

Stereochemical Revision, Total Synthesis and Solution State Conformation of the Complex Chlorosulfolipid Mytilipin B

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Supporting Information

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1 General Methods

Chemicals: Solvents and Reagents were purchased from Acros, Aldrich, TCI, Fluorochem, Combi-Blocks, Fluka, Merck or Lancaster and were used as received if not noted otherwise. Deuterated solvents were obtained from Armar Chemicals. Dry solvents and pyridine over molecular sieves were bought from Acros and used as received.

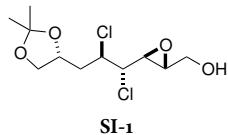
Reaction Handling: All reactions were performed in vacuum dried glassware with a positive pressure of dry nitrogen. Reactions were monitored by thin layer chromatography and stirred magnetically if not noted otherwise. Thin layer chromatography was performed on MERCK silica gel F254 TLC glass plates and visualized with UV fluorescence quenching, Seebach's stain and/or potassium permanganate stain. Chromatographic purification was performed as flash column chromatography with 0.3–0.5 bar pressure using SILICYCLE SiliaFlash Silica Gel P6o.

NMR spectra were recorded at room temperature on Varian Mercury (300 MHz), , Bruker AV and DRX (400 MHz), Bruker DRX and DRXII (500 MHz) or Bruker AVIII (600 MHz with cryoprobe). All chemical shifts are reported in ppm with the residual solvent peak as the standard (CDCl_3 = 7.26 ppm and 77.16 ppm, d_6 -acetone 2.05 ppm and 29.84 ppm, C_6D_6 7.16 ppm and 128.06 ppm, d_4 -MeOD 3.31 ppm and 49.00 ppm). Signal multiplicities are denoted as follows: s = singlet, d = doublet, t = triplet, q = quartet, quint = quintet, sept = septet, m = multiplet, b = broad signal. Coupling constants are given in Hz. ^{13}C -NMR spectra were recorded with broadband ^1H -decoupling. Measurements on Bruker DRX and or Bruker AVIII were performed by Mr. Rene Arnold, Mr. Rainer Frankenstein and Mr. Stephan Burkhardt under the direction of Dr. Marc-Olivier Ebert. FT-IR spectra were recorded as thin films on a Perkin Elmer Two-FT-IR spectrometer and the respective absorptions are denoted in wavenumbers (cm^{-1}). Optical rotations were recorded on a JASCO P-2000 Polarimeter, cuvette length = 10 cm. 1 mL cell volume. The concentration $c = 1$ corresponds to 10 mg mL^{-1} . High-resolution ESI-MS was recorded on a BRUKER DALTONICS MAXIS(UHR-TOF) by Mr. Louis Bertschi, Mr. Oswald Greter or Mr. Daniel Wirz. X-Ray diffraction analysis was performed by Dr. Nils Trapp and Mr. Michael Solar at the Laboratorium fur Organische Chemie at ETH Zurich on a BRUKER Kappa Apex II DUO system equipped with a graphite monochromator . The data obtained was deposited at the Cambridge Crystallographic Data Centre.

2 Total Synthesis of Revised Undecachlorosulfolipid

2.1 Total Synthesis of the Aldehyde Fragment of Revised Undecachlorosulfolipid

(*2S,3S,4S,5R*)-4,5-dichloro-6-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)hexane-1,2,3-triol

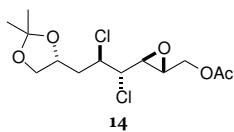


SI-1

A suspension of dried, powdered 4 Å molecular sieves (29 g) in anhydrous CH₂Cl₂ (1000 mL) is cooled to -20 °C. To this is then added freshly distilled D-(−)-diethyltartrate (23.14 mL, 135 mmol, 1.25 equiv.) and subsequently freshly distilled Ti(O*i*Pr)₄ (36.1 mL, 123 mmol, 1.14 equiv.). After stirring for 20 min allylic alcohol **13**[1] (29.0 g, 108 mmol) is added dropwise as a solution in CH₂Cl₂ (1000 mL). After stirring at -20 °C for another 30 min TBHP in decane (5.5 M, 58.8 mL, 323 mmol, 3 equiv.) is added. After stirring for 20 min at this temperature the flask is transferred to a -20 °C freezer and allowed to age for 24 h. The reaction is subsequently quenched at -20 °C through the addition of water and stirred mechanically at room temperature for 30 min. After this time an aqueous, precooled 30% NaOH solution saturated with NaCl is added. The mixture is filtered through a plug of glass wool. Brine is added and the phases are allowed to separate. The layers are separated and the aqueous phase is extracted twice with CH₂Cl₂. The combined organic extracts are dried over MgSO₄, filtered and the filter cake is washed with CH₂Cl₂ until no more product is eluting. The solution is concentrated under vacuum and the crude product then purified by column chromatography (Et₂O–pentane 1:1) to yield the product epoxide **SI-1** (22.0 g, 77 mmol, 72%) as a colorless oil.

HR-MS(ESI⁺): calculated for C₁₁H₁₈Cl₂NaO₄ [M+Na⁺]: *m/z* = 307.0474, found: *m/z* = 307.0479
¹H – NMR (400 MHz CDCl₃) δ[ppm] = 4.46 (ddd, J = 11.0, 4.3, 2.5 Hz, 1H), 4.39 (dtd, J = 9.1, 6.0, 3.1 Hz, 1H), 4.12 (dd, J = 8.2, 6.1 Hz, 1H), 3.96 (dd, J = 12.9, 2.4 Hz, 1H), 3.79 (dd, J = 7.7, 4.3 Hz, 1H), 3.71 (dd, J = 12.9, 3.9 Hz, 1H), 3.62 (dd, J = 8.2, 6.0 Hz, 1H), 3.39 (dd, J = 7.8, 2.1 Hz, 1H), 3.14 (dt, J = 4.3, 2.3 Hz, 1H), 2.16 (ddd, J = 14.4, 9.4, 2.5 Hz, 1H), 1.99 (ddd, J = 14.3, 11.1, 3.2 Hz, 1H), 1.84 (s, 1H), 1.41 (s, 3H), 1.35 (s, 3H). **¹³C – NMR** (101 MHz CDCl₃) δ[ppm] = 109.5, 72.8, 69.3, 64.1, 61.4, 60.7, 57.8, 54.7, 39.5, 27.3, 25.7. **Optical Rotation:** [α]_D^{25,6} = +28.6 (c = 1.0, CHCl₃). **IR** (film): ν = 3443(b), 2987(m), 2936(m), 2876(m), 1381(s), 1372 (s), 1216 (s), 1059 (s), 832 (m), 515 (m).

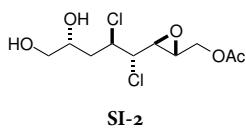
((*2R,3S*)-3-((*1S,2R*)-1,2-dichloro-3-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)propyl)oxiran-2-yl)methyl acetate



To a solution of **SI-1** (20.0 g, 70.1 mmol) in CH_2Cl_2 (350 mL) cooled to 0 °C was added pyridine (11.34 mL, 140 mmol) and AcCl (5.98 mL, 84 mmol). After stirring for 30 min, the reaction was quenched with sat. $\text{NH}_4\text{Cl}_{(\text{aq})}$, the phases were separated and the aqueous phase was extracted twice with CH_2Cl_2 . The combined organics were dried (Na_2SO_4), filtered, and concentrated. Column chromatography (10 % to 30 % EtOAc in hexane) yielded the acetate **14** (17.6 g, 76%) as a colorless oil.

HR-MS(ESI⁺): calculated for $\text{C}_{13}\text{H}_{20}\text{Cl}_2\text{O}_5\text{Na} [\text{M}+\text{Na}^+]$: $m/z = 349.0580$, found: $m/z = 349.0580$
¹H - NMR (400 MHz CDCl_3) δ [ppm] = 4.44 (ddd, $J = 11.0, 4.2, 2.5$ Hz, 1H), 4.40 (dd, $J = 12.5, 3.3$ Hz, 1H), 4.41 – 4.34 (m, 1H), 4.11 (dd, $J = 8.2, 6.1$ Hz, 1H), 3.99 (dd, $J = 12.5, 5.9$ Hz, 1H), 3.74 (dd, $J = 7.6, 4.3$ Hz, 1H), 3.60 (dd, $J = 8.3, 6.0$ Hz, 1H), 3.29 (dd, $J = 7.6, 2.0$ Hz, 1H), 3.20 (ddd, $J = 5.9, 3.2, 2.0$ Hz, 1H), 2.13 (ddd, $J = 14.4, 9.5, 2.6$ Hz, 1H), 2.08 (s, 3H), 1.99 (ddd, $J = 14.3, 11.0, 3.1$ Hz, 1H), 1.39 (s, 3H), 1.34 (s, 3H). **¹³C - NMR** (101 MHz CDCl_3) δ [ppm] = 170.6, 109.5, 72.7, 69.3, 63.7, 63.3, 61.4, 55.5, 54.8, 39.6, 27.3, 25.7, 20.8. **Optical Rotation**: $[\alpha]_D^{25.8} = +29.6$ ($c = 1.0$, CHCl_3). **IR** (film): $\tilde{\nu} = 2987$ (m), 2940(m), 1745 (s), 1381 (m), 1371 (m), 1227 (s), 1059 (m), 833 (m).

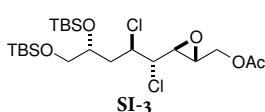
((2R,3S)-3-((1S,2R,4R)-1,2-dichloro-4,5-dihydroxypentyl)oxiran-2-yl)methyl acetate



To a solution of acetal **14** (2.83 g, 8.65 mmol) in MeOH (170 mL) was added (–)-camphorsulfonic acid (201 mg, 0.865 mmol) and the reaction was stirred for 3.5 h. Hereafter, the mixture was diluted with EtOAc and sat. $\text{NaHCO}_3_{(\text{aq})}$. The phases were separated and the aqueous phase was extracted three times with EtOAc. The combined organic phases were dried (Na_2SO_4), filtered, and concentrated under reduced pressure. Purification by column chromatography (gradient elution with 50 % to 90 % EtOAc in hexane, then EtOAc) gave diol **SI-2** (1.98 g, 80%) as a colorless oil.

HR-MS(ESI⁺): calculated for $\text{C}_{10}\text{H}_{16}\text{Cl}_2\text{NaO}_5 [\text{M}+\text{Na}^+]$: $m/z = 309.0267$, found: $m/z = 309.0259$
¹H - NMR (400 MHz CDCl_3) δ [ppm] = 4.56 (ddd, $J = 11.0, 4.0, 2.8$ Hz, 1H), 4.41 (dd, $J = 12.5, 3.2$ Hz, 1H), 4.08 – 3.97 (m, 2H), 3.80 (dd, $J = 7.6, 3.9$ Hz, 1H), 3.71 (dd, $J = 11.1, 3.2$ Hz, 1H), 3.50 (dd, $J = 11.1, 6.7$ Hz, 1H), 3.33 (dd, $J = 7.6, 2.0$ Hz, 1H), 3.23 (ddd, $J = 5.9, 3.2, 2.0$ Hz, 1H), 2.48 (s, 2H), 2.10 (s, 3H), 2.03 (ddd, $J = 14.7, 10.3, 2.8$ Hz, 1H), 1.90 (ddd, $J = 14.7, 10.9, 2.3$ Hz, 1H). **¹³C - NMR** (101 MHz CDCl_3) δ [ppm] = 170.8, 68.8, 66.8, 63.8, 63.4, 61.3, 55.5, 55.0, 38.0, 20.8. **Optical Rotation**: $[\alpha]_D^{26.1} = +18.0$ ($c = 1.0$, CHCl_3). **IR** (film): $\tilde{\nu} = 3408$ (b), 2928(w), 1740(s), 1370(w), 1234(s), 1039(m).

((2R,3S)-3-((1S,2R,4R)-4,5-bis((tert-butyldimethylsilyl)oxy)-1,2-dichloropentyl)oxiran-2-yl)methyl acetate

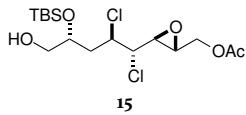


A solution of **SI-2** (8.3 g, 29 mmol) in CH_2Cl_2 (290 mL) was cooled to –78 °C and 2,6-lutidine (13.5 mL, 116 mmol) was added followed by dropwise addition of TBSOTf (16.6 mL, 72.3 mmol). After stirring the reaction for 40 min, $\text{NaHCO}_3_{(\text{aq})}$ was added, the phases were separated

and the aqueous phase was extracted twice with CH_2Cl_2 . The combined organic phases were dried over Na_2SO_4 , filtered, and concentrated. Purification by column chromatography (gradient elution with 5 % to 10 % Et_2O in pentane) afforded the bis-TBS ether **SI-3** (11.5 g, 22.2 mmol, 77 %) as a colorless liquid.

HR-MS(ESI⁺): calculated for $\text{C}_{22}\text{H}_{45}\text{Cl}_2\text{O}_5\text{Si}_2$ [M+H⁺]: $m/z = 515.2177$, found: $m/z = 515.2175$ **¹H-NMR** (400 MHz CDCl_3) δ [ppm] = 4.44 – 4.37 (m, 2H), 4.00 (dd, $J = 12.5, 5.9$ Hz, 1H), 3.96 (dd, $J = 10.0, 6.9, 4.9, 2.1$ Hz, 1H), 3.76 (dd, $J = 7.6, 4.1$ Hz, 1H), 3.60 (dd, $J = 10.1, 5.0$ Hz, 1H), 3.42 (dd, $J = 10.1, 6.6$ Hz, 1H), 3.28 (dd, $J = 7.6, 2.0$ Hz, 1H), 3.20 (ddd, $J = 5.5, 3.3, 2.0$ Hz, 1H), 2.14 – 2.05 (m, 4H), 1.90 (ddd, $J = 14.4, 10.0, 2.3$ Hz, 1H), 0.91 – 0.87 (m, 18H), 0.13 (s, 3H), 0.10 (s, 3H), 0.06 (s, 6H). **¹³C-NMR** (101 MHz CDCl_3) δ [ppm] = 170.6, 70.0, 67.5, 64.4, 63.5, 61.2, 55.7, 54.8, 39.7, 26.1, 26.0, 20.8, 18.5, 18.2, -3.9, -4.7, -5.2, -5.2. **Optical Rotation:** $[\alpha]_D^{26.1} = +36.5$ ($c = 0.5$, CHCl_3). **IR** (film): $\tilde{\nu} = 2955(\text{m}), 2930(\text{m}), 2858(\text{m}), 1748(\text{s}), 1478(\text{m}), 1363(\text{m}), 1227(\text{m}), 1115(\text{m}), 1087(\text{m}), 1005(\text{w}), 833(\text{s})$.

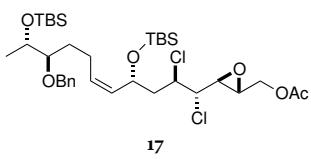
((2R,3S)-3-((1S,2R,4R)-4-((tert-butyldimethylsilyl)oxy)-1,2-dichloro-5-hydroxypentyl)oxiran-2-yl)methyl acetate



To a solution of **SI-3** (11.5 g, 22.2 mmol) in THF (146 mL) at -10°C was dropwise added a solution of 70% HF-pyridine (11.89 mL) and pyridine (23.8 mL, 294 mmol) in THF (39 mL) at -10°C . The mixture was stirred for 44 h at this temperature and then poured into sat. NaHCO_3 _(aq). The aqueous phase was extracted with EtOAc twice, and the combined organics were dried over Na_2SO_4 , filtered, and concentrated. Purification by column chromatography (5 %, 20 % and 50 % EtOAc in hexane) gave **15** (5.54 g, 13.80 mmol, 62%), starting material **SI-3** (1.44 g, 2.79 mmol, 13%) and the double-deprotected diol **SI-2** (1.20 g, 4.18 mmol, 19%). After reprotection of the diol, a second cycle delivered another 1.30 g of **15**, accounting for a total yield of 77% over two cycles.

HR-MS(ESI⁺): calculated for $\text{C}_{16}\text{H}_{34}\text{Cl}_2\text{NO}_5\text{Si}$ [M+Na⁺]: $m/z = 423.1132$, found: $m/z = 423.1130$ **¹H-NMR** (400 MHz CDCl_3) δ [ppm] = 4.41 (dd, $J = 12.5, 3.3$ Hz, 1H), 4.36 (ddd, $J = 11.4, 3.9, 2.1$ Hz, 1H), 4.12 – 4.02 (m, 1H), 4.01 (dd, $J = 12.5, 6.0$ Hz, 1H), 3.75 (dd, $J = 7.8, 3.9$ Hz, 1H), 3.67 (dd, $J = 11.4, 4.2$ Hz, 1H), 3.51 (dd, $J = 11.2, 3.3$ Hz, 1H), 3.29 (dd, $J = 7.8, 2.0$ Hz, 1H), 3.21 (ddd, $J = 6.0, 3.3, 2.0$ Hz, 1H), 2.22 (ddd, $J = 14.5, 10.1, 2.1$ Hz, 1H), 2.10 (s, 3H), 1.92 (ddd, $J = 14.5, 11.4, 2.2$ Hz, 1H), 1.73 (Bs, 1H), 1.57 (Bs, 1H), 0.92 (s, 9H), 0.16 (s, 3H), 0.14 (s, 3H). **¹³C-NMR** (101 MHz CDCl_3) δ [ppm] = 170.7, 69.6, 66.8, 64.3, 63.5, 61.4, 55.6, 55.0, 38.9, 26.0, 20.9, 18.2, -4.2, -4.6. **Optical Rotation:** $[\alpha]_D^{26.1} = +30.2$ ($c = 0.5$, CHCl_3). **IR** (film): $\tilde{\nu} = 3489(\text{b}), 2954(\text{m}), 2929(\text{s}), 2857(\text{w}), 1746(\text{s}), 1386(\text{w}), 1252(\text{s}), 1231(\text{s}), 1040(\text{s}), 837(\text{s}), 778(\text{s})$.

((2R,3S)-3-((1S,2R,4R,9R,10S,Z)-9-(benzyloxy)-4,10-bis((tert-butyldimethylsilyl)oxy)-1,2-dichloroundec-5-en-1-yl)oxiran-2-yl)methyl acetate



Oxidation: To a solution of primary alcohol **15** (1.30 g, 3.24 mmol) and *t*BuOH (0.31 mL, 3.24 mmol) in CH₂Cl₂ (32.4 mL) was added Dess-Martin Periodinane (2.06 g, 4.86 mmol) and the reaction was stirred for 10 min. A 1:1 mixture of sat. NaHCO₃(aq) and sat. Na₂S₂O₃(aq) was added and after phase separation the aqueous phase was extracted with CH₂Cl₂. The combined organic phases

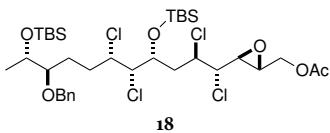
were washed first with a 1:1 mixture of sat. NaHCO₃(aq) and sat. Na₂S₂O₃(aq), then with brine, and the organics were then dried over Na₂SO₄, filtered, and concentrated. Purification by chromatography over a short plug of silica (20 % EtOAc in hexane) afforded the crude aldehyde **4** (1.29 g, 100 %) which was used directly in the next step. HR-MS(ESI⁺): calculated for C₃₃H₅₇Cl₄O₅Si₂⁺ [M+H⁺]: *m/z* = 729.2493, found: *m/z* = 729.2488.

Olefination: Aldehyde **4** (1.29 g, 3.24 mmol) and triphenylphosphonium iodide **16**[1] (2.72 g, 3.82 mmol) were separately azeotropically dried by concentration under reduced pressure from a solution in benzene three times and transferred to a Schlenk apparatus. To the phosphonium iodide was added THF (21.5 mL) and the solution was cooled to 0 °C. A 0.5 M solution of KHMDS (7.45 mL, 3.73 mmol) was added dropwise and the mixture was stirred for 30 min before it was cooled to -78 °C. Hereafter, THF (46 mL) was added to the aldehyde and this solution was transferred precooled to -78 °C into the solution containing the ylide and the resulting mixture was stirred for 30 min, then warmed to 0 °C and stirred for another 30 min. The reaction was diluted with Et₂O and quenched with phosphate buffer (pH7). The phases were separated and the aqueous phase was extracted three times with EtOAc. The combined organic phases were dried (Na₂SO₄), filtered, and concentrated, and the product was purified by column chromatography (5 % to 10 % EtOAc in hexane) to give **17** (2.13 g, 3.02 mmol, 93 %) as a colorless oil.¹

HR-MS(ESI⁺): calculated for C₃₅H₆₀Cl₂O₆Si₂Na [M+Na⁺]: *m/z* = 725.3198, found: *m/z* = 725.3195.

¹H-NMR (400 MHz CDCl₃) δ[ppm] = 7.38 – 7.23 (m, 5H), 5.39 – 5.34 (m, 2H), 4.81 – 4.72 (m, 2H), 4.59 – 4.50 (m, 2H), 4.44 (ddd, J = 11.3, 4.1, 2.2 Hz, 1H), 4.39 (dd, J = 12.4, 3.3 Hz, 1H), 3.98 (dd, J = 12.4, 6.1 Hz, 1H), 3.86 (qd, J = 6.2, 3.9 Hz, 1H), 3.71 (dd, J = 7.7, 3.9 Hz, 1H), 3.32 – 3.24 (m, 2H), 3.19 (ddd, J = 6.1, 3.3, 2.0 Hz, 1H), 2.34 – 2.22 (m, 1H), 2.09 (s, 4H), 2.13 – 1.97 (m, 2H), 1.80 (ddd, J = 14.2, 11.1, 2.4 Hz, 1H), 1.67 – 1.46 (m, 2H), 1.18 (d, J = 6.3 Hz, 3H), 0.90 (s, 9H), 0.88 (s, 9H), 0.09 (s, 3H), 0.07 (s, 3H), 0.06 (s, 3H), 0.04 (s, 3H). ¹³C-NMR (101 MHz cDCl₃) δ[ppm] = 170.7, 139.1, 133.2, 130.1, 128.4, 128.0, 127.6, 83.7, 73.0, 70.9, 65.6, 64.2, 63.6, 61.3, 55.6, 54.9, 43.2, 31.1, 26.0, 26.0, 24.3, 20.8, 19.5, 18.2, 18.2, -4.0, -4.3, -4.6, -4.8. Optical Rotation: [α]_D^{26.2} = +24.4 (c = 0.5, CHCl₃). IR (film): ν = 2955(S), 2930(S), 2858(S), 1749(s), 1472(w), 1369(w), 1253(s), 1083(s), 836(s), 777 (S).

