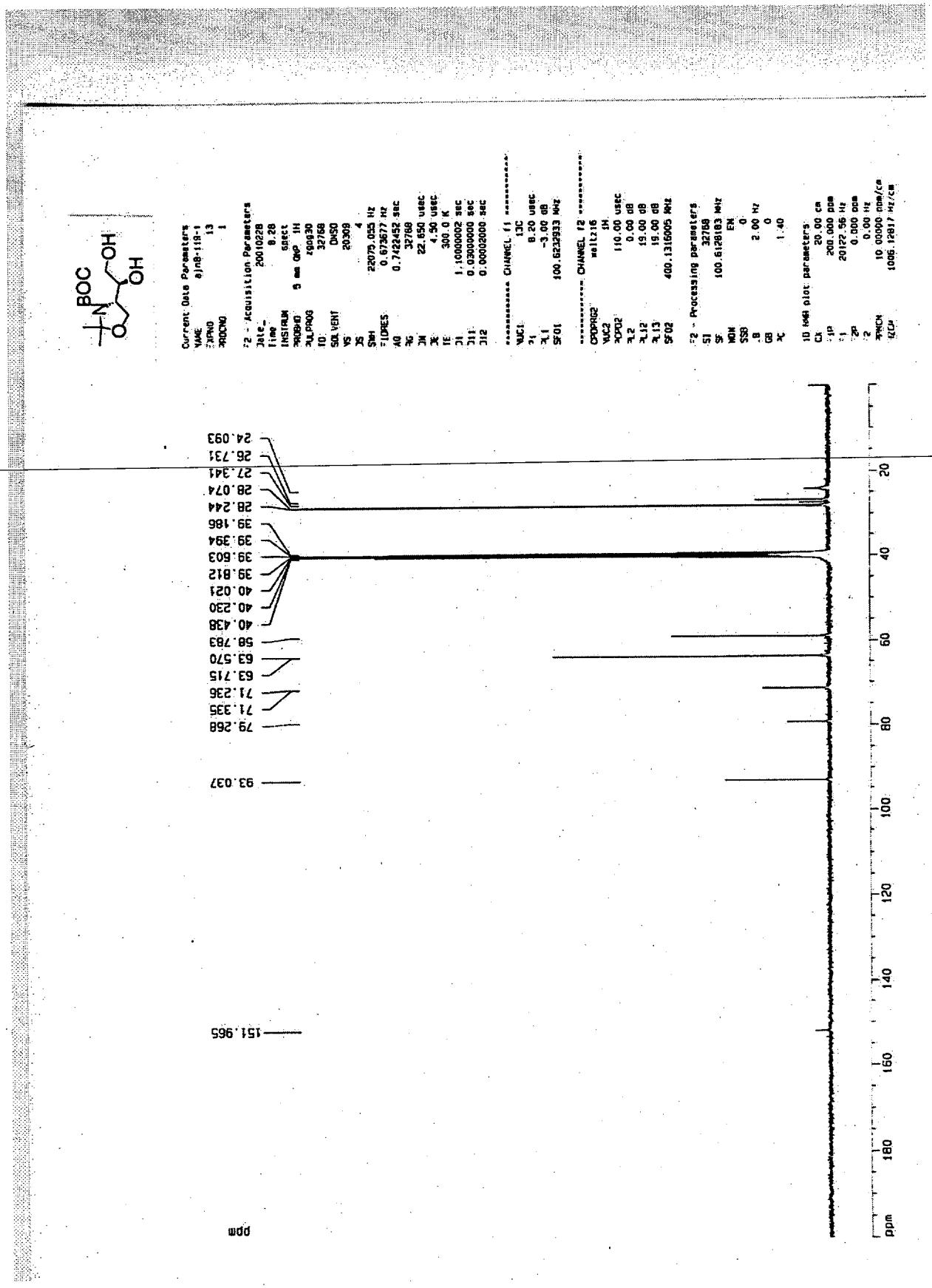
BOC
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28.074
28.244
39.186
39.394
39.603
39.812
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40.438
58.783
63.570
63.715
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71.335
79.268
93.037
151.965
ppm