((2R,3S)-3-((1S,2R,4R,5S,6S,9R,10S)-9-(benzyloxy)-4,10-bis((tert-butyldimethylsilyl)oxy)-1,2,5,6-tetrachloroundecyl)oxiran-2-yl)methyl acetate



To a solution of Et₄NCl₃ (2.86 g, 12.1 mmol) in CH₂Cl₂ (10.1 mL) at -78 °C was added precooled **17** (2.13 g, 3.03 mmol) in CH₂Cl₂ (15.1 mL) and the resulting solution was stirred for 45 min. Excess Et₄NCl₃ was then quenched through the addition of cy-

¹The double bond configuration was determined to be (*Z*) from the ³J_{H-H}=11.0 Hz coupling constant in C₆D₆.

clopentene (2.66 ml, 30.3 mmol) followed by a spatula tip of solid NaHCO₃. The reaction was allowed to warm to room temperature and a 1:1 mixture of sat. NaHCO_{3(aq)} and sat. Na₂S₂O_{3(aq)} was added. The aqueous phase was separated and extracted three times with CH₂Cl₂ and the combined organic phases were dried (Na₂SO₄), filtered, and concentrated. Purification by column chromatography (5 % to 10 % EtOAc in hexane) gave tetrachloride **18** (2.17 g, 92 %) as a colorless oil together with an inseparable diastereomer (dr = 5:1).

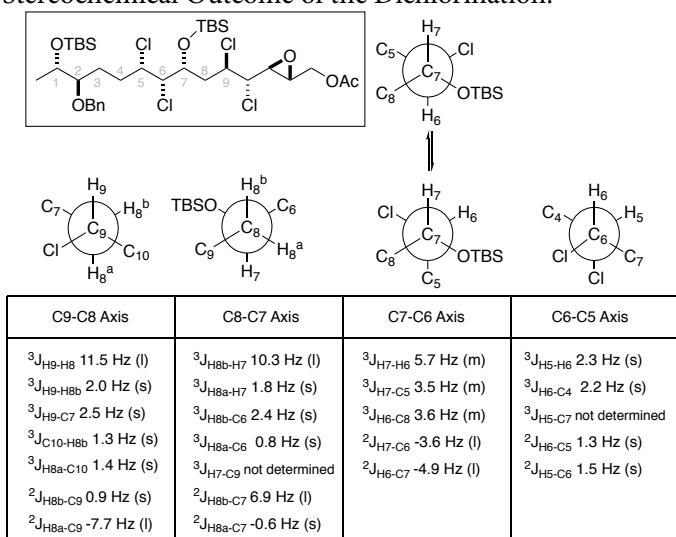
HR-MS(ESI⁺): calculated for C₃₅H₆₄Cl₄O₆Si₂N [M+NH₄⁺]: m/z = 790.3021, found: m/z = 790.3013

¹H - NMR (500 MHz CDCl₃) δ[ppm] = 7.36 – 7.25 (m, 5H), 4.76 (d, J = 11.3 Hz, 1H), 4.49 (d, J = 11.4 Hz, 1H), 4.41 (dd, J = 12.4, 3.3 Hz, 1H), 4.28 (ddd, J = 11.3, 4.4, 2.1 Hz, 1H), 4.28 – 4.19 (m, 2H), 4.00 (dd, J = 12.4, 6.0 Hz, 1H), 3.93 (dd, J = 5.7, 2.3 Hz, 1H), 3.86 (dd, J = 6.3, 4.0 Hz, 1H), 3.70 (dd, J = 7.6, 4.5 Hz, 1H), 3.27 (dd, J = 7.6, 2.0 Hz, 1H), 3.20 (ddd, J = 6.1, 3.3, 2.0 Hz, 1H), 2.27 (ddd, J = 14.5, 11.4, 1.9 Hz, 1H), 2.18 – 2.12 (m, 1H), 2.10 (s, 3H), 2.09 – 1.78 (m, 3H), 1.55 – 1.47 (m, 1H), 1.18 (d, J = 6.3 Hz, 3H), 0.90 (s, 9H), 0.90 (s, 9H), 0.17 (s, 3H), 0.15 (s, 3H), 0.08 – 0.06 (m, 6H).

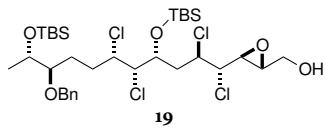
¹³C - NMR (126 MHz CDCl₃) δ[ppm] = 170.7, 139.0, 128.4, 127.9, 127.7, 83.8, 73.1, 72.5, 70.9, 67.8, 64.0, 63.5, 61.3, 61.2, 55.6, 54.9, 37.9, 34.2, 28.6, 26.1, 26.0, 20.9, 19.5, 18.3, 18.2, -3.8, -4.2, -4.3, -4.5.

Optical Rotation: [α]_D^{26.4} = +25.4 (c = 0.5, CHCl₃). **IR (film):** ν̄ = 2955 (m), 2930 (s), 2857 (m), 1747 (s), 1463 (w), 1367 (m), 1231 (s), 1254 (s), 1098 (s), 836 (s), 777 (s).

Stereochemical Outcome of the Dichlorination:



((2R,3S)-3-((1S,2R,4R,5S,6S,9R,10S)-9-(benzyloxy)-4,10-bis((tert-butyldimethylsilyl)oxy)-1,2,5,6-tetrachloroundecyl)oxiran-2-yl)methanol

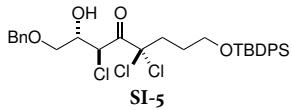


Acetate **18** (2.12 g, 2.74 mmol) was dissolved in MeOH (27 mL) and cooled to 0 °C, then K₂CO₃ (1.13 g, 8.21 mmol) was added and the reaction was stirred for 20 min. The mixture was diluted with sat. NH₄Cl_(aq), extracted with EtOAc three times, and the combined organics were dried (Na₂SO₄), filtered, and concentrated. Purification by column chromatography (10 % to 20 % EtOAc in hexane)

gave **19** (1.80 g, 90 %) as a colorless oil together with the inseparable diastereomer ($\text{dr} = 6:1$). **HR-MS(ESI⁺)**: calculated for $C_{33}H_{58}\text{Cl}_4\text{O}_5\text{Si}_2\text{K} [\text{M}+\text{K}^+]$: $m/z = 769.2208$, found: $m/z = 769.2200$. **¹H-NMR** (400 MHz CDCl_3) δ [ppm] = 1H NMR (400 MHz, Chloroform-d) – 7.39 – 7.25 (m, 5H), 4.77 (d, $J = 11.4$ Hz, 1H), 4.49 (d, $J = 11.4$ Hz, 1H), 4.31 (ddd, $J = 11.2, 4.3, 2.1$ Hz, 1H), 4.28 – 4.19 (m, 2H), 3.94 (dd, $J = 5.7, 2.4$ Hz, 1H), 3.93 – 3.81 (m, 2H), 3.75 (dd, $J = 7.7, 4.3$ Hz, 1H), 3.75 – 3.65 (m, 1H), 3.35 (dd, $J = 7.8, 2.1$ Hz, 1H), 3.28 (dt, $J = 8.8, 3.3$ Hz, 1H), 3.13 (dt, $J = 3.8, 2.3$ Hz, 1H), 2.29 (ddd, $J = 14.4, 11.2, 2.0$ Hz, 1H), 2.17 (ddd, $J = 14.5, 10.0, 2.2$ Hz, 1H), 2.06 – 1.77 (m, 3H), 1.67 (d, $J = 7.7, 5.4$ Hz, 1H), 1.57 – 1.45 (m, 1H), 1.18 (d, $J = 6.2$ Hz, 3H), 0.91 (s, 9H), 0.90 (s, 9H), 0.18 (s, 3H), 0.15 (s, 3H), 0.09 – 0.06 (m, 6H). **¹³C-NMR** (101 MHz CDCl_3) δ [ppm] = 138.9, 128.5, 128.0, 127.7, 83.9, 73.1, 72.5, 71.0, 67.8, 64.3, 61.5, 61.1, 60.6, 57.9, 54.8, 37.7, 34.2, 28.7, 26.1, 26.0, 19.5, 18.3, 18.2, -3.8, -4.2, -4.3, -4.5. **Optical Rotation:** $[\alpha]_D^{26.5} = +26.4$ ($c = 0.5$, CHCl_3). **IR** (film): $\tilde{\nu} = 3410(\text{b}), 2955(\text{s}), 2930(\text{s}), 2858(\text{s}), 1472(\text{m}), 1256(\text{s}), 1101(\text{s}), 836(\text{s}), 777(\text{s})$.

2.2 Total Synthesis of the Sulfone Fragment of Revised Undecachlorosulfolipid

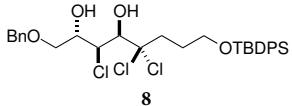
1-((2R,3S)-3-((benzyloxy)methyl)oxiran-2-yl)-5-((tert-butyldiphenylsilyl)oxy)-2,2-dichloropentan-1-one



Freshly distilled SiCl_4 (16.7 mL, 146 mmol, 2 equiv.) is added to a 4 L round-bottom flask containing a solution of epoxide **7[1]** (41.6 g, 72.8 mmol) in CH_2Cl_2 (730 mL, 0.1 M) at 0 °C over 2 min. After stirring for 5 min HMPA (2.53 mL, 14.56 mmol, 0.2 equiv.) is added dropwise, after 5 min the cooling bath is removed and stirring is continued for 96 h. Over this time the initial pale yellow color turns blue and later dark purple. Subsequently, excess SiCl_4 is quenched by the addition of NaHCO_3 (48.9 g, 582 mmol) and water in one portion while rapidly stirring. The reaction mixture is then passed through a large frit filled with celite. The celite is subsequently washed with Et_2O until no more product elutes as detected by TLC. The phases are then separated, the aqueous phases is extracted thrice with ether and the combined organic phases are washed with H_2O , 10% $\text{CuSO}_4\text{(aq)}$ and again H_2O . After drying with MgSO_4 and filtering, the volatiles are removed under vacuum to obtain 40.1 g of the **SI-5** (65.9 mmol, 91%). This crude product was used without further purification for the next step as partial epimerisation took place on silica.

HR-MS(ESI⁺): calculated for $C_{31}H_{37}\text{Cl}_3\text{O}_4\text{SiNa} [\text{M}+\text{Na}^+]$: $m/z = 629.1419$, found: $m/z = 629.1408$. **¹H-NMR** (300 MHz CDCl_3) δ [ppm] = 7.72 – 7.60 (m, 4H), 7.46 – 7.28 (m, 11H), 5.18 (d, $J = 9.0$ Hz, 1H), 4.62 (s, 2H), 4.28 – 4.17 (m, 1H), 3.88 (dd, $J = 10.2, 3.5$ Hz, 1H), 3.80 – 3.61 (m, 4H), 2.73 (d, $J = 9.0$ Hz, 1H), 2.50 (dd, $J = 9.7, 5.0$ Hz, 2H), 1.95–1.82 (m, 2H), 1.05 (s, 9H). **¹³C-NMR** (126 MHz CDCl_3) δ [ppm] = 191.9, 137.5, 135.7, 133.8, 133.7, 129.8, 128.7, 128.2, 127.9, 127.8, 89.3, 73.8, 72.0, 69.1, 62.9, 52.1, 39.7, 28.1, 27.0, 19.4. **IR** (film): $\tilde{\nu} = 2929$ (s), 2857 (s), 1741 (s), 1428 (m), 1271 (m), 1112 (s), 823 (m), 738 (m), 702 (s). The data matched those previously reported.[1]

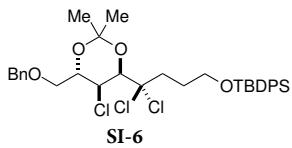
(2S,3S,4R)-1-(benzyloxy)-8-((tert-butyldiphenylsilyl)oxy)-3,5,5-trichlorooctane-2,4-diol



Solid NaBH₄ (9.95 g, 263 mol, 4 equiv.) was added portion-wise to acetic acid at 0 °C and stirred at this temperature until the bubbling ceased. Then the ketone **SI-5** (40.0 g, 65.8 mol) is added by cannula as a solution in acetonitrile (330 mL). The flask containing the starting material is rinsed twice with a minimal amount of acetonitrile, which is also added to the borohydride solution. The reaction mixture is stirred for 1 h after which excess reagent is quenched carefully by the addition of brine and stirred until the bubbling ceases. The phases are subsequently separated, the aqueous phase is extracted thrice with ethyl acetate and the combined organic extracts are dried over MgSO₄, filtered and evaporated under vacuum. The obtained oil is purified by column chromatography (pentane-Et₂O 2:1) to yield the desired *anti*-1,3-diol **8** as a colorless oil (37.1 g, 60.8 mol, 92%).

HR-MS(ESI⁺): calculated for C₃₁H₃₉Cl₃O₄SiNa [M+Na⁺]: *m/z* = 631.1575, found: *m/z* = 631.1565
¹H-NMR (400 MHz CDCl₃) δ[ppm] = 7.73 – 7.66 (m, 4H), 7.49 – 7.29 (m, 11H), 4.72 (dd, J = 8.6, 0.8 Hz, 1H), 4.62 (s, 2H), 4.57 (dd, J = 10.2, 0.8 Hz, 1H), 4.01 – 3.90 (m, 1H), 3.82 – 3.73 (m, 4H), 3.02 (d, J = 10.2 Hz, 1H), 2.86 (d, J = 7.3 Hz, 1H), 2.62 – 2.50 (m, 1H), 2.39 (ddd, J = 14.4, 8.8, 7.1 Hz, 1H), 2.00 (dq, J = 9.0, 6.3 Hz, 2H), 1.08 (s, 9H). **¹³C-NMR** (101 MHz CDCl₃) δ[ppm] = 137.47, 135.69, 133.83, 133.81, 129.75, 128.69, 128.16, 127.94, 127.79, 96.90, 74.90, 73.70, 71.61, 70.10, 63.09, 60.58, 41.19, 28.25, 26.98, 19.34. **IR** (film): $\tilde{\nu}$ = 3441 (b), 3070 (w), 2930 (m), 2858 (m), 1428 (m), 1106 (s), 732 (s), 699 (s), 613 (s), 504 (m). The data matched those previously reported.[1]

(4-((4R,5S,6S)-6-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-1,3-dioxan-4-yl)-4,4-dichlorobutoxy)(tert-butyl)diphenylsilane

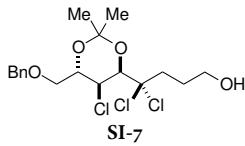


A round-bottom flask is charged with diol **8** (37.0 g, 60.6 mmol) dissolved in CH₂Cl₂ (606 mL, 0.1 M) and cooled to 0 °C. 2-Methoxy-1-propene (23.1 mL, 243 mmol) is added followed by pyridinium para-toluenesulfonate (1.5 g, 6.06 mmol, 0.1 equiv.). The mixture is stirred for 60 min at 0 °C and the warmed to room temperature and stirred for 24 h. After completion of the reaction the mixture is neutralized

with pH7 buffer, stirred rapidly for 10 min and the phases are separated. The aqueous phase is extracted thrice with CH₂Cl₂, dried, filtered and concentrated under vacuum. Purification by column chromatography yields **SI-6** (28.6 g, 73% yield).

HR-MS(ESI⁺): calculated for C₃₄H₄₃Cl₃O₄SiNa [M+Na⁺]: *m/z* = 671.1888, found: *m/z* = 671.1884
¹H-NMR (400 MHz CDCl₃) δ[ppm] = 7.69 (dt, J = 6.4, 1.7 Hz, 4H), 7.50 – 7.27 (m, 11H), 4.64 (d, J = 4.4 Hz, 2H), 4.48 (dt, J = 11.3, 3.8 Hz, 2H), 4.06 (ddd, J = 7.6, 4.6, 3.1 Hz, 1H), 3.76 (t, J = 6.0 Hz, 2H), 3.74 – 3.68 (m, 2H), 2.76 (ddd, J = 14.5, 9.4, 6.4 Hz, 1H), 2.44 (ddd, J = 14.5, 9.3, 6.7 Hz, 1H), 2.10 – 1.96 (m, 2H), 1.52 (s, 3H), 1.46 (s, 3H), 1.07 (s, 9H). **¹³C-NMR** (101 MHz CDCl₃) δ[ppm] = 137.9, 135.7, 135.7, 133.9, 133.9, 129.7, 129.7, 128.6, 127.9, 127.8, 127.8, 127.8, 103.5, 93.1, 77.1, 76.2, 73.7, 68.9, 63.1, 57.2, 39.5, 28.1, 27.0, 24.5, 23.5, 19.4. **IR** (film): $\tilde{\nu}$ = 3071 (w), 2931 (m), 2858 (m), 1428 (w), 1381 (m), 1223 (m), 1110 (s), 823 (m), 733 (s), 699 (s), 505 (s). The data matched those previously reported.[1]

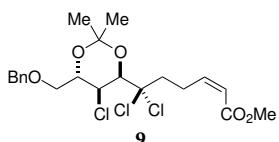
4-((4*R*,5*S*,6*S*)-6-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-1,3-dioxan-4-yl)-4,4-dichlorobutan-1-ol



To a solution of acetic acid (3.77 mL, 65.9 mL) in DMF (330 mL) is added a freshly prepared solution of tetrabutylammonium fluoride trihydrate (17.23 g, 54.6 mmol) in THF (66 mL). The mixture is stirred at room temperature for 30 min and then canulated into a solution of silyl ether **SI-6** (28.6 g, 43.9 mmol) in DMF (435 mL). The mixture is subsequently stirred for 24 h. The mixture is diluted with ether and water while cooling with an ice bath. The aqueous phases is extracted thrice with Et₂O and the combined organic phases are washed with 5% aqueous LiCl, dried with MgSO₄, filtered and evaporated. Purification by column chromatography (EtOAc–Hex 1:3) yields the product **SI-7** as a colorless oil (18.1 g, 43.9 mmol, 100%).

HR-MS(ESI⁺): calculated for C₁₈H₂₅Cl₃O₄Na [M+Na⁺]: *m/z* = 433.0711, found: *m/z* = 433.0721
¹H-NMR (400 MHz CDCl₃) δ[ppm] = 7.39 – 7.27 (m, 5H), 4.64 (d, J = 12.5 Hz, 1H), 4.60 (d, J = 12.4 Hz, 1H), 4.50 (d, J = 3.9 Hz, 1H), 4.46 (dd, J = 7.5, 3.8 Hz, 1H), 4.03 (ddd, J = 7.5, 4.5, 3.1 Hz, 1H), 3.74 (t, J = 6.3 Hz, 2H), 3.69 (d, J = 4.5 Hz, 1H), 3.68 (d, J = 3.1 Hz, 1H), 2.69 (ddd, J = 14.5, 9.3, 6.6 Hz, 1H), 2.41 (ddd, J = 14.6, 8.8, 7.2 Hz, 1H), 2.10 – 1.99 (m, 3H), 1.50 (s, 3H), 1.45 (s, 3H).
¹³C-NMR (101 MHz CDCl₃) δ[ppm] = 137.9, 128.6, 127.9, 127.9, 103.5, 93.0, 77.4, 76.2, 73.8, 68.9, 62.3, 57.3, 39.2, 28.3, 24.5, 23.5. **IR** (film): ν = 3405 (b), 2989 (m), 2936 (m), 1454 (m), 1382 (s), 1224 (s), 1120 (m), 1052 (m), 737 (m), 698 (m). The data matched those previously reported.[1]

methyl (Z)-6-((4*R*,5*S*,6*S*)-6-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-1,3-dioxan-4-yl)-6,6-dichlorohex-2-enoate



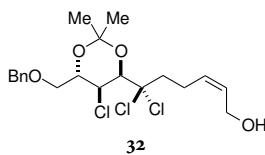
Alcohol Oxidation: A solution of alcohol **SI-7** (18.1 g, 43.9 mmol) is dissolved in CH₂Cl₂ (440 mL) and cooled to 0 °C. Dess-Martin periodinane (24.2 g, 57.1 mmol, 1.3 equiv.) is added and after stirring at 0 °C for 5 min the mixture is stirred at room temperature for 60 min until complete conversion is observed. The solution is cooled back to 0 °C and excess periodinane is quenched through the addition of a precooled 1:1 mixture (v/v) aq. NaHCO₃ and aq. Na₂S₂O₃. Filtration through a plug of silica (Eluent: EtOAc–Hex 1:3) yields the aldehyde **SI-8** (17.5 g, 42.7 mmol, 97%) that is used without further purification. **¹H-NMR** (300 MHz CDCl₃) δ[ppm] = 9.86 (t, J = 0.8 Hz, 1H), 7.47 – 7.26 (m, 5H), 4.65 (d, J = 12.3 Hz, 1H), 4.59 (d, J = 12.3 Hz, 1H), 4.52 (d, J = 3.8 Hz, 1H), 4.47 (dd, J = 7.5, 3.8 Hz, 1H), 4.03 (ddd, J = 7.5, 4.3, 3.2 Hz, 1H), 3.70 – 3.68 (m, 2H), 3.06 – 2.91 (m, 3H), 2.77 – 2.61 (m, 1H), 1.50 (s, 3H), 1.44 (s, 3H).

Still-Gennari Olefination: To a solution of methyl-2-(bis(2,2,2-trifluoroethoxy)phosphoryl)acetate (9.06 mL, 42.7 mmol) in THF (431 mL) is added a solution of 18-crown-6 (56.4 g, 214 mmol) in THF (431 mL). The mixture is cooled to -78 °C and KHMDS (0.5 M in PhMe, 85.4 mL) is added. After stirring for 10 min a solution of aldehyde **SI-8** is added in THF (431 mL). After stirring for 15 min, excess reagent is quenched by addition of aq. NH₄Cl. The resulting mixture is stirred rapidly for 15 min at room temperature. The phases are then separated, the aqueous phases is extracted twice with CH₂Cl₂, the solvent evaporated under vacuum and the crude product is then

purified by column chromatography (EtOAc–Hex 1:7) to yield the product **9** as a colorless oil (14.3 g, 30.8 mmol, 72%).

HR-MS(ESI⁺): calculated for C₂₁H₂₇Cl₃O₅Na [M+Na⁺]: *m/z* = 487.0816, found: *m/z* = 487.0818
¹H-NMR (400 MHz CDCl₃) δ [ppm] = 7.41 – 7.25 (m, 5H), 6.27 (dt, *J* = 11.4, 7.6 Hz, 1H), 5.84 (dt, *J* = 11.4, 1.7 Hz, 1H), 4.64 (d, *J* = 12.3 Hz, 1H), 4.60 (d, *J* = 12.2 Hz, 1H), 4.50 (d, *J* = 3.8 Hz, 1H), 4.47 (dd, *J* = 7.5, 3.8 Hz, 1H), 4.02 (ddd, *J* = 7.6, 4.5, 3.2 Hz, 1H), 3.73 (s, 3H), 3.68 (d, *J* = 4.5 Hz, 1H), 3.68, (d, *J* = 3.14 Hz, 1H), 3.18 – 3.07 (m, 2H), 2.74 (ddd, *J* = 14.6, 8.6, 7.2 Hz, 1H), 2.43 (ddd, *J* = 14.4, 9.2, 6.9 Hz, 1H), 1.50 (s, 3H), 1.44 (s, 3H). **¹³C-NMR** (101 MHz CDCl₃) δ [ppm] = 166.7, 148.0, 137.9, 128.6, 127.9, 127.8, 120.7, 103.6, 92.2, 77.1, 76.2, 73.7, 68.9, 57.3, 51.4, 41.5, 24.9, 24.5, 23.5. **IR** (film): $\tilde{\nu}$ = 3031 (w), 2991 (m), 2947 (m), 1722 (s), 1382 (m); 1224 (s), 1172 (s), 698 (m). The data matched those previously reported.[1]

(Z)-6-((4R,5S,6S)-6-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-1,3-dioxan-4-yl)-6,6-dichlorohex-2-en-1-ol

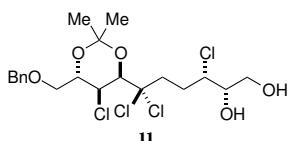


To a solution of enoate **9** (14.3 g, 30.8 mmol) in THF (615 mL, 0.05 M) at -78 °C is added a solution of DIBAL (1 M in hexanes, 123 mL, 4 equiv.). After stirring for 4 hour at this temperature excess DIBAL is quenched with EtOAc, The flask is allowed to warm to room temperature, 2 M aq. NaOH is added and the reaction mixture is rapidly stirred for 30 min. The suspension is filtered through celite and the phases are separated.

The aqueous phases is extracted thrice with Et₂O, the combined organic phases are dried over MgSO₄ and filtered. The solvent is removed under vacuum and the crude product is purified by column chromatography (Et₂O–pentane 1:1) to yield the product **32** as a colorless oil (12.9 g, 29.5 mmol, 96%).

¹H-NMR (500 MHz CDCl₃) δ [ppm] = 7.41 – 7.26 (m, 5H), 5.67 (dtt, *J* = 10.8, 6.5, 1.4 Hz, 1H), 5.56 (dtt, *J* = 10.9, 7.3, 1.4 Hz, 1H), 4.64 (d, *J* = 12.2 Hz, 1H), 4.60 (d, *J* = 12.6 Hz, 1H), 4.48 (t, *J* = 4.3 Hz, 1H), 4.46 (t, *J* = 3.7 Hz, 1H), 4.25 (dd, *J* = 6.6, 1.4 Hz, 1H), 4.02 (ddd, *J* = 7.5, 4.7, 2.9 Hz, 1H), 3.73 – 3.63 (m, 2H), 2.69 – 2.59 (m, 1H), 2.60 – 2.51 (m, 2H), 2.39 – 2.30 (m, 1H), 1.50 (s, 3H), 1.44 (s, 3H). **¹³C-NMR** (126 MHz CDCl₃) δ [ppm] = 137.8, 130.5, 129.9, 128.5, 127.8, 127.7, 103.4, 92.4, 77.1, 76.1, 73.6, 68.7, 58.6, 57.2, 42.1, 24.4, 23.3, 23.1. **IR** (film): $\tilde{\nu}$ = 3423 (b), 2990 (m), 2937 (m), 1382 (s); 1224 (s); 1121 (m), 739 (m), 698 (m). The data matched those previously reported.[1]

(2S,3S)-6-((4R,5S,6S)-6-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-1,3-dioxan-4-yl)-3,6,6-trichlorohexane-1,2-diol



Epoxidation: A suspension of dried 4 Å molecular sieves (12.91 g) in anhydrous CH₂Cl₂ (307 mL) is cooled to -20 °C. To this is then added freshly distilled L-(+)-diethyltartrate (7.1 mL, 41.3 mmol, 1.4 equiv.) and subsequently freshly distilled Ti(O*i*Pr)₄ (10.47 mL, 35.4 mmol, 1.2 equiv.). After stirring for 20 min a solution of allylic alcohol **32** (12.9 g, 29.5 mmol) is added as a solution in CH₂Cl₂ (307 mL). After stirring at -20 °C for another 30 min TBHP (5.5 M, 16.1 mL, 88 mmol, 3 equiv.) is added. After stirring for 20 min at this temperature the flask is transferred to a -20 °C freezer and

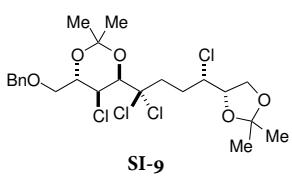
allowed to age for 24 h. The reaction is subsequently quenched at -20°C through the addition of water and stirred at room temperature for 30 min. After this time an aqueous 30% NaOH solution saturated with NaCl is added and the solution is mechanically stirred for 30 min. The mixture is filtered through a plug of glass wool. Brine is added and the phases are allowed to separate. The layers are separated and the aqueous phase is extracted twice with CH_2Cl_2 . The combined organic extracts are dried over MgSO_4 , filtered and the filter cake is washed with CH_2Cl_2 until no more product is eluting. The solution is concentrated under vacuum and the crude product then purified by column chromatography (Et_2O -pentane 1:1) to yield the product epoxide **10** (11.14 g, 24.55 mmol, 83%, dr 4:1) as a colorless oil.

HR-MS(ESI⁺): calculated for $\text{C}_{20}\text{H}_{27}\text{Cl}_3\text{O}_5\text{Na} [\text{M}+\text{Na}^+]$: $m/z = 475.0816$, found: $m/z = 475.0818$
¹H - NMR (400 MHz CDCl_3) δ [ppm] = 7.41 – 7.25 (m, 5H), 4.64 (d, $J = 12.3$ Hz, 1H), 4.60 (d, $J = 12.3$ Hz, 1H), 4.51 (ddd, $J = 5.0, 2.5, 2.5$ Hz, 1H), 4.47 (dd, $J = 7.4, 3.8$ Hz, 1H), 4.03 (ddd, $J = 7.5, 4.5, 3.1$ Hz, 1H), 3.97 – 3.85 (m, 1H), 3.80 – 3.69 (m, 1H), 3.72 – 3.62 (m, 2H), 3.20 (dt, $J = 6.7, 4.3$ Hz, 1H), 3.08 (dddd, $J = 13.1, 8.9, 5.2, 1.9$ Hz, 1H), 2.85 (ddd, $J = 14.5, 9.7, 6.3$ Hz, 1H), 2.43 (ddd, $J = 14.5, 9.8, 6.1$ Hz, 1H), 2.11 – 2.00 (m, 2H), 1.50 (s, 3H), 1.45 (s, 3H). **IR** (film): $\tilde{\nu} = 3447$ (b), 2989 (m), 2937 (m), 2867 (w), 1454 (m), 1382 (s), 1223 (s), 1041 (s), 740 (m), 698 (m).

Epoxide opening: A round bottom flask is charged with ethyl acetate (220 mL) and anhydrous MgCl_2 (6.30 g, 66.1 mmol). The suspension is heated to 80°C and stirred for 10 min during which the previously cloudy mixture becomes clear with some residual solids. To this is then added the starting epoxide **10** dissolved in 50 mL ethyl acetate. The mixture is stirred for 5 min and then allowed to cool to room temperature, water is added, the phases are separated and the aqueous phase is extracted three times with ethyl acetate. The solvent is removed under vacuum and the product is purified by column chromatography (Et_2O -pentane 2:1) to yield the product **11** (9.25 g, 18.9 mmol, 86%) as a colorless oil along with the undesired 1,3-diol (1.35 g, 2.75 mmol, 12.5%).

HR-MS(ESI⁺): calculated for $\text{C}_{20}\text{H}_{29}\text{Cl}_4\text{O}_5^+ [\text{M}+\text{H}^+]$: $m/z = 489.0769$, found: $m/z = 489.0764$.
¹H - NMR (400 MHz CDCl_3) δ [ppm] = 7.40 – 7.27 (m, 5H), 4.64 (d, $J = 12.2$ Hz, 1H), 4.60 (d, $J = 12.2$ Hz, 1H), 4.50 (d, $J = 3.8$ Hz, 1H), 4.47 (dd, $J = 7.5, 3.9$ Hz, 1H), 4.14 – 4.08 (m, 1H), 4.03 (ddd, $J = 7.5, 4.4, 3.1$ Hz, 1H), 3.84 – 3.78 (m, 1H), 3.77 – 3.71 (m, 2H), 3.71 – 3.64 (m, 2H), 2.77 – 2.59 (m, 2H), 2.40 – 2.19 (m, 2H), 1.51 (s, 3H), 1.45 (s, 3H). **¹³C - NMR** (101 MHz CDCl_3) δ [ppm] = 137.8, 128.6, 127.9, 127.8, 103.6, 92.2, 77.1, 76.1, 74.4, 73.7, 68.8, 64.6, 63.9, 57.3, 39.8, 30.3, 24.5, 23.5. **IR** (film): $\tilde{\nu} = 3415$ (b), 3932 (w), 2990 (m), 2929 (m), 1454 (m), 1382 (m), 1223 (s); 1056 (s), 907 (s), 728 (s). The data matched those previously reported.[1]

(4S,5S,6R)-4-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-(S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxane

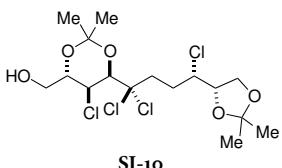


oil.

A round-bottom flask is charged with 1,2-diol **11** (9.0 g, 18 mmol), acetone (184 mL, 0.1 M), anhydrous CuSO_4 (3.81 g, 23.8 mol, 1.3 equiv.) and *p*-toluenesulfonic acid (35 mg, 0.18 mmol, 1 mol%). The mixture is stirred for 24 h and the acid is then quenched through addition of solid K_2CO_3 . The mixture is filtered and the solvent evaporated under vacuum. Purification by column chromatography (Et_2O -pentane 1:7) yields bis-acetal **SI-9** (7.7 g, 15 mmol, 79%) as a colorless

HR-MS(ESI⁺): calculated for C₂₃H₃₃Cl₄O₅ [M+H⁺]: m/z = 529.1079, found: m/z = 529.1077. **¹H – NMR** (400 MHz CDCl₃) δ[ppm] = 7.41 – 7.25 (m, 5H), 4.65 (d, J = 12.3 Hz, 1H), 4.61 (d, J = 1.1 Hz, 1H), 4.48 (dt, J = 11.3, 3.9 Hz, 2H), 4.33 (ddd, J = 6.7, 6.1, 5.2 Hz, 1H), 4.11 (dd, J = 8.7, 6.7 Hz, 1H), 4.03 (ddd, J = 7.5, 4.5, 3.1 Hz, 1H), 3.98 – 3.89 (m, 1H), 3.75 – 3.63 (m, 2H), 2.77 – 2.60 (m, 2H), 2.43 – 2.28 (m, 1H), 2.19 – 2.07 (m, 1H), 1.51 (s, 3H), 1.49 (s, 3H), 1.45 (s, 3H), 1.38 (s, 3H). **¹³C – NMR** (101 MHz CDCl₃) δ[ppm] = 137.9, 128.6, 128.0, 127.9, 110.4, 103.6, 92.3, 78.5, 77.4, 76.2, 73.8, 68.8, 66.4, 62.1, 57.3, 40.0, 29.1, 26.4, 25.3, 24.5, 24.5, 23.5. **IR (film):** ν = 3427 (b), 3032 (w), 2986 (w), 2927 (m), 1725 (m), 1453 (m), 1374 (m), 1223 (s), 1246 (s), 1046 (s), 699 (s). The data matched those previously reported.[1]

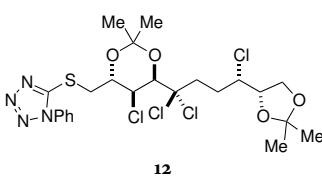
((4S,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)methanol



A flask with a three way stopcock is charged with benzyl ether **SI-9** (7.71 g, 14.5 mmol), ethyl acetate (290 mL) and 10% Palladium on charcoal (308 mg). The stopcock is attached to a hydrogen balloon and a manifold. The flask is evacuated and flushed with nitrogen three times and then evacuated and flushed with hydrogen three times. After the last flush, the hydrogen valve stays open for 1.5 h while rapidly stirring the reaction mixture. The flask is then evacuated and flushed with nitrogen three times before opening the flask to air and filtering the suspension through a plug of celite. The solvent is removed under vacuum and the crude product is purified by column chromatography (Et₂O–pentane 1:2 to 2:3) to yield the product alcohol **SI-10** (6.13 g, 13.9 mmol, 95%) as a colorless oil.

¹H – NMR (400 MHz CDCl₃) δ[ppm] = 4.52 – 4.43 (m, 2H), 4.33 (td, J = 6.7, 5.1 Hz, 1H), 4.12 (dd, J = 8.7, 6.7 Hz, 1H), 4.00 – 3.89 (m, 3H), 3.88 (ddd, J = 12.0, 5.7, 2.6 Hz, 1H), 3.74 (ddd, J = 12.0, 7.4, 4.7 Hz, 1H), 2.78 – 2.61 (m, 2H), 2.46 – 2.27 (m, 1H), 2.21 – 2.06 (m, 1H), 1.83 (dd, J = 7.5, 5.7 Hz, 1H), 1.52 (s, 3H), 1.49 (s, 3H), 1.44 (s, 3H), 1.38 (s, 3H). **¹³C – NMR** (101 MHz CDCl₃) δ[ppm] = 110.4, 103.7, 92.2, 78.5, 77.4, 76.8, 66.3, 62.1, 62.0, 56.8, 39.9, 29.1, 26.4, 25.3, 24.3, 23.7. **IR (film):** ν = 3470 (b), 2989 (m), 2937 (m), 1381 (s), 1222 (s), 1061 (s), 856 (m). The data matched those previously reported.[1]

5-(((4S,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)methyl)thio)-1-phenyl-1H-tetrazole



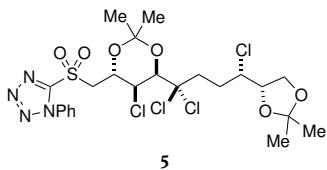
Solid 1-Phenyl-1H-tetrazole-5-thiol (4.46 g, 25.0 mmol) is dissolved in dry THF (80 mL) and recrystallized PPh₃ (5.34 g, 20.4 mmol) is added. The mixture is cooled to 0 °C and DIAD (4.97 mL, 25.2 mmol) is added. After stirring for 10 min the alcohol **SI-10** (6.12 g, 13.9 mmol) is added as a solution in THF (80 mL). The flask that contained **SI-10** is rinsed twice with 40 mL THF each. The reaction mixture is stirred for 20 min at 0 °C and then at room temperature for 40 min. The mixture is cooled back to 0 °C and aq. NaHCO₃ is added. The phases are separated and the aqueous layer is extracted three times with Et₂O. The

combined organic layers are dried over MgSO_4 , filtered and the solvent is removed under vacuum. The crude product is purified by column chromatography (EtOAc–Hex 1:4) to yield the product **12** (8.32 g, 13.9 mmol, 100%) as a white solid. Single-crystals were obtained through slow evaporation from the same solvent mixture.

HR-MS(ESI⁺): calculated for $\text{C}_{23}\text{H}_{31}\text{Cl}_4\text{O}_4\text{N}_4\text{S} [\text{M}+\text{H}^+]$: $m/z = 599.0806$, found: $m/z = 599.0815$

¹H-NMR (400 MHz CDCl_3) δ [ppm] = 7.65 – 7.53 (m, 5H), 4.50 (d, $J = 4.0$ Hz, 1H), 4.37 (dd, $J = 7.7, 4.0$ Hz, 1H), 4.33 (ddd, $J = 6.7, 6.0, 5.0$ Hz, 1H), 4.24 (td, $J = 7.8, 3.5$ Hz, 1H), 4.11 (dd, $J = 8.7, 6.7$ Hz, 1H), 3.98 – 3.88 (m, 3H), 3.62 (dd, $J = 13.4, 7.6$ Hz, 1H), 2.68 (dd, $J = 8.4, 7.3$ Hz, 2H), 2.39 – 2.26 (m, 1H), 2.18 – 2.04 (m, 1H), 1.48 (s, 3H), 1.44 (s, 3H), 1.38 (bs, 6H). **¹³C-NMR** (101 MHz CDCl_3) δ [ppm] = 153.7, 133.7, 130.5, 130.1, 124.1, 110.4, 104.1, 91.9, 78.5, 75.0, 66.3, 62.0, 59.8, 39.9, 35.6, 29.1, 26.4, 25.3, 24.1, 24.1, 23.5. **IR** (film): $\tilde{\nu} = 2988$ (m), 2925 (m), 2853 (m), 1736 (m), 1500 (s), 1383 (s), 1221 (s), 1059 (s), 761 (m), 694 (m). The data matched those previously reported.[1]

5-(((4*S*,5*S*,6*R*)-5-chloro-2,2-dimethyl-6-((*S*)-1,1,4-trichloro-4-((*S*)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)methyl)sulfonyl)-1-phenyl-1*H*-tetrazole



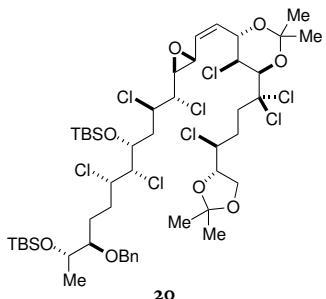
To sulfide **12** (8.1 g, 13.49 mmol) is added ethanol (13.5 mL). $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4 \text{H}_2\text{O}$ (2.50 g, 2.02 mol, 0.15 equiv.) is dissolved in 30% aq. hydrogen peroxide (10.34 mL, 101 mmol) and this solution was then added slowly to the starting material. 20 mL THF were added to this and the mixture was heated to 60 °C for 3 h. The reaction mixture was allowed to cool to room temperature, diluted with water and the phases were separated. The aqueous phase was extracted thrice with CH_2Cl_2 , the volatiles were removed under vacuum. The obtained mixture was diluted with water and CH_2Cl_2 , the phases separated and the organic layer was washed with aq. $\text{Na}_2\text{S}_2\text{O}_3$, dried, filtered and evaporated. The crude product was purified by column chromatography (EtOAc–Hex 1:3) to obtain the product **5** (6.97 g, 11.02 mmol, 82%) as a white foam.

HR-MS(ESI⁺): calculated for $\text{C}_{23}\text{H}_{31}\text{Cl}_4\text{N}_4\text{O}_4\text{S} [\text{M}+\text{H}^+]$: $m/z = 631.0708$, found: $m/z = 631.0713$

¹H-NMR (500 MHz CDCl_3) δ [ppm] = 7.71 – 7.58 (m, 5H), 4.51 – 4.42 (m, 2H), 4.32 (td, $J = 6.4, 4.9$ Hz, 1H), 4.28 (dd, $J = 8.3, 4.3$ Hz, 1H), 4.10 (dd, $J = 8.7, 6.6$ Hz, 1H), 4.04 (dd, $J = 15.0, 2.6$ Hz, 1H), 3.95 – 3.87 (m, 3H), 2.63 (ddd, $J = 9.3, 5.4, 3.3$ Hz, 2H), 2.38 – 2.26 (m, 1H), 2.17 – 2.05 (m, 1H), 1.48 (s, 3H), 1.38 (s, 3H), 1.36 (s, 3H), 1.25 (s, 3H). **¹³C-NMR** (126 MHz CDCl_3) δ [ppm] = 154.2, 133.0, 131.9, 130.0, 125.5, 110.4, 104.6, 91.4, 78.4, 76.7, 71.3, 66.3, 61.9, 58.9, 57.1, 39.9, 29.0, 26.4, 25.3, 23.6, 23.1. **IR** (film): $\tilde{\nu} = 2989$ (m), 1498 (m), 1383 (s), 1354 (s), 1220 (s), 1155 (s), 1057 (s); 764 (m), 689 (m). The data matched those previously reported.[1]

2.3 Final Steps towards 4a

(5R,6S,7S,10R,11S)-10-(benzyloxy)-6,7-dichloro-5-((2R,3S)-2,3-dichloro-3-((2S,3R)-3-((Z)-2-((4S,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)vinyl)oxiran-2-yl)propyl)-2,2,3,3,11,13,13,14,14-nonamethyl-4,12-dioxa-3,13-disilapentadecane



Oxidation: To a solution of alcohol **19** (650 mg, 0.89 mmol) in CH_2Cl_2 (8 mL) was added water (16 μL , 0.89 mmol), Dess-Martin periodinane (564 g, 1.33 mmol) and the mixture was stirred for 30 min. The reaction was then quenched with a 1:1 mixture of sat. $\text{NaHCO}_3(\text{aq})$ and sat. $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$ and stirred until two clear phases were obtained. The aqueous phase was extracted twice with CH_2Cl_2 and hereafter the combined organic phases were washed with a 1:1 mixture of sat. $\text{NaHCO}_3(\text{aq})$ and sat. $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$, brine, then dried over MgSO_4 , filtered, and concentrated. Purification by column chromatography (20 % EtOAc in hexane) on a short pad afforded the aldehyde **6** (484 mg, 75 %) which was used directly in

the next step.

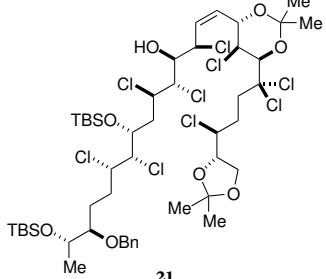
$^1\text{H-NMR}$ (300 MHz CDCl_3) δ [ppm] = 9.08 (d, J = 6.0 Hz, 1H), 7.44–7.30 (m, 5H), 4.77 (d, J = 11.5 Hz, 1H), 4.49 (d, J = 11.5 Hz, 1H), 4.35–4.16 (m, 3H), 3.95 (ddd, J = 5.7, 4.1, 2.1 Hz, 1H), 3.87 (dt, J = 6.2, 3.2 Hz, 1H), 3.76–3.69 (m, 2H), 3.69–3.61 (m, 2H), 3.37 (dd, J = 5.9, 1.6 Hz, 1H), 3.34–3.22 (m, 1H), 2.36–2.15 (m, 2H), 2.04–1.79 (m, 2H), 1.19 (d, J = 6.3 Hz, 3H), 0.91 (s, 9H), 0.90 (s, 9H), 0.18 (s, 3H), 0.16 (s, 3H), 0.07 (s, 3H), 0.07 (s, 3H). **HR-MS(ESI $^+$)**: calculated for $\text{C}_{33}\text{H}_{57}\text{Cl}_4\text{O}_5\text{Si}_2^+$ [$\text{M}+\text{H}^+$]: m/z = 729.2493, found: m/z = 729.2488.

Olefination: Aldehyde **6** (2.08 g, 2.85 mmol) and sulfone **11** (1.98 g, 3.14 mmol) were azeotropically dried together by concentrating from benzene three times. The flask was evacuated and backfilled with nitrogen. The starting materials were dissolved in toluene (71 mL) and the solution was cooled to -78°C . A solution of NaHMDS in PhMe (0.6 M, 51.3 mL, 3.08 mmol) was added dropwise and the mixture was stirred for 1 h, and hereafter allowed to slowly warm to r.t. overnight. Saturated $\text{NaHCO}_3(\text{aq})$ was added and after separating the phases, the aqueous phase was extracted with Et_2O three times. The combined organic phases were washed with brine, dried (MgSO_4), filtered, and concentrated. Column chromatography (8 % Et_2O in pentane) gave the slightly impure title compound **20** (1.58 g, 49 %).

HR-MS(ESI $^+$): calculated for $\text{C}_{49}\text{H}_{84}\text{Cl}_8\text{NO}_8\text{Si}_2^+$ [$\text{M}+\text{NH}_4^+$]: m/z = 1150.3238, found: m/z = 1150.3236
 $^1\text{H-NMR}$ (600 MHz CDCl_3) δ [ppm] = 7.39–7.27 (m, 4H), 7.21–7.13 (m, 1H), 5.78 (ddd, J = 11.3, 8.1, 1.0 Hz, 1H), 5.34 (ddd, J = 11.3, 8.6, 1.1 Hz, 1H), 4.76 (d, J = 11.5 Hz, 1H), 4.83–4.69 (m, 1H), 4.59 (d, J = 4.1 Hz, 1H), 4.49 (d, J = 11.5 Hz, 1H), 4.38–4.28 (m, 2H), 4.28–4.19 (m, 3H), 4.12 (dd, J = 8.7, 6.6 Hz, 1H), 4.00–3.90 (m, 3H), 3.86 (dd, J = 6.3, 4.1 Hz, 1H), 3.77 (ddd, J = 8.6, 1.9, 0.9 Hz, 1H), 3.71 (dd, J = 7.9, 4.3 Hz, 1H), 3.30–3.23 (m, 2H), 2.71 (m, 2H), 2.44–2.24 (m, 4H), 2.24–2.09 (m, 2H), 2.05–1.77 (m, 2H), 1.54 (s, 3H), 1.49 (s, 3H), 1.46 (s, 3H), 1.38 (s, 3H), 1.18 (d, J = 6.2 Hz, 3H), 0.90 (s, 9H), 0.90 (s, 9H), 0.17 (s, 3H), 0.15 (s, 3H), 0.07 (s, 3H), 0.06 (s, 3H). **$^{13}\text{C-NMR}$** (150 MHz CDCl_3) δ [ppm] = 139.0, 132.0, 130.2, 129.2, 128.5, 127.9, 110.4, 103.9, 92.1, 83.8, 78.5, 77.0, 73.1, 73.0, 72.5, 70.9, 67.7, 66.3, 64.4, 62.1, 61.7, 61.3, 59.1, 54.3, 39.9, 37.8, 34.2, 29.1, 28.6, 26.4, 26.1, 26.0,

25.3, 24.2, 23.7, 19.5, 18.3, 18.2, -3.8, -4.2, -4.3, -4.5.

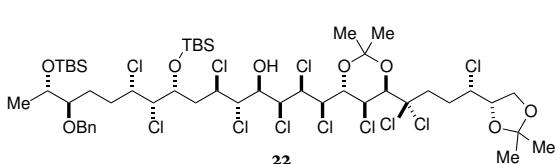
(3*R*,4*S*,5*S*,6*R*,8*R*,9*S*,10*S*,13*R*,14*S*,*Z*)-13-(benzyloxy)-8,14-bis((tert-butylidemethylsilyl)oxy)-3,5,6,9,10-pentachloro-1-((4*S*,5*S*,6*R*)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-1-en-4-ol



Epoxide **20** (1610 mg, 1.42 mmol) was dried by azeotropic concentration from benzene three times and then dissolved in EtOAc (47.2 mL) and CH₂Cl₂ (23.6 mL) in a schlenk tube. TMSCl (5.39 mL, 42.5 mmol) was added followed by slow addition of HCl in EtOAc (1 M, 9.91 mL, 9.91 mmol) by syringe pump over 2 h. Excess acid was then quenched with sat. NaHCO₃(aq) and the phases were separated. The aqueous phase was extracted with EtOAc three times and the combined organic phases were then dried (MgSO₄), filtered, and concentrated. Purification by column chromatography (15 % Et₂O in pentane) gave chlorohydrin **21** (810 mg, 49 %) as a colorless oil.

HR-MS(ESI⁺): calculated for C₄₉H₈₅Cl₉NO₈Si₂ [M+NH₄⁺]: *m/z* = 1186.3005, found: *m/z* = 1186.3010
¹H - NMR (600 MHz CDCl₃) δ[ppm] = 7.35–7.27 (m, 5H), 5.99 (dd, J = 11.3, 10.0, 4.4, 1.2 Hz, 1H), 5.71–5.62 (m, 2H), 4.75 (d, J = 11.5 Hz, 1H), 4.71–4.63 (m, 2H), 4.61–4.56 (m, 1H), 4.48 (d, J = 11.4 Hz, 1H), 4.37–4.28 (m, 2H), 4.29–4.20 (m, 2H), 4.11 (ddd, J = 8.6, 6.7, 1.2 Hz, 1H), 3.94 (ddt, J = 8.7, 3.8, 2.0 Hz, 3H), 3.90–3.81 (m, 2H), 3.33–3.21 (m, 1H), 2.75–2.63 (m, 2H), 2.45–2.29 (m, 2H), 2.21–2.09 (m, 1H), 2.07–1.72 (m, 4H), 1.55 (s, 3H), 1.51–1.48 (m, 3H), 1.46 (s, 3H), 1.38 (s, 3H), 1.18 (d, J = 6.3 Hz, 3H), 0.90 (s, 9H), 0.89 (s, 9H), 0.18 (s, 3H), 0.13 (s, 3H), 0.07 (s, 3H), 0.06 (s, 3H).
¹³C - NMR (150 MHz CDCl₃) δ[ppm] = 139.0, 130.5, 129.0, 128.5, 128.0, 127.7, 110.4, 104.1, 91.9, 83.8, 78.5, 76.9, 74.3, 73.1, 73.1, 72.5, 70.9, 67.5, 66.6, 66.3, 62.0, 61.4, 61.1, 59.5, 59.4, 40.0, 36.0, 34.3, 29.1, 28.6, 26.4, 26.1, 26.0, 25.3, 24.2, 23.6, 19.5, 18.3, 18.2, -3.9, -4.2, -4.3, -4.5. **IR (film):** ν = 3438 (b), 2954 (m), 2930 (m), 2857 (m), 1471 (w), 1381 (m); 1256 (m), 1221 (m), 1091 (s), 835 (s), 732 (s).

(1*R*,2*R*,3*S*,4*R*,5*S*,6*R*,8*R*,9*S*,10*S*,13*R*,14*S*)-13-(benzyloxy)-8,14-bis((tert-butylidemethylsilyl)oxy)-1,2,3,5,6,9,10-heptachloro-1-((4*R*,5*S*,6*R*)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadecan-4-ol



A solution of allyl chloride **21** (1063 mg, 0.91 mmol) in CH₂Cl₂ (21 mL) was cooled to -78 °C. A solution of Et₄NCl₃ (1072 mg, 4.53 mmol) in CH₂Cl₂ (10.5 mL) and the mixtures were stirred for 1.5 h, then warmed to 0 °C and stirred for 1.5 h, and finally warmed to r.t. and stirred for 30 min before excess

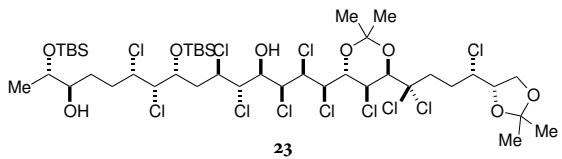
trichloride salt was quenched with a 1:1 mixture of sat. NaHCO₃(aq) and sat. Na₂S₂O₃(aq). The aqueous phase was extracted three times with CH₂Cl₂ and the combined organic phases were

then dried (MgSO_4), filtered, and concentrated. Purification by column chromatography (10 % Et_2O in pentane) afforded undecachloride **22** (644 mg, 57 %) as a colorless oil.

HR-MS(ESI⁺): calculated for $\text{C}_{49}\text{H}_{85}\text{Cl}_{11}\text{NO}_8\text{Si} [\text{M}+\text{NH}_4^+]$: $m/z = 1256.2382$, found: $m/z = 1256.2369$

¹H-NMR (600 MHz acetone - d_6) δ [ppm] = 7.47–7.31 (m, 4H), 7.31–7.24 (m, 1H), 5.19 (dd, $J = 12.8$, 11.2 Hz, 1H), 4.98–4.83 (m, 2H), 4.83–4.68 (m, 5H), 4.65–4.51 (m, 5H), 4.42–4.34 (m, 2H), 4.35–4.25 (m, 2H), 4.19–4.09 (m, 3H), 4.08–3.96 (m, 1H), 3.91 (dd, $J = 8.5$, 6.0 Hz, 1H), 3.35 (dd, $J = 8.5$, 3.4 Hz, 1H), 2.75–2.70 (m, 2H), 2.58–2.42 (m, 1H), 2.41–2.30 (m, 1H), 2.24–2.08 (m, 3H), 2.03–1.66 (m, 1H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.18 (d, $J = 6.3$ Hz, 3H), 0.93 (s, 9H), 0.92 (s, 9H), 0.22 (s, 3H), 0.22 (s, 3H), 0.11 (s, 3H), 0.10 (s, 3H). **¹³C-NMR** (150 MHz acetone - d_6) δ [ppm] = 140.2, 129.0, 128.5, 128.1, 110.4, 104.6, 93.5, 84.3, 79.5, 79.0, 77.6, 73.9, 73.1, 71.7, 71.1, 69.7, 68.8, 68.7, 67.6, 66.9, 65.5, 63.1, 63.1, 61.4, 61.1, 59.7, 41.2, 37.3, 34.8, 30.5, 26.6, 26.5, 26.3, 25.6, 25.4, 23.5, 19.9, 19.0, 18.6, -3.6, -4.0, -4.3, -4.4. **Optical Rotation:** $[\alpha]_D^{23.3} = +19$ ($c = 0.94$, CHCl_3). **IR** (film): $\tilde{\nu} = 2953$ (m), 2939 (m), 2857 (m), 1699 (w), 1381 (m), 1254 (m), 1222 (m), 1095 (s), 835 (s), 776 (s).

(2S,3R,6S,7S,8R,10R,11S,12R,13S,14R,15R)-2,8-bis((tert-butyldimethylsilyl)oxy)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadecane-3,12-diol



To a flask containing the benzyl ether **22** (394 mg, 317 μmol) was added palladium on carbon (789 mg, extent of labeling: 10 wt% loading (dry basis), matrix activated carbon, wet support, water content: 50 %, Degussa type E101 NE/W, supplier: Sigma-Aldrich®).

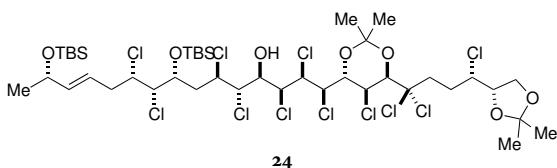
64 mL of a 1:1 mixture of dry THF and

Methanol (extra dry, stored over molecular sieves) was added, while rapidly stirring the flask was evacuated and refilled with nitrogen twice and then evacuated and refilled with hydrogen twice. Hydrogen was bubbled through the solution for 10 min and after this time the suspension was warmed to 35 °C (still fitted with a hydrogen balloon but with the needle out of the solution and the outlet removed) and stirred vigorously for 5 min at this temperature. The reaction mixture was allowed to cool to room temperature, evacuated and refilled with nitrogen twice. The reaction mixture was then filtered through a plug of celite, the solvent was removed under reduced pressure and the residue was purified by column chromatography (EtOAc–Hex 1:9) to yield the product **23** as a colorless oil (65%, 236 mg, 204 μmol).

¹H-NMR (600 MHz acetone - d_6) δ [ppm] = 5.20 (dd, $J = 13.0$, 10.8 Hz, 1H), 4.95 – 4.84 (m, 2H), 4.83 – 4.68 (m, 4H), 4.67 – 4.56 (m, 4H), 4.55 – 4.42 (m, 1H), 4.42 – 4.35 (m, 1H), 4.35 – 4.27 (m, 2H), 4.24 – 4.11 (m, 3H), 3.91 (dd, $J = 8.5$, 6.0 Hz, 1H), 3.83 – 3.68 (m, 1H), 3.58 – 3.49 (m, 1H), 3.44 – 3.33 (m, 1H), 2.79 – 2.68 (m, 2H), 2.60 – 2.42 (m, 1H), 2.42 – 2.29 (m, 1H), 2.26 – 2.11 (m, 3H), 2.01 – 1.70 (m, 1H), 1.54 (s, 3H), 1.45 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.14 (d, $J = 6.2$ Hz, 3H), 0.94 (s, 9H), 0.91 (s, 9H), 0.24 (s, 3H), 0.23 (s, 3H), 0.10 (s, 3H), 0.09 (s, 3H). **¹³C-NMR** (150 MHz acetone - d_6) δ [ppm] = 110.4, 104.7, 93.6, 79.5, 79.0, 77.6, 76.3, 75.4, 73.9, 73.0, 71.7, 70.4, 69.8, 68.8, 67.7, 66.9, 65.6, 63.1, 61.5, 61.1, 59.7, 41.2, 37.4, 35.3, 30.6, 26.6, 26.5, 26.3, 25.7, 25.4, 23.5, 19.5, 19.0, 18.6,

-3.6, -4.0, -4.1, -4.4. **Optical Rotation:** $[\alpha]_D^{22.9} = +11$ ($c = 0.30$, CHCl_3). **HR-MS(ESI}^+): calculated for $\text{C}_{42}\text{H}_{79}\text{Cl}_{11}\text{NO}_8\text{Si}_2^+ [\text{M}+\text{NH}_4^+]$: $m/z = 1166.1913$, found: $m/z = 1166.1925$ **IR (film):** $\tilde{\nu} = 3409$ (b), 2954 (s), 2930 (s), 2857 (s), 1471 (m), 1383 (m), 1257 (s), 1222 (s), 1093 (s), 837 (s), 777 (s).**

((1*R*,*2R*,*3S*,*4R*,*5S*,*6R*,*8R*,*9S*,*10S*,*14S*,*E*)-8,14-bis((tert-butyldimethylsilyl)oxy)-1,2,3,5,6,9,10-heptachloro-1-((4*R*,*5S*,*6R*)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-12-en-4-ol)



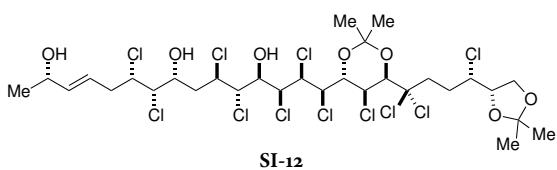
A Schlenk flask was charged with the azeotropically dried diol **23** (141 mg, 122 μmol) and toluene (29.1 mL). To this was then added dropwise 147 μL (0.12 equiv.) of a 0.2 M solution of Martin's Sulfurane in benzene. The reaction mixture was stirred for 15 min at room temperature after which more Sulfurane was

added as the stock solution in portions of 0.12 equiv every 15 minutes until complete conversion was reached (ca. 1.2 equiv. of sulfurane total). Excess reagent was then quenched through addition of sat. NaHCO_3 (aq.), the phases were separated and the aqueous phase was extracted three times with diethyl ether. The combined organic phases were dried over Na_2SO_4 , filtered and evaporated under reduced pressure. The obtained oil was purified by column chromatography (10% Et_2O in pentane) to yield the slightly impure product **24** as a colorless oil (81 mg, 71 μmol , 58%). **HR-MS(ESI}^+): calculated for $\text{C}_{42}\text{H}_{77}\text{Cl}_{11}\text{NO}_7\text{Si}_2^+ [\text{M}+\text{NH}_4^+]$: $m/z = 1148.1807$, found: $m/z = 1148.1804$ **$^1\text{H-NMR}$** (600 MHz acetone – d_6) δ [ppm] = 5.73-5.66 (m, 2H), 4.90-4.84 (m, 1H), 4.83-4.69 (m, 4H), 4.66-4.62 (m, 1H), 4.61 (dd, $J = 9.7, 2.1$ Hz, 1H), 4.43 (ddd, $J = 8.0, 6.1, 2.1$ Hz, 1H), 4.41-4.26 (m, 5H), 4.25-4.19 (m, 1H), 4.19-4.11 (m, 2H), 3.92 (dd, $J = 8.5, 6.0$ Hz, 1H), 2.76-2.68 (m, 2H), 2.65 (q, $J = 6.7$ Hz, 2H), 2.53-2.42 (m, 1H), 2.40-2.30 (m, 1H), 2.22-2.13 (m, 2H), 1.54 (s, 3H), 1.45 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.19 (d, $J = 6.3$ Hz, 3H), 0.97-0.86 (m, 18H), 0.26-0.18 (m, 6H), 0.14-0.05 (m, 6H). **$^{13}\text{C-NMR}$** (150 MHz, acetone – d_6) δ [ppm] = 140.2, 124.0, 110.4, 104.7, 93.6, 79.5, 79.0, 77.7, 73.8, 71.7, 69.5, 68.8, 68.5, 67.6, 66.9, 65.6, 63.2, 61.6, 61.30, 61.2, 59.7, 41.2, 40.6, 37.5, 30.6, 26.6, 26.5, 26.5, 26.3, 26.3, 25.7, 25.4, 24.8, 23.5, 19.0, 18.8, -3.6, -4.0, -4.3, -4.5 **Optical Rotation:** $[\alpha]_D^{26.8} = +20.9$ ($c = 0.25$, C_6H_6). **IR (film):** $\tilde{\nu} = 2954$ (m), 2929 (s), 2857 (m), 1718 (w), 1463 (w), 1382 (m), 1258 (s), 1222 (s), 1095 (s), 837 (s), 777 (s).**

((1*R*,*2R*,*3S*,*4R*,*5S*,*6R*,*8R*,*9S*,*10S*,*14S*,*E*)-8,14-bis((tert-butyldimethylsilyl)oxy)-1,2,3,5,6,9,10-heptachloro-1-((4*R*,*5S*,*6R*)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-12-en-4-ol)

A teflon vial was charged with the starting material **24** (2.1 mg, 1.85 μmol) dissolved in 185 μL MeCN and cooled to 0 °C. To this mixture was then added dropwise 19 μL of a stock solution comprised of 2 mL MeCN , 0.28 mL HF (70 % HF in pyridine) and 0.14 mL pyridine. The mixture was stirred for 1 h, another 38 μL of the stock solution were added and the mixture heated to 40 °C for 14 h. The mixture was then allowed to cool to room temperature and transferred

into a vial with 1 mL NaHCO₃(aq). The vial was washed with CH₂Cl₂ twice, the organic phases were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with Na₂SO₄, filtered and evaporated. The crude product was purified by column chromatography (Et₂O–Pentane 25% to 100%) to give **SI-12** (1.6 mg, 1.8 µmol, 95%).²



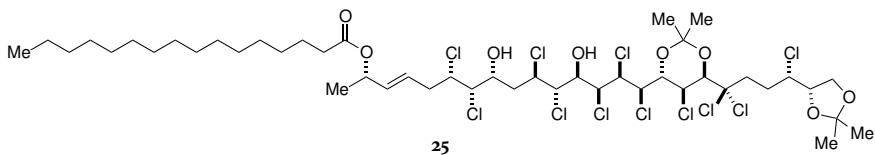
¹H – NMR (600 MHz acetone – d₆) δ[ppm] = 5.72 (dd, J = 15.4 Hz, 5.1 Hz, 1H), 5.66 (dt, J = 15.6 Hz, 6.8 Hz, 1H), 5.05 (dt, J = 10.6, 1.7 Hz, 1H), 4.76 (dd, J = 9.6, 1.8 Hz, 1H), 4.74 (dd, J = 5.1, 2.8 Hz, 1H), 4.70 (dd, J = 9.6, 1.4 Hz, 1H), 4.63 (d, J = 2.1 Hz, 1H), 4.57 (dd, J = 9.7, 1.9 Hz, 1H), 4.43 (dt, J = 6.2, 3.3 Hz, 1H), 4.26 (t, J =

8.8 Hz, 1H), 4.23-4.20 (m, 2H), 4.18-4.14 (m, 1H), 4.13 (dd, J = 8.5, 6.8 Hz, 1H), 3.97-3.92 (m, 2H), 3.91 (dd, J = 8.5, 6.0 Hz, 1H), 2.77-2.70 (m, 2H), 2.41-2.32 (m, 1H), 2.35-2.31 (m, 2h), 2.22-2.14 (m, 1H), 2.11-2.06 (m, 1H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41(s, 3H), 1.32 (s, 5H), 1.19 (d, J = 6.4 Hz, 3H).

¹³C – NMR (101 MHz acetone – d₆) δ[ppm] = 140.6, 123.7, 110.4, 104.6, 93.5, 79.5, 79.0, 77.6, 71.2, 71.1, 70.3, 68.6, 68.1, 67.9, 66.9, 65.5, 63.2, 63.1, 61.2, 60.7, 59.6, 41.2, 39.7, 37.9, 30.7, 26.5, 25.7, 25.4, 24.1, 23.5. **Optical Rotation:** [α]_D^{28.7} = +15.1 (c = 1.5, C₆H₆). **IR** (film): $\tilde{\nu}$ = 3381 (b), 2926 (s), 1445 (m), 1382 (m), 1222 (s), 1058 (m), 848 (w), 679 (w).

²Acquisition of a high resolution mass for this compound failed.

(2S,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-8,12-dihydroxypentadec-3-en-2-yl pentadecanoate



22.7 mg of the triol **SI-12** were dissolved in 2.5 mL CH₂Cl₂ and cooled to -78 °C. 20 µL of a stock solution of pyridine (0.33 mL in

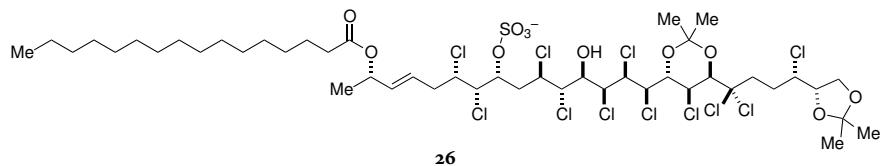
4.7 mL CH₂Cl₂) was added followed by 42 µL of a stock solution of palmitoyl chloride (0.4 mL in 4.6 mL CH₂Cl₂). The solution was stirred at -78 °C for 30 min and then allowed to warm to -40 °C over 1 h. At this point TLC showed full conversion, the reaction mixture was cooled back to -78 °C and excess palmitoyl chloride was quenched by the addition of 20 µL methanol. The mixture was then allowed to warm to room temperature over 1 h and subsequently diluted with CH₂Cl₂ and pH7 NaH₂PO₄/Na₂HPO₄ buffer. The phases are separated and the organic phase is extracted with CH₂Cl₂ thrice. The combined organic phases were dried over Na₂SO₄, filtered and concentrated. the crude mixture is purified by column chromatography (hexane-EtOAc 15% to hexane-EtOAc 20%) to give ester **25** as a white foam (67%, 19.3 mg, 17.0 µmol).

HR-MS(ESI⁺): calculated for C₄₆H₇₉Cl₁₁N₁O₈⁺ [M+NH₄⁺]: *m/z* = 1164.2298, found: *m/z* = 1164.2290

¹H-NMR (600 MHz acetone - d₆) δ[ppm] = 5.76 (ddd, J = 15.6 Hz, 6.6 Hz, 6.6 Hz, 1H), 5.69 (dd, J = 15.5, 5.9 Hz, 1H), 5.36-5.25 (m, 1H), 5.03 (d, J = 10.9 Hz, 1H), 4.91 (d, J = 8.8 Hz, 1H), 4.81-4.69 (m, 4H), 4.61 (d, J = 2.7 Hz, 1H), 4.57 (dd, J = 9.8, 1.9 Hz, 1H), 4.43-4.36 (m, 3 h), 4.30-4.22 (m, 2H), 4.18-4.11 (m, 3H), 3.92 (dd, J = 8.5, 6.0 Hz, 1H), 3.91 (dd, J = 8.5, 6.0 Hz, 1H), 2.75-2.72 (m, 4H), 2.41-2.31 (m, 3H), 2.31-2.25 (m, 3H), 2.23-2.12 (m, 3H), 1.64-1.64 (m, 5H), 1.53 (ddd, J = 1.3, 0.6, 0.3 Hz, 3H), 1.28 (d, 3H), 0.86 (s, 3H). **¹³C-NMR** (126 MHz acetone - d₆) δ[ppm] = 172.9, 135.1, 127.3, 110.4, 104.6, 93.6, 79.5, 79.0, 77.7, 71.2, 71.2, 70.6, 70.1, 68.6, 68.2, 66.9, 65.5, 63.2, 62.9, 61.2, 60.7, 59.6, 41.2, 39.6, 38.0, 35.0, 32.7, 30.6, 30.4, 30.4, 30.3, 26.5, 25.8, 25.7, 25.4, 23.5, 23.3, 20.6, 14.4.

Optical Rotation: [α]_D^{27.6} = +1.6 (c = 1.0, C₆H₆). **IR (film):** ν̄ = 3396 (b), 2924 (s), 2854 (s), 1710 (m), 1457 (w), 1381 (m), 1223 (m), 851 (w).

(2S,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-12-hydroxy-2-(palmitoyloxy)pentadec-3-en-8-yl sulfate

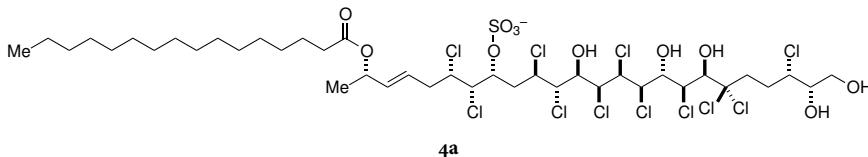


Diol **25** (10 mg, 8.7 μ mol) was dissolved in pyridine (0.44 ml) and Na_2SO_4 (100 mg) was added as a solid. To this was then added

260 μ L of a 0.2 M stock solution of $\text{DMF}\cdot\text{SO}_3$ in DMF (52 μ mol, 6 equiv.). The mixture was heated to 40 °C and stirred for 4 h 40 min. The reaction mixture was allowed to cool to room temperature, a small amount of NaHCO_3 (aq) was added and stirred for another 1 h. The mixture was then directly charged onto a silica gel column and the product was eluted with 2 % to 5 % MeOH in CH_2Cl_2 to give the sulfate **26** as a white foam (80%, 8.6 mg, 7.0 μ mol).

HR-MS(ESI⁺): calculated for $\text{C}_{46}\text{H}_{74}\text{Cl}_{11}\text{O}_{11}\text{S}^-$ [M⁻]: *m/z* = 1219.1531, found: *m/z* = 1219.1518 **¹H-NMR** (600 MHz acetone - d₆) δ [ppm] = 5.82 (td, J = 15.3, 7.7 Hz, 1H), 5.73 (dd, J = 15.5, 6.1 Hz, 1H), 5.32 (dt, J = 12.6, 6.3 Hz, 1H), 5.18 (dt, J = 7.9, 1.9 Hz, 1H), 5.10 (dd, J = 9.3, 1.7 Hz, 1H), 4.88-4.84 (m, 1H), 4.79-4.75 (m, 1H), 4.73 (dd, J = 9.5, 1.8 Hz, 1H), 4.64 (d, J = 2.5 Hz, 1H), 4.62 (dt, J = 9.4, 1.1 Hz, 1H), 4.45-4.24 (m, 6H), 4.20-4.11 (m, 2H), 3.91 (dq, J = 6.6, 2.4 Hz, 1H), 2.80-2.76 (m, 2H), 2.73-2.69 (m, 2H), 2.56-2.45 (m, 1H), 2.36-2.32 (m, 1H), 2.28 (t, J = 7.4 Hz, 2H), 2.27-2.16 (m, 2H), 1.53 (s, 3H), 1.45 (s, 3H), 1.40 (s, 3H), 1.31 (s, 3H), 1.34-1.24 (m, 29H), 0.87 (t, J = 7.0 Hz, 6H). **¹³C-NMR** (151 MHz acetone - d₆) δ [ppm] = 172.9, 135.1, 127.0, 110.2, 104.3, 93.3, 79.6, 78.9, 76.8, 76.1, 70.8, 69.7, 69.6, 68.1, 67.9, 66.9, 65.8, 63.3, 63.2, 61.1, 60.5, 59.3, 41.1, 38.7, 38.4, 34.8, 30.6, 30.4, 30.4, 30.4, 30.4, 30.4, 30.3, 30.3, 26.4, 25.7, 25.4, 20.6. **Optical Rotation:** $[\alpha]_D^{26.5} = +13.3$ (*c* = 0.5, C_6H_6). **IR (film):** $\tilde{\nu}$ = 3419 (b), 2925 (s), 2854 (m), 1716 (m), 1457 (w), 1381 (m), 1261 (s), 1223 (s), 1048 (m), 585 (w).

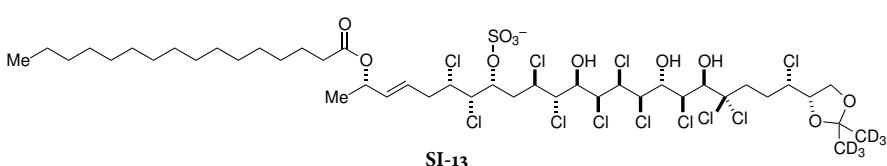
**(2S,6S,7S,8R,10R,11S,12R,13S,14S,15R,16R,17S,18R,22S,23S,E)-
6,7,10,11,13,14,15,17,19,19,22-undecachloro-12,16,18,23,24-pentahydroxy-2-
(palmitoyloxy)tetracos-3-en-8-yl
sulfate**



A point-bottom flask is charged with 3 mg of bis-acetal **26** and 510 µL of a 1:1 v/v mixture of water and TFA. The solution is stirred

for 4 h before the solvent is evaporated and the residue is quickly charged onto a silica gel column from which the product is eluted with 5 % to 10 % MeOH in CH₂Cl₂ to obtain pentaol **4a** as a white foam (72%, 2.0 mg, 1.8 µmol).

HR-MS(ESI⁻): calculated for C₄₀H₆₆Cl₁₁O₁₁S⁻ [M⁻]: *m/z* = 1145.0826, found: *m/z* = 1145.0887. **¹H-NMR** (600 MHz acetone - d₆) δ[ppm] = 6.16 (d, J = 6.6 Hz, 1H), 5.82 (dt, J = 15.3, 6.6 Hz, 1H), 5.73 (dd, J = 15.6, 6.2 Hz, 1H), 5.41 (d, J = 6.9 Hz, 1H), 5.34 (p, J = 5.8 Hz, 3H), 5.20 (dd, J = 10.0, 8.2 Hz, 1H), 5.17 (s, 1H), 5.00 (d, J = 6.7 Hz, 1H), 4.96 (dd, J = 9.6, 1.2 Hz, 1H), 4.89 (ddd, J = 8.2, 3.4, 1.1 Hz, 1H), 4.63 (d, J = 9.6 Hz, 1H), 4.53 (dd, J = 12.6, 6.5 Hz, 1H), 4.51 (d, J = 7.0 Hz, 1H), 4.45 (d, J = 11.0 Hz, 1H), 4.41-4.37 (m, 2H), 4.35 (dd, J = 9.6, 1.8 Hz, 1H), 4.28 (ddd, J = 9.1, 7.2, 1.5 Hz, 1H), 4.13 (dd, J = 9.4, 6.4 Hz, 1H), 3.99 – 3.93 (m, 1H), 3.71 – 3.63 (m, 2H), 2.78 – 2.56 (m, 5H), 2.44 – 2.31 (m, 2H), 2.29 (t, J = 7.4 Hz, 2H), 2.24 (ddd, J = 15.8, 8.1, 1.5 Hz, 1H), 1.60 (dt, J = 14.4, 6.7 Hz, 2H), 1.35 – 1.25 (m, 27H), 0.88 (t, J = 6.9 Hz, 3H). **¹³C-NMR** (151 MHz acetone - d₆) δ[ppm] = 173.0, 135.1, 127.3, 97.2, 79.3, 76.8, 75.7, 73.7, 70.8, 69.7, 69.3, 67.9, 67.5, 66.1, 64.7, 64.4, 62.8, 61.0, 61.0, 59.5, 42.1, 39.0, 35.0, 32.7, 31.5, 30.4, 30.4, 30.4, 25.8, 23.3, 20.6, 14.4. **Optical Rotation:** [α]_D^{26.2} = +17.3 (c = 0.2, MeOH).



1 mg of pentaol **4a** were dissolved in 700 µL d₆-acetone. To this solution was added 50 µL of a stock solution of 1.6 mg p-

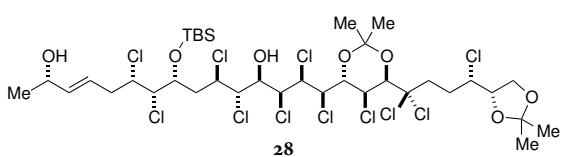
toluenesulfonic acid in 0.5 mL d₆-acetone. After 15 min complete conversion was observed, two drops of sat. NaHCO₃(aq.) were added, the sample was filtered through celite and concentrated. Column chromatography delivered the product **14** as a colorless oil (96%, 1.0 mg, 0.84 µmol).

HR-MS(ESI⁻): calculated for C₄₃H₆₄Cl₁₁D₆O₁₁S⁻ [M⁻]: *m/z* = 1185.1595, found: *m/z* = 1185.1625. **¹H-NMR** (600 MHz acetone - d₆) δ[ppm] = 5.83 (td, J = 15.1, 8.1 Hz, 1H), 5.73 (ddt, J = 15.5, 6.1, 1.0 Hz, 1H), 5.36-5.34 (m, 2H), 5.21 (dt, J = 7.1, 1.8 Hz, 1H), 5.17 (dd, J = 2.1, 1.1 Hz, 1H), 4.98 (dd, J = 9.5, 1.6 Hz, 1H), 4.89 (ddd, J = 8.6, 3.3, 1.9 Hz, 1H), 4.61 (dd, J = 9.5, 1.3 Hz, 1H), 4.56 (dd, J =

6.7, 1.0 Hz, 1H), 4.53–4.49 (m, 2H), 4.46 (dd, J = 9.6, 1.6 Hz, 1H), 4.41 (td, J = 6.6, 4.3 Hz, 1H), 4.34 (dd, J = 6.3, 3.4 Hz, 1H), 4.30 (dd, J = 9.6, 1.6 Hz, 1H), 4.30–4.24 (m, 2H), 4.17 (ddd, J = 8.7, 7.2, 1.6 Hz, 1H), 4.13 (dd, J = 8.2, 6.7 Hz, 1H), 3.87 (dd, J = 8.3, 6.4 Hz, 1H), 2.77 (2H), 2.73–2.69 (m, 2H), 2.70–2.65 (m, 1H), 2.40–2.33 (m, 1H), 2.31–2.65 (m, 3H), 2.22 (ddd, J = 16.4, 7.2, 1.9 Hz, 1H), 2.04 (2H), 1.59 (qd, J = 13.1, 6.3 Hz, 6H). 1.35–1.23 (m, 27H) 0.89–0.86 (t, J = 6.99 Hz, 3H). ^{13}C –NMR³ = 134.2, 126.3, 77.9, 77.2, 75.6, 75.4, 69.7, 68.6, 68.5, 66.8, 66.8, 66.4, 65.2, 62.2, 62.1, 60.0, 59.6, 58.6, 40.4, 37.8, 35.3, 34.0, 30.4, 26.8, 24.8, 31.7, 29.2, 22.3, 19.7, 19.2.

2.4 C-1 Inverted Diastereomer

(2S,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-8-((tert-butyldimethylsilyl)oxy)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-3-ene-2,12-diol



A teflon vial was charged with bis-silyl ether **24** dissolved in 7.1 mL MeCN. To this mixture was then added dropwise 1.4 mL of a stock solution comprised of 2 mL MeCN, 0.28 mL HF (70 % HF in pyridine) and 0.14 mL pyridine. The reaction mixture was stirred at room temperature for 100 min, then cooled to 0 °C and

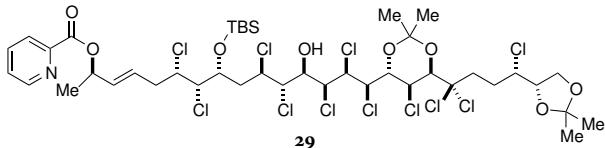
stirred for another 4 h. The solution was transferred into a vial with NaHCO₃(aq). The vial was rinsed with CH₂Cl₂ twice, the organic phases were collected and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with Na₂SO₄, filtered and evaporated. The product was purified by column chromatography (Et₂O–Pentane 35 %, 50 % and 100 %). The product **28** was obtained as a white foam (36.5 mg, 0.036 mmol, 50%) along with the double-deprotected **SI-12** (9.7 mg, 10.7 μmol, 15%) and slightly impure starting material **24** (28.3 mg, 0.025 mmol, 35%).⁴

^1H –NMR (400 MHz CDCl₃) δ [ppm] = 5.80 – 5.57 (m, 2H), 5.28 – 5.16 (m, 1H), 4.96 – 4.81 (m, 1H), 4.84 – 4.66 (m, 4H), 4.70 – 4.53 (m, 2H), 4.53 – 4.39 (m, 1H), 4.43 – 4.34 (m, 2H), 4.35 – 4.16 (m, 4H), 4.20 – 4.09 (m, 2H), 3.91 (dd, J = 8.6, 5.9 Hz, 1H), 3.81 – 3.71 (m, 1H), 2.78 – 2.68 (m, 2H), 2.68 – 2.59 (m, 2H), 2.55 – 2.41 (m, 1H), 2.42 – 2.29 (m, 1H), 2.25 – 2.11 (m, 2H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.19 (d, J = 6.4 Hz, 3H), 0.95 – 0.90 (m, 9H), 0.24 – 0.10 (m, 6H). ^{13}C –NMR (101 MHz CDCl₃) δ [ppm] = 140.7, 123.8, 110.4, 104.6, 93.5, 79.4, 79.0, 77.6, 73.8, 71.7, 68.8, 68.0, 67.8, 67.6, 66.9, 66.5, 65.5, 63.1, 61.5, 61.1, 61.0, 59.6, 41.2, 40.7, 30.7, 30.5, 26.6, 26.5, 26.5, 26.4, 26.2, 25.4, 24.1, 23.5, 18.9, -3.7, -4.1. **Optical Rotation:** $[\alpha]_D^{28.1} = +11.7$ (c = 1.0, C₆H₆). IR (film): $\tilde{\nu}$ = 3375 (b), 2954 (m), 2931 (m), 2858 (m), 1463 (w), 1382 (s), 1258 (s), 1223 (s), 1095 (s), 1061 (s), 839 (s), 779 (s).

³The ^{13}C –data was determined by HSQC where possible (150 MHz acetone – d₆) δ [ppm] (d⁶ – acetone, 600 MHz/150 MHz, 298 K)

⁴Acquisition of a high resolution mass for this compound failed.

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-8,12-dihydroxypentadec-3-en-2-yl picolinate



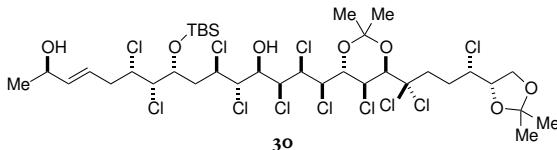
To a Schlenk tube charged with the starting material **28** (5.0 mg, 4.9 μmol) is added 50 μL of a stock solution of 2-picolinic acid in THF (4.82 mg, 0.04 mmol 2-picolinic acid in 0.5 mL THF) and the solvent is evaporated. 50 μL of a PPh_3 -stock solution (10.27 mg, 0.04 mmol PPh_3

in 0.5 mL THF) is added and the mixture is cooled to -20°C for 10 min. Then 50 μL of a solution of diisopropyl azodicarboxylate (DIAD) (7.7 μL , 0.04 mmol DIAD in 0.5 mL THF) is added dropwise over 3 min. The reaction is stirred for 3 h at this temperature and is then allowed to warm to room temperature over 2 h and then stirred at room temperature for 2 h. When TLC shows no more starting material, excess reagent is quenched through the addition of $\text{NaHCO}_3\text{(aq)}$. The product is extracted three times with ethyl acetate and the combined organic phases are washed with brine. Evaporation of the solvent and purification by column chromatography (20% Et_2O in pentane) delivered the product **29** as a colorless oil (1.0 mg, 0.9 μmol , 18%).

HR-MS(ESI⁺): calculated for $\text{C}_{42}\text{H}_{63}\text{Cl}_{11}\text{Si}_1\text{N}_1\text{O}_8^+ [\text{M}+\text{H}^+]$: $m/z = 1122.0891$, found: $m/z = 1122.0877$

¹H - NMR (400 MHz acetone - d_6) δ [ppm] = 8.75 (ddd, $J = 4.8, 1.6, 0.8$ Hz, 1H), 8.33 (dt, $J = 7.9, 1.0$ Hz, 1H), 8.19 (td, $J = 7.7, 1.7$ Hz, 1H), 7.83 (ddd, $J = 7.6, 4.8, 1.2$ Hz, 1H), 6.81 (d, $J = 8.3$ Hz, 1H), 6.04 (ddd, $J = 15.3, 9.5, 5.8$ Hz, 1H), 5.73 (dd, $J = 15.5, 8.4$ Hz, 1H), 5.54 (dq, $J = 8.2, 6.4$ Hz, 1H), 5.05 (dd, $J = 9.3, 1.8$ Hz, 1H), 4.93 (dt, $J = 11.1, 1.8$ Hz, 1H), 4.80 (dd, $J = 9.7, 1.8$ Hz, 1H), 4.75 (dd, $J = 9.7, 1.3$ Hz, 1H), 4.67 (dd, $J = 9.7, 2.4$ Hz, 1H), 4.59 (ddd, $J = 9.7, 8.1, 1.4$ Hz, 1H), 4.41 (ddd, $J = 10.3, 4.3, 1.4$ Hz, 1H), 4.39 – 4.33 (m, 2H), 4.26 (dd, $J = 9.2, 5.2$ Hz, 1H), 4.17 – 4.02 (m, 3H), 3.92 – 3.86 (m, 2H), 3.47 (d, $J = 2.6$ Hz, 1H), 2.76 – 2.60 (m, 3H), 2.53 – 2.41 (m, 1H), 2.36 – 2.07 (m, 3H), 1.90 (ddd, $J = 13.8, 10.4, 1.6$ Hz, 1H), 1.53 (d, $J = 6.5$ Hz, 3H), 1.41 (s, 3H), 1.40 (s, 3H), 1.32 (s, 3H), 1.00 (s, 3H), 0.58 (s, 9H), 0.13 (s, 3H), 0.08 (s, 3H). **¹³C - NMR** (101 MHz acetone - d_6) δ [ppm] = 165.0, 151.4, 140.0, 134.5, 134.2, 132.3, 129.5, 127.2, 110.4, 104.5, 93.4, 79.3, 79.0, 77.9, 75.2, 72.7, 71.1, 68.8, 68.6, 68.3, 66.9, 65.6, 63.2, 61.0, 59.7, 59.5, 59.4, 41.1, 39.2, 37.2, 26.6, 26.5, 25.4, 25.3, 23.1, 20.5, 18.9, -3.3, -3.8. **Optical Rotation:** $[\alpha]_D^{27.3} = +21$ ($c = 0.07$, C_6H_6). **IR (film):** $\tilde{\nu} = 2926$ (s), 2854 (m), 1722 (m), 1463 (w), 1381 (w), 1245 (m), 1223 (m), 1111 (m), 840 (m), 590 (w).

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-8-((tert-butyldimethylsilyl)oxy)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-3-ene-2,12-diol



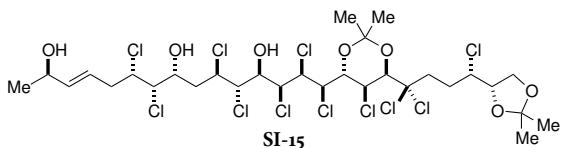
A point-bottom flask was charged with the starting material **29** (2.2 mg, 1.95 μ mol) dissolved in 200 μ L CHCl₃. To this is then added 60 μ L of a Cu(OAc)₂ stock solution (23 mg Cu(OAc)₂ in 90 μ L MeOH and 1 mL CHCl₃, gives a slightly cloudy suspension that is filtered before use.) The mixture is stirred for

24 h at room temperature. An aqueous 0.1 M solution of Na₂EDTA is added and the mixture is rapidly stirred for 5 min, the phases are separated and the aqueous phase is extracted three times with CH₂Cl₂. The combined organic phases are dried over Na₂SO₄, filtered and the solvent evaporated. Purification by column chromatography (20% to 35% to 50% Et₂O in pentane) delivered the product **30** as a colorless oil. (2.0 mg, 2.0 μ mol, 100%).⁵

¹H - NMR (500 MHz acetone - d₆) δ [ppm] = 5.72 (ddt, J = 15.4, 5.3, 1.1 Hz, 1H), 5.63 (dddd, J = 15.3, 7.5, 6.4, 1.3 Hz, 1H), 5.39 (d, J = 11.0 Hz, 1H), 4.87 (dt, J = 11.7, 2.1 Hz, 1H), 4.85 (d, J = 12 Hz, 1H), 4.78 – 4.69 (m, 3H), 4.65 (d, J = 2.7 Hz, 1H), 4.61 (dd, J = 9.7, 2.1 Hz, 1H), 4.45 – 4.36 (m, 3H), 4.33 – 4.26 (m, 2H), 4.27 – 4.20 (m, 2H), 4.16 – 4.13 (m, 1H), 4.13 (dd, J = 8.6, 6.8 Hz, 1H), 3.92 (dd, J = 8.5, 6.0 Hz, 1H), 3.76 (d, J = 4.4 Hz, 1H), 2.74 (dt, J = 10.2, 5.1 Hz, 2H), 2.64 (ddt, J = 14.2, 14.2, 6.8 Hz, 2H), 2.47 (ddd, J = 13.5, 11.5, 1.7 Hz, 1H), 2.37 (dddd, J = 13.7, 10.5, 5.7, 3.0 Hz, 1H), 2.24 – 2.13 (m, 2H), 1.54 (s, 3H), 1.45 (s, 4H), 1.41 (s, 4H), 1.32 (s, 3H), 1.19 (d, J = 6.4 Hz, 3H), 0.94 (s, 9H), 0.23 (s, 3H), 0.22 (s, 3H). **¹³C - NMR** (126 MHz acetone - d₆) δ [ppm] = 140.8, 123.8, 110.4, 104.6, 93.6, 79.5, 79.0, 77.6, 73.9, 71.6, 68.9, 68.2, 67.9, 67.8, 66.9, 65.6, 63.2, 61.5, 61.2, 61.2, 59.7, 41.2, 40.7, 37.2, 30.6, 26.6, 26.5, 25.6, 25.4, 24.1, 23.5, 19.0, -3.6, -4.0. **Optical Rotation:** $[\alpha]_D^{27.9} = +30.9$ (*c* = 0.5, C₆H₆). **IR** (film): $\tilde{\nu}$ = 3395 (b), 2988 (m), 2954 (s), 2930 (s), 2857 (m), 1463 (w), 1382 (s), 1258 (s), 1223 (s), 1095 (s), 840 (s), 779 (s).

⁵Acquisition of a high resolution mass for this compound failed.

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-3-ene-2,8,12-triol



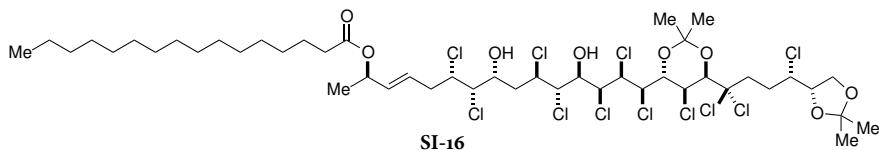
A teflon vial was charged with the starting material **3o** (2.0 mg, 2.0 μ mol) dissolved in 490 μ L MeCN. To this mixture was then added 90 μ L of a stock solution comprised of 2 mL MeCN, 0.28 mL HF (70% in pyridine) and 0.14 mL pyridine. The mixture was heated to 40 °C and stirred for 14 h. The

vessel was then allowed to cool to room temperature and transferred into a vial with 1 mL NaHCO_{3(aq)}. Residual material was transferred from the teflon vial with CH₂Cl₂ twice, the combined organic phases were separated and the aqueous phase was extracted three times with CH₂Cl₂. All combined organic phases were dried with Na₂SO₄, filtered and evaporated. The product was purified by column chromatography (Et₂O–pentane 1:1, then 2:1, then 1:0) to yield **SI-15** as a colorless oil.⁶ ¹H – NMR (600 MHz acetone – d₆) δ [ppm] = 5.71 (dd, J = 15.4, 5.5 Hz, 1H), 5.65 (dd, J = 15.6, 6.6 Hz, 1H), 5.05 (d, J = 11.4 Hz, 1H), 4.80–4.74 (m, 1H), 4.76 (dd, J = 9.5, 1.8 Hz, 1H), 4.69 (dd, J = 9.5, 1.3 Hz, 1H), 4.66–4.63 (bs, 1H), 4.56 (dd, J = 9.7, 1.9 Hz, 1H), 4.41–4.34 (m, 4H), 4.29–4.11 (m, 6H), 3.91 (dd, J = 8.5, 6.0 Hz, 1H), 2.73 (ddd, J = 10.7, 7.5, 5.3 Hz, 2H), 2.69 (t, J = 5.8 Hz, 1H), 2.62 (dt, J = 14.1, 7.1 Hz, 1H), 2.40–2.32 (m, 2H), 2.22–2.15 (m, 2H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.18 (d, J = 6.4 Hz, 3H). ¹³C – NMR (151 MHz acetone – d₆) δ [ppm] = 140.7, 123.9, 110.4, 104.5, 93.6, 93.6, 79.6, 79.0, 77.5, 71.1, 71.0, 70.3, 68.7, 68.4, 68.1, 67.0, 65.7, 63.2, 63.2, 60.5, 59.6, 41.2, 41.2, 39.7, 30.6, 30.6, 26.5, 25.8, 25.4, 24.1, 23.6.

Optical Rotation: $[\alpha]_D^{25.7} = +14.6$ ($c = 0.4$, C₆H₆). **IR** (film): $\tilde{\nu} = 3364$ (b), 2988 (m), 2929 (m), 1382 (s), 1260 (m), 1222 (s), 1092 (m), 1058 (s), 846 (m), 679 (s).

⁶Acquisition of a high resolution mass for this compound failed.

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((4S)-1,1,4-trichloro-4-(2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-8,12-dihydroxypentadec-3-en-2-yl palmitate



7 mg of triol **SI-15** were dissolved in 770 μ L CH_2Cl_2 and cooled to -78°C . 93 μ L of a stock solution of pyridine (0.33 mL in

4.7 mL CH_2Cl_2) was added followed by 146 μ L of a stock solution of palmitoyl chloride (0.4 mL in 4.6 mL CH_2Cl_2). The solution was stirred at -78°C for 30 min and then allowed to warm to -40°C over 1 h. The reaction mixture was then cooled to -78°C and 20 μ L methanol were added and the solution was allowed to reach room temperature over 1 h. After dilution with CH_2Cl_2 and pH₇ $\text{NaH}_2\text{PO}_4/\text{Na}_2\text{HPO}_4$ buffer the phases were separated and the organic phase was extracted with CH_2Cl_2 thrice. The combined organic phases were dried over Na_2SO_4 , filtered and concentrated. The crude mixture is purified by column chromatography (hexane–EtOAc 15% to hexane–EtOAc 20%) to give **SI-16** (75%, 6.9 mg, 5.8 μ mol).

HR-MS(ESI⁺): calculated for $\text{C}_{46}\text{H}_{75}\text{Cl}_{11}\text{O}_8\text{K}^+ [\text{M}+\text{H}^+]$: $m/z = 1185.1592$, found: $m/z = 1185.1610$

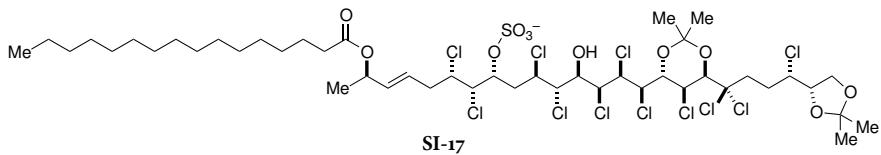
¹H – NMR (600 MHz acetone – d₆) δ [ppm] = 5.77 (dt, $J = 15.5, 6.9$ Hz, 1H), 5.70 (dd, $J = 15.5, 6.1$ Hz, 1H), 5.32 (app. quintet, $J = 6.4$ Hz, 1H), 5.09 (d, $J = 10.7$ Hz, 1H), 4.77–4.74 (m, 2H), 4.70 (s, 1H), 4.67 (dd, $J = 9.2, 1.1$ Hz, 1H), 4.54 (dd, $J = 9.7, 1.8$ Hz, 1H), 4.42–4.39 (m, 2H), 4.33 (dd, $J = 9.0, 4.7$ Hz, 1H), 4.29 (d, $J = 10.4$ Hz, 1H), 4.19–4.12 (m, 5H), 3.91 (dd, $J = 8.5, 6.1$ Hz, 1H), 2.76–2.70 (m, 3H), 2.70–2.63 (m, 1H), 2.28 (t, $J = 7.4$ Hz, 2H), 2.13–2.08 (m, 2H), 1.59 (2H), 1.52 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.34–1.26 (m,), 1.33 (s, 3H), 1.29 (d, 3H), 0.88 (t, $J = 7.1$ Hz, 3H)

¹³C – NMR (151 MHz acetone – d₆) δ [ppm] = 173.0, 135.0, 127.7, 110.4, 104.3, 93.5, 79.7, 79.0, 77.1, 71.2, 71.2, 70.7, 70.3, 70.3, 68.7, 68.6, 67.0, 65.8, 63.3, 63.1, 60.2, 59.4, 41.4, 39.6, 37.7, 35.0, 30.7, 30.4, 26.5, 25.9, 25.5, 23.7, 23.3, 20.6

14.4 Optical Rotation: $[\alpha]_D^{27.8} = +28.4$ ($c = 0.5$, C_6H_6).

IR (film): $\tilde{\nu} = 3381$ (b), 2925 (s), 2854 (s), 1712 (m), 1456 (w), 1381 (m), 1261 (m), 1222 (m), 1091 (w), 846 (w).

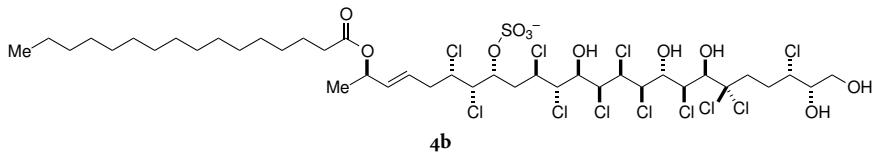
(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((4S)-1,1,4-trichloro-4-(2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-12-hydroxy-2-(palmitoyloxy)pentadec-3-en-8-yl sulfate



Diol **SI-16** (7.2 mg, 6.1 μmol) was dissolved in 300 μL pyridine and 70 mg Na_2SO_4 (81 equiv., 0.1 mmol) was added. 183 μL of a 0.2 M

$\text{SO}_3 \cdot \text{DMF}$ stock solution (100 mg $\text{SO}_3 \cdot \text{DMF}$ in 3.3 mL DMF) was added (8.9 μmol , 6 equiv.). The mixture was heated to 40 °C for 4 h. After this time the mixture was allowed to cool to room temperature and 2 drops of NaHCO_3 (aq.) were added. The solvent was evaporated and the residue was purified by column chromatography (5% MeOH in CH_2Cl_2) to yield **SI-17** (83%, 6.2 mg, 5.1 μmol). **HR-MS(ESI⁻)**: calculated for $\text{C}_{46}\text{H}_{74}\text{Cl}_{11}\text{O}_{11}\text{S}^- [\text{M}^-]$: $m/z = 1223.1467$, found: $m/z = 1223.1515$. **¹H-NMR** (600 MHz acetone - d_6) δ [ppm] = 5.81 (dt, $J = 15.5, 6.7$ Hz, 1H), 5.75 (dd, $J = 15.8, 5.7$ Hz, 1H), 5.34 (quintet, $J = 6.4$ Hz, 1H), 5.14 (td, $J = 4.4, 2.4$ Hz, 1H), 5.05 (dd, $J = 9.4, 1.9$ Hz, 1H), 4.85 (ddd, $J = 7.9, 3.4, 1.9$ Hz, 1H), 4.78 (dd, $J = 4.6, 2.6$ Hz, 1H), 4.74 (dd, $J = 9.4, 1.8$ Hz, 1H), 4.66 (d, $J = 2.5$ Hz, 1H), 4.62 (dt, $J = 9.8, 1.0$ Hz, 1H), 4.45 (q, $J = 6.0$ Hz, 1H), 4.41 (d, $J = 3.6$ Hz, 2H), 4.35 (dd, $J = 9.6, 1.6$ Hz, 1H), 4.33 (dd, $J = 9.4, 4.6$ Hz, 1H), 4.30 (ddd, $J = 9.6, 5.9, 1.6$ Hz, 1H), 4.18-4.16 (m, 1H), 4.15 (dd, $J = 8.4, 6.8$ Hz, 1H), 3.91 (dd, $J = 8.4, 6.2$ Hz, 1H), 2.80-2.75 (m, 2H), 2.72 (ddd, $J = 13.2, 11.1, 4.9$ Hz, 2H), 2.64 (dtd, $J = 16.1, 7.9, 3.0$ Hz, 1H), 2.37 (dddd, $J = 14.2, 10.9, 4.7, 3.3$ Hz, 1H), 2.31-2.26 (m, 1H), 2.28 (t, $J = 3.0$ Hz, 2H), 2.20 (dtd, $J = 10.8, 9.6, 4.9$ Hz, 1H), 1.61-1.56 (m, 2H), 1.54 (s, 3H), 1.46 (s, 3H), 1.41 (s, 3H), 1.33-1.26 (m, 27H), 1.32 (s, 3H), 0.88 (t, $J = 7.3$ Hz, 3H). **¹³C-NMR** (151 MHz acetone - d_6) δ [ppm] = 174.6, 135.2, 127.0, 110.3, 104.3, 93.3, 79.8, 79.0, 76.8, 76.7, 70.6, 69.8, 69.7, 68.0, 67.8, 67.1, 65.9, 63.3, 63.1, 61.3, 60.5, 59.3, 41.4, 38.8, 38.8, 34.2, 30.8, 30.4, 30.4, 30.4, 30.4, 30.3, 26.5, 26.0, 25.8, 25.5, 25.2, 23.8, 23.3, 20.6, 14.4. **Optical Rotation:** $[\alpha]_D^{27.0} = +32.4$ ($c = 0.5, \text{C}_6\text{H}_6$). **IR** (film): $\tilde{\nu} = 2925$ (s), 2854 (s) 1718 (m), 1463 (m), 1380 (m), 1259 (m), 1223 (m); 1056 (w), 907 (w), 851 (w).

**(2R,6S,7S,8R,10R,11S,12R,13S,14S,15R,16R,17S,18R,22S,23S,E)-
6,7,10,11,13,14,15,17,19,19,22-undecachloro-12,16,18,23,24-pentahydroxy-2-
(palmitoyloxy)tetracos-3-en-8-yl
sulfate**



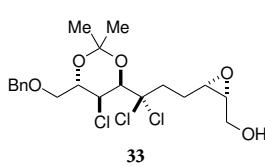
A point-bottom flask is charged with 3.1 mg of bis-acetal **SI-17** and 520 μ L of a 1:1 v/v mixture of water and TFA. The solution

is stirred for 3.5 h before the solvent is evaporated and the residue is quickly charged onto a silica gel column from which the product is eluted with 5 % to 10 % MeOH in CH_2Cl_2 to obtain pentaol **4b** as a colorless glass (72%, 2.1 mg, 1.8 μ mol).

HR-MS(ESI⁻): calculated for $\text{C}_{40}\text{H}_{66}\text{Cl}_{11}\text{O}_{11}\text{S}^- [\text{M}^-]$: $m/z = 1145.0826$, found: $m/z = 1145.0846$. **¹H-NMR** (600 MHz acetone - d_6) δ [ppm] = 6.21 (d, $J = 6.6$ Hz, 1H), 5.82 (dt, $J = 15.0, 6.7$ Hz, 1H), 5.74 (ddt, $J = 15.6, 6.0, 1.1$ Hz, 1H), 5.39 – 5.32 (m, 2H), 5.18 (dt, $J = 8.1, 1.6$ Hz, 1H), 5.18 (s, 1H), 4.95 (dd, $J = 9.7, 1.8$ Hz, 1H), 4.91 (ddd, $J = 8.8, 3.6, 1.6$ Hz, 1H), 4.65 (dd, $J = 9.7, 1.3$ Hz, 1H), 4.60 (d, $J = 6.7$ Hz, 1H), 4.58 – 4.52 (m, 2H), 4.44 (dd, $J = 5.5, 3.6$ Hz, 1H), 4.40 – 4.34 (m, 2H), 4.27 (ddd, $J = 9.7, 7.5, 1.8$ Hz, 1H), 4.12 (ddd, $J = 9.8, 6.7, 1.8$ Hz, 1H), 4.07 – 3.97 (m, 1H), 3.72 (t, $J = 5.9$ Hz, 2H), 2.81 – 2.71 (m, 3H), 2.62 (dt, $J = 14.5, 7.6$ Hz, 1H), 2.57 (ddd, $J = 15.8, 9.1, 1.8$ Hz, 1H), 2.45 – 2.37 (m, 2H), 2.30 (td, $J = 7.3, 1.4$ Hz, 2H), 2.31 – 2.23 (m, 1H), 1.60 (p, $J = 7.3$ Hz, 2H), 1.37 – 1.25 (m, 27H), 0.91 – 0.85 (m, 3H). **¹³C-NMR** (151 MHz acetone - d_6) δ [ppm] = 173.1, 135.1, 127.2, 96.9, 79.5, 76.7, 75.3, 74.0, 70.7, 69.6, 69.3, 68.1, 67.2, 66.0, 64.5, 64.1, 62.6, 61.1, 60.9, 59.5, 42.6, 39.2, 37.8, 35.0, 32.7, 31.5, 30.4, 30.4, 30.4, 30.3, 30.3, 25.8, 23.3, 20.6, 14.4. **Optical Rotation:** $[\alpha]_D^{25.7} = +16.7$ ($c = 0.4$, MeOH). **IR** (film): $\tilde{\nu} = 3418$ (b), 2926 (s), 2854 (m), 1706 (m), 1457 (w), 1378 (w), 1258 (s), 1051 (m), 907 (m).

2.5 Synthesis of C21/C22 Inverted Fragment

((2R,3S)-3-(3-((4R,5S,6S)-6-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-1,3-dioxan-4-yl)-3,3-dichloropropyl)oxiran-2-yl)methanol

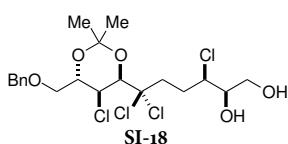


A suspension of dried 4 Å molecular sieves (1.90 g) in anhydrous CH_2Cl_2 (45 mL) is cooled to -20 °C. To this is then added freshly distilled L-(+)-diethyltartrate (1.04 mL, 6.1 mmol, 1.4 equiv.) and subsequently freshly distilled $\text{Ti(O}^i\text{Pr)}_4$ (1.54 mL, 5.2 mmol, 1.2 equiv.). After stirring for 20 min, allylic alcohol **32** (1.90 g, 4.34 mmol) is added as a solution in CH_2Cl_2 (45 mL). After stirring at -20 °C for another 30 min TBHP (5.5 M, 2.37 mL, 13.0 mmol, 3 equiv.) is added. After stirring for 20 min at this temperature, the flask is transferred to a -20 °C freezer and allowed to age for 24 h. The reaction is subsequently quenched at -20 °C through the addition of water and stirred at room temperature for 30 min. After this time an aqueous 30% NaOH solution saturated

with NaCl is added and the solution is mechanically stirred for 30 min. The mixture is filtered through a plug of glass wool. Brine is added and the phases are allowed to separate. The layers are separated and the aqueous phase is extracted twice with CH₂Cl₂. The combined organic extracts are dried over MgSO₄, filtered and the filter cake is washed with CH₂Cl₂ until no more product is eluting. The solution is concentrated under vacuum and the crude product then purified by column chromatography (Et₂O–pentane 1:1) to yield the product epoxide **33** (1.50 g, 3.31 mmol, 76%, dr 4:1) as a colorless oil.

HR-MS(ESI⁺): calculated for C₂₀H₂₇Cl₃O₅K [M+K⁺]: *m/z* = 491.0556, found: *m/z* = 491.0555. **¹H-NMR** (400 MHz CDCl₃) δ[ppm] = 7.39 – 7.27 (m, 5H), 4.65 (d, J = 12.2 Hz, 1H), 4.60 (d, J = 12.2 Hz, 1H), 4.53 – 4.42 (m, 2H), 4.02 (ddd, J = 7.5, 4.5, 3.0 Hz, 1H), 3.89 (dd, J = 12.2, 4.3 Hz, 1H), 3.75 (dd, J = 12.1, 6.7 Hz, 1H), 3.71 – 3.64 (m, 2H), 3.20 (dt, J = 6.7, 4.3 Hz, 1H), 3.10 (dddd, J = 7.1, 5.6, 4.2, 2.9 Hz, 1H), 2.74 (ddd, J = 14.4, 9.6, 6.0 Hz, 1H), 2.57 (ddd, J = 14.5, 9.7, 6.6 Hz, 1H), 2.09 – 2.01 (m, 2H), 1.50 (s, 3H), 1.44 (s, 3H). **¹³C-NMR** (100 MHz CDCl₃) δ[ppm] = 137.9, 128.6, 128.0, 127.9, 103.6, 92.3, 77.3, 76.3, 73.8, 68.9, 60.9, 57.4, 57.0, 56.4, 39.4, 24.5, 24.0, 23.5. The data matched those previously reported.[2]

(2*R*,3*R*)-6-((4*R*,5*S*,6*S*)-6-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-1,3-dioxan-4-yl)-3,6,6-trichlorohexane-1,2-diol



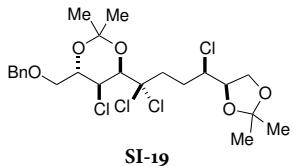
A round-bottom flask is charged with ethyl acetate (50 mL) and anhydrous MgCl₂ (1.52 g, 15.9 mmol). The suspension is heated to 80 °C and stirred for 10 min during which the previously cloudy mixture becomes clear with some residual solids. To this is then added the starting epoxide **33** (2.41 g, 5.31 mmol) dissolved in 10 mL ethyl acetate. The mixture is stirred for 5 min and then allowed to cool to room temperature, water is added, the phases are separated and the aqueous phase is extracted three times with ethyl acetate and the combined organic phases are dried over Na₂SO₄. The solvent is removed under reduced pressure and the product is purified by column chromatography (Et₂O–pentane 2:1) to yield the product **SI-18** (2.01 g, 4.10 mmol, 77%) as a colorless oil along with the undesired 1,3-diol (500 mg, 1.02 mmol, 19%).

HR-MS(ESI⁺): calculated for C₂₀H₂₈Cl₄O₅Na [M+Na⁺]: *m/z* = 511.0583, found: *m/z* = 511.0582. **¹H-NMR** (400 MHz CDCl₃) δ[ppm] = 7.39 – 7.27 (m, 5H), 4.64 (d, J = 12.3 Hz, 1H), 4.60 (d, J = 12.2 Hz, 1H), 4.51 (d, J = 3.9 Hz, 1H), 4.46 (dd, J = 7.6, 3.8 Hz, 1H), 4.12 (dt, J = 9.3, 4.2 Hz, 1H), 4.03 (ddd, J = 7.6, 4.5, 3.1 Hz, 1H), 3.81 (ddd, J = 7.0, 4.8, 2.3 Hz, 1H), 3.77 – 3.73 (m, 2H), 3.70 – 3.67 (m, 2H), 2.97 (ddd, J = 14.1, 10.6, 4.5 Hz, 1H), 2.48 – 2.38 (m, 1H), 2.37 – 2.24 (m, 2H), 1.51 (s, 3H), 1.45 (s, 3H). **¹³C-NMR** (101 MHz CDCl₃) δ[ppm] = 137.9, 128.6, 128.0, 127.9, 103.6, 92.3, 77.3, 76.3, 74.4, 73.8, 68.8, 64.7, 64.0, 57.2, 39.7, 30.4, 24.5, 23.5. The data matched those previously reported.[2]

(4*S*,5*S*,6*R*)-4-((benzyloxy)methyl)-5-chloro-2,2-dimethyl-6-((*R*)-1,1,4-trichloro-4-((*R*)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxane

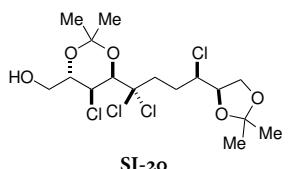
A round-bottom flask is charged with 1,2-diol **SI-18** (2.0 g, 4.08 mmol), acetone (41 mL, 0.1 M), anhydrous CuSO₄ (0.85 g, 5.30 mol, 1.3 equiv.) and *p*-toluenesulfonic acid (7.8 mg, 0.04 mmol, 1 mol%). The mixture is stirred for 24 h and the acid is then quenched through addition of solid

K_2CO_3 . The mixture is filtered and the solvent evaporated under vacuum. Purification by column chromatography (Et_2O -pentane 1:7) yields bis-acetal **SI-19** (1.76 g, 3.31 mmol, 81%) as a colorless oil.



HR-MS(ESI⁺): calculated for $\text{C}_{23}\text{H}_{33}\text{Cl}_4\text{O}_5$ [M+H⁺]: $m/z = 529.1077$ found: $m/z = 529.1083$. **¹H - NMR** (500 MHz CDCl_3) δ [ppm] = 7.38 – 7.27 (m, 5H), 4.64 (d, $J = 12.3$ Hz, 1H), 4.60 (d, $J = 12.3$ Hz, 1H), 4.50 (d, $J = 3.8$ Hz, 1H), 4.46 (dd, $J = 7.6, 3.8$ Hz, 1H), 4.32 (td, $J = 6.3, 5.1$ Hz, 1H), 4.11 (dd, $J = 8.7, 6.7$ Hz, 1H), 4.03 (ddd, $J = 7.6, 4.6, 2.9$ Hz, 1H), 3.93 (dd, $J = 8.7, 6.0$ Hz, 1H), 3.70 – 3.67 (m, 2H), 3.02 (ddd, $J = 14.8, 11.0, 4.4$ Hz, 1H), 2.44 – 2.28 (m, 2H), 2.18 – 2.09 (m, 1H), 1.51 (s, 3H), 1.48 (s, 3H), 1.45 (s, 3H), 1.38 (s, 3H). **¹³C - NMR** (126 MHz CDCl_3) δ [ppm] = 137.9, 128.6, 128.0, 127.9, 110.4, 103.6, 92.4, 78.5, 77.4, 76.3, 73.8, 68.9, 66.3, 62.0, 57.2, 39.8, 29.2, 26.4, 25.3, 24.5, 23.5. The data matched those previously reported.[2]

((4S,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)methanol



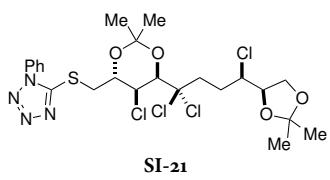
A flask with a three way stopcock is charged with benzyl ether **SI-19** (1.76 g, 3.31 mmol), ethyl acetate (66 mL) and 10% palladium on charcoal (71 mg). The stopcock is attached to a hydrogen balloon and a manifold. The flask is evacuated and reflushed with nitrogen three times and then evacuated and reflushed with hydrogen three times. After the last flush, the hydrogen valve stays open for 1.5 h. The flask is then evacuated and reflushed with nitrogen three times before opening the flask to air and filtering the suspension through a plug of celite. The solvent is removed under vacuum and the crude product is purified by column chromatography (Et_2O -pentane 1:2 to 2:3) to yield the product alcohol **SI-20** (1.45 g, 13.9 mmol, 95%) as a colorless oil.

HR-MS(ESI⁺): calculated for $\text{C}_{16}\text{H}_{27}\text{Cl}_4\text{O}_5$ [M+H⁺]: $m/z = 439.0607$, found: $m/z = 439.0592$. **¹H - NMR** (400 MHz C_6D_6) δ [ppm] = 4.45 – 4.32 (m, 2H), 3.91 (ddd, $J = 6.8, 6.0, 4.2$ Hz, 1H), 3.81 (ddd, $J = 7.1, 4.7, 2.6$ Hz, 1H), 3.74 (dd, $J = 8.5, 6.0$ Hz, 1H), 3.66 (dd, $J = 8.5, 6.8$ Hz, 1H), 3.51 (dt, $J = 8.8, 4.3$ Hz, 1H), 3.46 (ddd, $J = 11.9, 5.2, 2.5$ Hz, 1H), 3.38 (ddd, $J = 12.0, 7.2, 4.8$ Hz, 1H), 3.23 (ddd, $J = 14.9, 9.9, 6.5$ Hz, 1H), 2.56 – 2.43 (m, 1H), 2.42 – 2.30 (m, 2H), 1.45 (s, 3H), 1.23 (s, 3H), 1.23 (s, 3H), 1.21 (s, 3H). **¹³C - NMR** (101 MHz C_6D_6) δ [ppm] = 110.2, 103.4, 93.1, 78.4, 77.9, 77.3, 66.4, 62.1, 61.8, 57.1, 40.1, 30.0, 26.4, 25.3, 24.2, 23.4. **Optical Rotation:** $[\alpha]_D^{23.2} = +29.0$ ($c = 1.0, \text{C}_6\text{H}_6$). **IR** (film): $\tilde{\nu} = 3471$ (b), 2989 (m), 2938 (w), 1381 (s), 1223 (s), 1065 (m), 857 (w). The data matched those previously reported.[2]

5-(((4S,5S,6R)-5-chloro-2,2-dimethyl-6-((S)-1,1,4-trichloro-4-((S)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)methylthio)-1-phenyl-1H-tetrazole

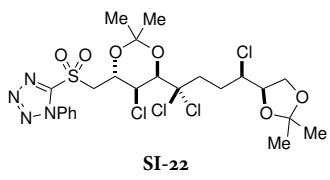
Solid 1-Phenyl-1H-tetrazole-5-thiol (0.89 g, 4.97 mmol) is dissolved in dry THF (15.8 mL) and recrystallized PPh_3 (1.37 g, 20.4 mmol) is added. The mixture is cooled to 0 °C and DIAD (0.99 mL, 5.0 mmol) is added. After stirring for 10 min the alcohol **SI-20** (1.21 g, 2.75 mmol) is added as a solution in THF (15.8 mL). The flask that contained **SI-20** is rinsed twice with 8 mL THF each.

The reaction mixture is stirred for 20 min at 0 °C and then at room temperature for 40 min. The mixture is cooled back to 0 °C and aq. NaHCO₃ is added. The phases are separated and the aqueous layer is extracted three times with Et₂O. The combined organic layers are dried over MgSO₄, filtered and the solvent is removed under vacuum. The crude product is purified by column chromatography (EtOAc–hex 1:4) to yield the product sulfide **SI-21** (1.50 g, 2.50 mmol, 91%) as a white foam.



HR-MS(ESI⁺): calculated for C₂₃H₃₁Cl₄O₄N₄S [M+H⁺]: *m/z* = 599.0815, found: *m/z* = 599.0808. **¹H-NMR** (500 MHz C₆D₆) δ[ppm] = 7.16 (q, *J* = 3.6, 3.0 Hz, 2H), 6.91 (dd, *J* = 5.2, 2.1 Hz, 3H), 4.37 (d, *J* = 3.9 Hz, 1H), 4.22 (td, *J* = 7.8, 3.5 Hz, 1H), 4.13 (dd, *J* = 7.5, 3.9 Hz, 1H), 3.92 (td, *J* = 6.4, 4.1 Hz, 1H), 3.75 (dd, *J* = 8.6, 6.0 Hz, 1H), 3.71 – 3.64 (m, 2H), 3.52 (dt, *J* = 8.6, 4.2 Hz, 1H), 2.50 – 2.40 (m, 1H), 3.29 (dd, *J* = 13.5, 8.1 Hz, 1H), 3.17 (dt, *J* = 14.8, 6.4 Hz, 1H), 2.45 (ddd, *J* = 14.3, 10.4, 6.0 Hz, 1H), 2.40 – 2.28 (m, 2H), 1.45 (s, 3H), 1.22 (s, 3H), 1.16 (s, 3H), 1.14 (s, 3H). **¹³C-NMR** (126 MHz C₆D₆) δ[ppm] = 153.6, 134.1, 129.9, 129.7, 124.1, 110.2, 103.9, 92.8, 78.4, 77.6, 75.4, 66.4, 62.0, 60.1, 40.0, 35.6, 29.9, 26.4, 25.3, 24.0, 23.2. **Optical Rotation:** [α]_D^{24.4} = +9.5 (c = 1.0, CHCl₃). **IR** (film): *ν* = 2989 (m), 2937 (w), 1500 (s), 1383 (s), 1222 (s), 1060 (m), 762 (m), 694 (m).

5-(((4*S*,5*S*,6*R*)-5-chloro-2,2-dimethyl-6-((*S*)-1,1,4-trichloro-4-((*S*)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)methyl)sulfonyl)-1-phenyl-1*H*-tetrazole

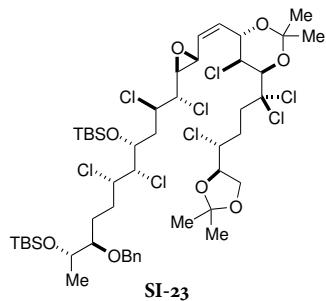


The starting sulfide **SI-21** (1.50 g, 2.50 mmol) is dissolved in ethanol (2.5 mL). Subsequently, (NH₄)₆Mo₇O₂₄ · 4 H₂O (0.46 g, 0.38 mmol, 0.15 equiv.) dissolved in 30% aq. hydrogen peroxide (1.91 mL, 18.7 mmol) is added slowly to the starting material. 3.75 mL THF were added and the mixture was heated to 60 °C for 3 h. The reaction mixture was allowed to cool to room temperature, diluted with water and the phases were separated. The aqueous phase was extracted thrice with CH₂Cl₂, the volatiles were removed under vacuum. The obtained mixture was diluted with water and CH₂Cl₂, the phases separated and the organic layer was washed with aq. Na₂S₂O₃, dried, filtered and evaporated. The crude product was purified by column chromatography (EtOAc–hex 1:3) to obtain the product **SI-22** (1.10 g, 1.74 mmol, 70%) as a white foam.

HR-MS(ESI⁺): calculated for C₂₃H₃₁Cl₄N₄O₆S [M+H⁺]: *m/z* = 631.0713, found: *m/z* = 631.0701. **¹H-NMR** (400 MHz CDCl₃) δ[ppm] = 7.71–7.59 (m, 5H), 4.48–4.42 (m, 1H), 4.32 (ddd, *J* = 6.7, 5.9, 5.0 Hz, 1H), 4.27 (dd, *J* = 8.3, 4.3 Hz, 1H), 4.10 (dd, *J* = 8.7, 6.7 Hz, 1H), 4.03 (dd, *J* = 15.0, 2.6 Hz, 1H), 3.97 – 3.84 (m, 3H), 2.98 (ddd, *J* = 15.6, 11.2, 4.3 Hz, 1H), 2.38 – 2.23 (m, 2H), 2.20 – 2.04 (m, 1H), 1.47 (s, 3H), 1.37 (s, 3H), 1.36 (s, 3H), 1.24 (s, 3H). **¹³C-NMR** (126 MHz CDCl₃) δ[ppm] = 154.2, 133.0, 131.9, 130.0, 125.5, 110.4, 104.6, 91.5, 78.4, 76.9, 71.3, 66.3, 61.8, 58.8, 57.1, 39.6, 29.0, 26.3, 25.3, 23.5, 23.1. **Optical Rotation:** [α]_D^{25.6} = +18.1 (c = 1.0, CHCl₃). **IR** (film): *ν* = 2989 (m), 2938 (w), 1498 (m), 1384 (s), 1354 (s), 1220 (s), 1155 (s), 1056 (s), 763 (s).

2.6 Final Steps and Fragment Coupling of C₂₁/C₂₂ Inverted Diastereomer

(5S,6R,7R,10R,11S)-10-(benzyloxy)-6,7-dichloro-5-((2S,3R)-2,3-dichloro-3-((2S,3R)-3-((Z)-2-((4S,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)vinyl)oxiran-2-yl)propyl)-2,2,3,3,11,13,13,14,14-nonamethyl-4,12-dioxa-3,13-disilapentadecane

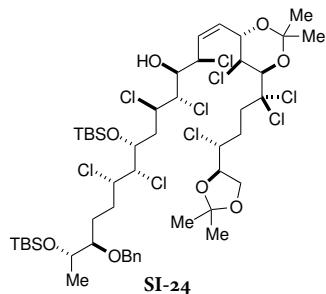


Olefination: Aldehyde **6** (1.11 g, 1.76 mmol) and sulfone **SI-22** (1.07 g, 1.46 mmol) were azeotropically dried together by concentrating from benzene three times. The flask was evacuated and backfilled with nitrogen. The starting materials were dissolved in toluene (71 mL) and the solution was cooled to -78 °C. A solution of NaHMDS in PhMe (0.6 M, 51.3 mL, 3.08 mmol) was added dropwise and the mixture was stirred for 1 h, and hereafter allowed to slowly warm to r.t. overnight. Saturated NaHCO₃(aq) was added and after separating the phases, the aqueous phase was extracted with Et₂O three times. The combined organic phases were washed with brine, dried (MgSO₄), filtered, and concentrated. Column chromatography (8 % Et₂O in pentane) gave the title compound **SI-23** (1.09 g, 66 %) as a mixture of diastereomers along with inseparable traces of **6** (ca. 5%).

HR-MS(ESI⁺): calculated for C₄₉H₈₄Cl₈NO₈Si₂ [M+NH₄⁺]: *m/z* = 1150.3238, found: *m/z* = 1150.3228.

¹H – NMR (500 MHz CDCl₃) δ[ppm] = 7.36 – 7.26 (m, 5H), 5.78 (dd, J = 11.3, 8.0 Hz, 1H), 5.35 (ddd, J = 11.1, 8.6, 1.2 Hz, 1H), 4.81 – 4.70 (m, 2H), 4.63 – 4.55 (m, 1H), 4.54 – 4.45 (m, 1H), 4.37 – 4.27 (m, 2H), 4.28 – 4.19 (m, 3H), 4.15 – 4.06 (m, 1H), 3.97 – 3.90 (m, 3H), 3.89 – 3.81 (m, 1H), 3.80 – 3.74 (m, 1H), 3.74 – 3.63 (m, 1H), 3.32 – 3.23 (m, 2H), 3.10 – 2.98 (m, 1H), 2.47 – 2.24 (m, 3H), 2.21 – 2.08 (m, 2H), 2.03 – 1.77 (m, 2H), 1.55 (s, 3H), 1.49 (s, 3H), 1.45 (s, 3H), 1.38 (s, 3H), 1.18 (d, J = 6.2 Hz, 3H), 0.20 – 0.12 (m, 6H), 0.10 – 0.04 (m, 6H). **¹³C – NMR** (126 MHz CDCl₃) δ[ppm] = 139.0, 132.0, 130.2, 128.5, 127.9, 127.7, 110.4, 103.8, 92.2, 83.8, 78.5, 77.4, 73.1, 73.0, 72.5, 70.9, 67.7, 66.3, 64.4, 61.9, 61.5, 61.3, 61.3, 59.1, 54.2, 39.7, 37.8, 34.2, 29.1, 28.6, 26.4, 26.1, 26.1, 26.0, 26.0, 25.3, 24.2, 23.7, 19.5, 18.3, 18.2, -3.79, -4.2, -4.3, -4.5. **Optical Rotation:** [α]_D^{25.1} = +9.0 (c = 0.42, CHCl₃). **IR (film):** ν = 2930 (s), 2857 (s), 1472 (w), 1382 (m), 1256 (s), 1222 (s), 837 (s), 777 (s).

(3*S*,4*S*,5*S*,6*R*,8*R*,9*S*,10*S*,13*R*,14*S*,*Z*)-13-(benzyloxy)-8,14-bis((tert-butylidemethylsilyl)oxy)-3,5,6,9,10-pentachloro-1-((4*S*,5*S*,6*R*)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-1-en-4-ol



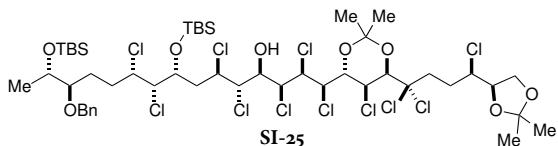
Epoxide **SI-23** (1.09 g, 0.96 mmol) was dried by azeotropic concentration from benzene three times and then dissolved in EtOAc (47.2 mL) and CH₂Cl₂ (23.6 mL) in a Schlenk tube. TMSCl (3.65 mL, 28.8 mmol) was added followed by slow addition of HCl in EtOAc (1 M, 9.8 mL, 9.8 mmol) by syringe pump over 2 h and stirred for another 0.5 h. The reaction mixture was poured into sat. NaHCO₃(aq) and the phases were separated. The aqueous phase was extracted with EtOAc three times and the combined organic phases were then dried (MgSO₄), filtered, and concentrated. Purification by column chromatography (10 % to 15 % Et₂O in pentane) gave slightly impure chlorohydrin **SI-24** (620 mg, 55 %) as a colorless oil.

HR-MS(ESI⁺): calculated for C₄₉H₈₅Cl₉NO₈Si₂ [M+NH₄⁺]: *m/z* = 1186.3005, found: *m/z* = 1186.2998. **¹H-NMR** (500 MHz CDCl₃) δ[ppm] = 7.37 – 7.27 (m, 5H), 6.06 – 5.95 (m, 1H), 5.73 – 5.62 (m, 2H), 4.79 – 4.69 (m, 1H), 4.70 – 4.64 (m, 2H), 4.62 – 4.57 (m, 1H), 4.54 – 4.45 (m, 1H), 4.36 – 4.29 (m, 2H), 4.28 – 4.17 (m, 3H), 4.14 – 4.08 (m, 1H), 3.97 – 3.91 (m, 3H), 3.90 – 3.80 (m, 2H), 3.32 – 3.24 (m, 1H), 3.03 (dd, *J* = 14.6, 10.8 Hz, 1H), 2.43 – 2.29 (m, 3H), 2.19 – 2.09 (m, 1H), 2.05 – 1.76 (m, 4H), 1.55 (s, 3H), 1.50 (m, 1H), 1.48 (s, 3H), 1.46 (s, 3H), 1.38 (s, 3H), 1.18 (d, *J* = 6.2 Hz, 3H), 0.93 – 0.86 (m, 18H), 0.20 – 0.11 (m, 6H), 0.08 – 0.05 (m, 6H). **¹³C-NMR** (126 MHz CDCl₃) δ[ppm] = 139.0, 130.5, 129.0, 128.5, 128.0, 127.7, 110.4, 104.1, 92.0, 83.8, 78.5, 77.1, 74.3, 73.2, 73.1, 72.6, 70.9, 67.5, 66.6, 66.3, 61.9, 61.3, 61.1, 59.5, 59.4, 39.8, 36.0, 34.3, 29.1, 28.6, 26.4, 26.1, 26.0, 25.3, 24.1, 23.6, 19.5, 18.3, 18.2, -3.8, -4.2, -4.3, -4.5. **Optical Rotation:** [α]_D^{24.3} = +24.3 (c = 0.97, C₆H₆). **IR (film):** ν = 3528 (b), 2955 (m), 2930 (s), 2857 (m), 1472 (w), 1382 (m), 1258 (m); 1223 (m), 1095 (s), 836 (s), 777 (s).

(1*R*,2*R*,3*S*,4*R*,5*S*,6*R*,8*R*,9*S*,10*S*,13*R*,14*S*)-13-(benzyloxy)-8,14-bis((tert-butylidemethylsilyl)oxy)-1,2,3,5,6,9,10-heptachloro-1-((4*R*,5*S*,6*R*)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadecan-4-ol

A solution of allyl chloride **SI-24** (618 mg, 0.53 mmol) in CH₂Cl₂ (12 mL) was cooled to -78 °C. A solution of Et₄NCl₃ (623 mg, 2.63 mmol) in CH₂Cl₂ (6 mL) was added and the mixture was stirred for 1.5 h, then warmed to 0 °C and stirred for 1.5 h, and finally warmed to room tempera-

ture and stirred for 30 min before excess trichloride salt was quenched with a 1:1 mixture of sat. $\text{NaHCO}_3\text{(aq)}$ and sat. $\text{Na}_2\text{S}_2\text{O}_3\text{(aq)}$. The aqueous phase was extracted three times with CH_2Cl_2 and the combined organic phases were then dried (MgSO_4), filtered, and concentrated. Purification by column chromatography (10 % Et_2O in pentane) afforded undecachloride **SI-25** (430 mg, 66 %) as a colorless oil.

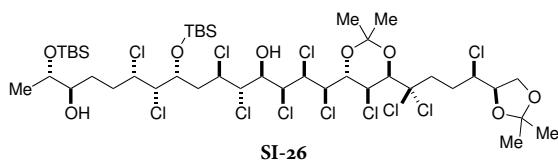


HR-MS(ESI⁺): calculated for $\text{C}_{49}\text{H}_{81}\text{Cl}_{11}\text{K}_1\text{O}_8\text{Si}_2$ [$\text{M}+\text{K}^+$]: $m/z = 1281.1626$, found: $m/z = 1281.1616$.

¹H - NMR (500 MHz d_6 -Acetone) δ [ppm] = 7.41 – 7.30 (m, 4H), 7.31 – 7.24 (m, 1H), 5.22 (bs, 1H), 4.92 – 4.84 (m, 1H), 4.84 – 4.69 (m, 5H), 4.65 – 4.52 (m, 3H), 4.43 – 4.34 (m, 2H), 4.34 – 4.24 (m, 2H), 4.20 – 4.09 (m, 3H), 4.07

– 3.98 (m, 1H), 3.92 (dd, $J = 8.6, 6.0$ Hz, 1H), 3.40–3.34 (m, 1H), 2.99 (ddd, $J = 14.9, 11.7, 3.8$ Hz, 1H), 2.54 – 2.43 (m, 2H), 2.40 – 2.31 (m, 1H), 2.24 – 2.09 (m, 3 H), 1.98 – 1.80 (m, 2H), 1.59 (m, 1H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3 H), 1.18 (d, $J = 6.3$ Hz, 3H), 0.94 – 0.91 (m, 18H), 0.25 – 0.19 (m, 6H), 0.13 – 0.08 (m, 6H). **¹³C - NMR** (126 MHz d_6 -Acetone) δ [ppm] = 140.2, 129.0, 128.49, 128.2, 110.4, 104.7, 93.6, 84.3, 79.5, 79.1, 77.8, 73.9, 73.1, 71.7, 71.1, 69.7, 68.8, 67.7, 66.9, 65.6, 63.1, 61.5, 61.1, 59.7, 41.0, 37.3, 34.8, 30.6, 28.6, 26.6, 26.5, 26.3, 25.6, 25.4, 23.5, 19.9, 19.0, 18.6, -3.6, -4.0, -4.3, -4.4. **Optical Rotation:** $[\alpha]_D^{24.4} = +26.5$ ($c = 1.0, \text{C}_6\text{H}_6$). **IR (film):** $\tilde{\nu} = 2954$ (s), 2931 (s), 2858 (m), 1472 (w), 1382 (m), 1257 (s), 1223 (s), 1096 (s), 837 (s), 777 (m).

(2S,3R,6S,7S,8R,10R,11S,12R,13S,14R,15R)-2,8-bis((tert-butyldimethylsilyl)oxy)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadecane-3,12-diol



To a flask containing the benzyl ether **SI-25** (430 mg, 346 μmol) was added palladium on carbon (861 mg, extent of labeling: 10 wt% loading (dry basis), matrix activated carbon, wet support, water content: 50 %, Degussa type E101 NE/W, supplier: Sigma-Aldrich). 70 mL of a 1:1 mixture of dry THF and

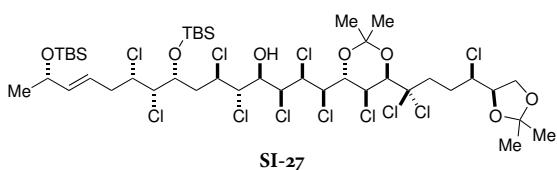
methanol (extra dry, stored over molecular sieves) was added, while rapidly stirring the flask was evacuated and refilled with nitrogen twice and then evacuated and refilled with hydrogen twice. Hydrogen was bubbled through the solution for 15 min and after this time the suspension was warmed to 35 °C (still fitted with a hydrogen balloon but with the needle out of the solution and the outlet removed) and stirred vigorously for 5 min at this temperature. The reaction mixture was allowed to cool to room temperature, evacuated and refilled with nitrogen twice. The reaction mixture was then filtered through a plug of celite, the solvent was removed under reduced pressure and the residue was purified by column chromatography (EtOAc-hex 1:9) to yield the slightly impure product **SI-26** as a colorless oil (61%, 245 mg, 212 μmol).

HR-MS(ESI⁺): calculated for $\text{C}_{42}\text{H}_{79}\text{Cl}_{11}\text{N}_1\text{O}_8\text{Si}_2$ [$\text{M}+\text{NH}_4^+$]: $m/z = 1166.1913$, found: $m/z = 1166.1908$.

¹H - NMR (500 MHz d_6 -Acetone) δ [ppm] = 4.94 – 4.81 (m, 1H), 4.78 – 4.70 (m, 3H), 4.64 (dd, J

= 15.1, 2.6 Hz, 1H), 4.60 (dd, J = 9.6, 1.6 Hz, 1H), 4.54 – 4.46 (m, 1H), 4.42 – 4.34 (m, 1H), 4.36 – 4.26 (m, 2H), 4.24 – 4.09 (m, 3H), 3.92 (dd, J = 8.6, 6.0 Hz, 1H), 3.78 – 3.68 (m, 1H), 3.43 – 3.35 (m, 1H), 3.05 – 2.95 (m, 1H), 2.54 – 2.42 (m, 2H), 2.41 – 2.30 (m, 1H), 2.24 – 2.11 (m, 3H), 2.00 – 1.84 (m, 2H), 1.54 (s, 3H), 1.45 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.15 (d, J = 6.3 Hz, 3H), 0.95 (s, 9H), 0.91 (s, 9H), 0.24 (s, 3H), 0.23 (s, 3H), 0.10 (s, 3H), 0.09 (s, 3H). ^{13}C -NMR (126 MHz d₆-Acetone) δ [ppm] = 110.4, 104.6, 93.7, 79.6, 79.1, 77.8, 76.3, 74.0, 73.0, 71.6, 69.9, 68.9, 67.8, 66.9, 65.6, 63.2, 63.1, 61.2, 59.7, 41.0, 37.2, 35.3, 30.6, 30.5, 26.7, 26.5, 26.3, 25.7, 25.4, 23.5, 19.6, 19.0, 18.6, -3.6, -4.0, -4.1, -4.4. Optical Rotation: $[\alpha]_D^{23.8} = +33.9$ (c = 0.35, CH₂Cl₂). IR (film): $\tilde{\nu}$ = 3357 (b), 2953 (m), 2929 (s), 2857 (m), 1472 (w), 1383 (m), 1257 (s), 1223 (s), 1095 (s), 838 (s), 778 (s).

(1R,2R,3S,4R,5S,6R,8R,9S,10S,14S,E)-8,14-bis((tert-butyldimethylsilyl)oxy)-1,2,3,5,6,9,10-heptachloro-1-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-12-en-4-ol

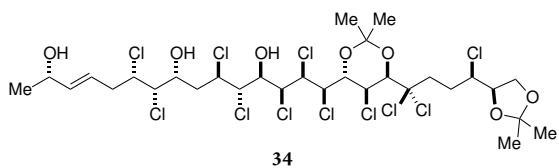


A Schlenk flask was charged with the azeotropically dried diol **SI-26** (245 mg, 212 μmol) and toluene (5.1 mL). To this was then added dropwise 255 μL (0.12 equiv.) of a 0.1 M solution of Martin's Sulfurane in benzene. The reaction mixture was stirred for 15 min at room temperature after which more Sulfurane was

added as the stock solution in portions of 0.12 equiv every 15 minutes until complete conversion was reached (ca. 1.2 equiv. of Sulfurane total). Excess reagent was then quenched through addition of sat. NaHCO₃(aq.), the phases were separated and the aqueous phase was extracted three times with diethyl ether. The combined organic phases were dried over Na₂SO₄, filtered and evaporated under reduced pressure. The obtained oil was purified by column chromatography (10% Et₂O in pentane) to yield the slightly impure product **SI-27** as a colorless oil (145 mg, 128 μmol , 60%).

HR-MS(ESI⁺): calculated for C₄₂H₇₇Cl₁₁NO₇Si₂ [M+NH₄⁺]: m/z = 1154.1730, found: m/z = 1154.1717. **¹H-NMR** (500 MHz, Acetone-d₆) δ [ppm] = -5.74 – 5.60 (m, 2H), 5.21 (d, J = 11.1 Hz, 1H), 4.95 – 4.83 (m, 1H), 4.82 – 4.70 (m, 4H), 4.65 (dd, J = 2.7, 1.9 Hz, 1H), 4.63 – 4.58 (m, 1H), 4.52 – 4.43 (m, 1H), 4.42 – 4.25 (m, 5H), 4.25 – 4.19 (m, 1H), 4.19 – 4.10 (m, 2H), 3.92 (dd, J = 8.6, 6.0 Hz, 1H), 3.05 – 2.95 (m, 1H), 2.70 – 2.61 (m, 2H), 2.53 – 2.45 (m, 2H), 2.35 (dd, J = 14.5, 11.4, 4.4, 3.1 Hz, 1H), 2.24 – 2.12 (m, 2H), 1.54 (s, 3H), 1.45 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.19 (d, J = 6.3 Hz, 3H), 0.95 – 0.92 (m, 9H), 0.92 – 0.90 (m, 9H), 0.26 – 0.22 (m, 6H), 0.12 – 0.05 (m, 6H). **¹³C-NMR** (126 MHz d₆-Acetone) δ [ppm] = 140.2, 124.0, 110.4, 104.7, 104.6, 93.7, 79.5, 79.0, 77.8, 73.8, 71.7, 69.5, 69.2, 68.8, 68.6, 67.6, 66.9, 65.6, 63.0, 61.6, 61.1, 59.6, 41.0, 40.6, 37.1, 30.6, 30.1, 26.6, 26.6, 26.5, 26.3, 26.3, 26.2, 25.4, 23.5, 19.0, 18.8, -3.7, -4.0, -4.3, -4.5.

(2S,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-3-ene-2,8,12-triol

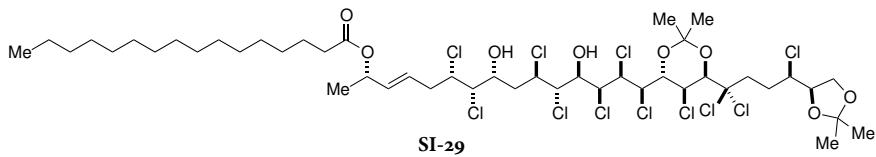


A teflon vial was charged with the starting material **SI-27** (145 mg, 128 µmol) dissolved in 11.8 mL MeCN and cooled to 0 °C. To this mixture was then added dropwise 2 mL MeCN, 0.28 mL HF (70 % HF in pyridine) and 0.14 mL pyridine. The mixture was

stirred for 2 h at room temperature (ca. 29 °C), and then for 6 h at 0 °C. The mixture was then transferred into NaHCO₃(aq). The vial was washed with CH₂Cl₂ twice, the organic phases were separated and the aqueous phase was extracted three times with CH₂Cl₂. The combined organic phases were dried with Na₂SO₄, filtered and evaporated. The crude product was purified by column chromatography (20 % to 100 % Et₂O–Pentane) to give slightly impure **SI-27** (16 mg, 14 µmol, 11%), monodeprotected **SI-28** (26 mg, 25 µmol, 20%) and **34** (76 mg, 84 µmol, 66%).⁷

¹H-NMR (500 MHz d₆-Acetone) δ[ppm] = 5.71 (dd, J = 15.4, 5.2 Hz, 1H), 5.65 (dt, J = 15.5, 6.3 Hz, 1H), 5.40 (d, J = 10.2 Hz, 1H), 4.77 – 4.71 (m, 2H), 4.69 (dd, J = 9.5, 1.5 Hz, 1H), 4.61 (t, J = 2.4 Hz, 1H), 4.56 (dt, J = 9.8, 1.7 Hz, 1H), 4.41 – 4.34 (m, 3H), 4.29 – 4.19 (m, 3 H), 4.19 – 4.08 (m, 3H), 3.91 (dd, J = 8.6, 6.0 Hz, 1H), 3.78 (d, J = 4.5 Hz, 1H), 3.03 – 2.93 (m, 1H), 2.74 – 2.58 (m, 2H), 2.48 (ddd, J = 14.6, 11.7, 4.5 Hz, 1H), 2.34 (dddd, J = 14.5, 11.6, 4.4, 3.0 Hz, 1H), 2.22 – 2.13 (m, 2H), 2.05 – 1.97 (m, 1H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.18 (d, J = 6.4 Hz, 3H). **¹³C-NMR** (126 MHz d₆-Acetone) δ[ppm] = 140.5, 123.7, 110.4, 104.6, 93.6, 79.5, 79.0, 77.7, 71.1, 71.0, 70.2, 68.5, 68.1, 67.9, 66.9, 65.5, 63.0, 63.0, 61.1, 60.6, 59.6, 40.9, 39.6, 37.8, 30.5, 26.5, 25.6, 25.4, 24.1, 23.5. **Optical Rotation:** [α]_D^{23.9} = +27.7 (c = 1.0, Me₂CO). **IR** (film): ν = 3373 (b), 2988 (m), 2931 (m), 1382 (s), 1222 (s), 1092 (m), 1020 (m), 846 (w).

(2S,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-8,12-dihydroxypentadec-3-en-2-yl palmitate



10 mg of triol **34** were dissolved in 1100 µL CH₂Cl₂ and cooled to -78 °C. 8.9 µL of a stock solution of pyridine (0.33 mL in

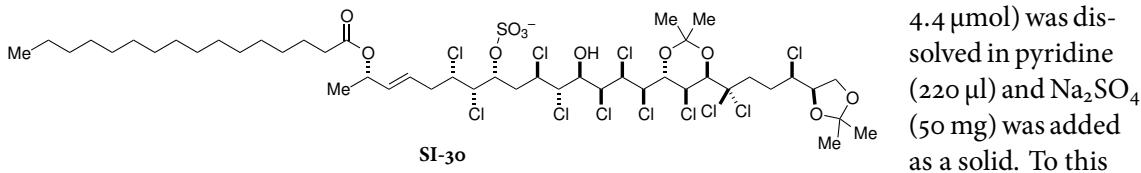
4.7 mL CH₂Cl₂) was added followed by 18.4 µL of a stock solution of palmitoyl chloride (0.4 mL in 4.6 mL CH₂Cl₂). The solution was stirred at -78 °C for 30 min and then allowed to warm to -40 °C over 1 h. Upon complete conversion, the reaction mixture was then cooled to -78 °C and 20 µL methanol were added and the solution was allowed to reach room temperature over 1 h. After dilution with CH₂Cl₂ and pH7 NaH₂PO₄/Na₂HPO₄ buffer the phases were separated and the organic phase was extracted with CH₂Cl₂ thrice. The combined organic phases were dried over Na₂SO₄, filtered and concentrated. The crude mixture is purified by column chromatography

⁷Acquisition of a high resolution mass for this compound failed.

(hexane–EtOAc 15% to hexane–EtOAc 20%) to give **SI-29** (76%, 9.6 mg, 8.4 μmol).

HR-MS(ESI}^-: calculated for $\text{C}_{46}\text{H}_{75}\text{Cl}_{11}\text{O}_8^-$ [M^-]: $m/z = 1140.2041$, found: $m/z = 1140.2072$. **$^1\text{H-NMR}$** (500 MHz d_6 -Acetone) δ [ppm] = 5.76 (dt, $J = 15.1, 6.6$ Hz, 1H), 5.69 (dd, $J = 15.6, 5.9$ Hz, 1H), 5.31 (p, $J = 6.4$ Hz, 1H), 5.04 (d, $J = 10.6$ Hz, 1H), 4.99 (s, 1H), 4.91 (s, 1H), 4.80 – 4.72 (m, 2H), 4.70 (d, $J = 9.6$ Hz, 1H), 4.64 (d, $J = 1.8$ Hz, 1H), 4.57 (dd, $J = 9.7, 1.5$ Hz, 1H), 4.44 – 4.34 (m, 3H), 4.30 – 4.20 (m, 2H), 4.18 – 4.09 (m, 3H), 3.91 (dd, $J = 8.5, 6.0$ Hz, 1H), 3.00 (ddd, $J = 15.1, 11.6, 4.0$ Hz, 1H), 2.77–2.63 (m, 2H), 2.48 (ddd, $J = 14.9, 11.9, 4.4$ Hz, 1H), 2.39 – 2.30 (m, 1H), 2.29 (t, $J = 7.5$ Hz, 2H), 2.24 – 2.10 (m, 2H), 2.07 (1H), 1.65 – 1.57 (m, 2H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.37–1.22 (m, 27H), 0.88 (t, $J = 6.8$ Hz, 3H). **$^{13}\text{C-NMR}$** (126 MHz d_6 -Acetone) δ [ppm] = 172.9, 135.1, 127.4, 110.4, 104.6, 93.7, 79.6, 79.1, 77.7, 71.2, 71.1, 70.6, 70.0, 68.7, 68.3, 66.9, 65.6, 65.0, 63.1, 63.0, 60.6, 59.6, 41.0, 39.6, 37.9, 35.0, 32.7, 30.6, 30.4, 30.4, 30.4, 30.2, 30.1, 26.5, 25.8, 25.7, 25.4, 23.6, 23.3, 20.6, 14.4. **Optical Rotation:** $[\alpha]_D^{24.7} = 10.8$ ($c = 0.2$, Me_2CO). **IR** (film): $\tilde{\nu} = 3426$ (b), 2926 (s), 2854 (m), 1716 (m), 1383 (m), 1222 (s), 974 (w).

(2S,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-12-hydroxy-2-(palmitoyloxy)pentadec-3-en-8-yl sulfate



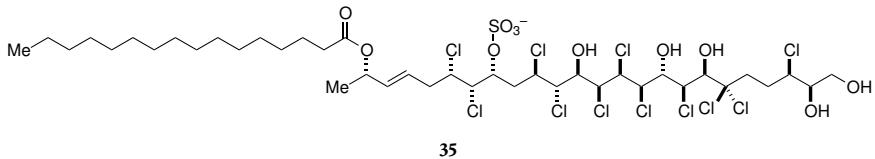
Diol **SI-29** (5 mg, 4.4 μmol) was dissolved in pyridine (220 μl) and Na_2SO_4 (50 mg) was added as a solid. To this was then added

131 μL of a 0.2 M stock solution of DMF-SO_3 in DMF (26 μmol , 6 equiv.). The suspension was heated to 40 °C and stirred for 4 h 15 min. The reaction mixture was allowed to cool to room temperature, a small amount of NaHCO_3 (aq) was added and stirred for another 1 h. The phases were separated and the aqueous phase was extracted thrice with CH_2Cl_2 . The combined organic fractions were evaporated and the product was purified by column chromatography (2 % to 5 % MeOH in CH_2Cl_2) to give the sulfate **SI-30** as a white foam (84%, 4.5 mg, 3.7 μmol).

$^1\text{H-NMR}$ (500 MHz d_6 -Acetone) δ [ppm] = 5.99 (d, $J = 6.5$ Hz, 1H), 5.81 (dt, $J = 15.3, 6.4$ Hz, 1H), 5.73 (dd, $J = 15.5, 5.9$ Hz, 1H), 5.33 (p, $J = 6.0$ Hz, 1H), 5.15 – 5.11 (m, 1H), 5.02 (dd, $J = 9.3, 1.8$ Hz, 1H), 4.86 (ddd, $J = 8.3, 3.4, 1.6$ Hz, 1H), 4.78 (dd, $J = 4.8, 2.5$ Hz, 1H), 4.74 (dd, $J = 9.5, 1.9$ Hz, 1H), 4.67 – 4.61 (m, 2H), 4.48 – 4.37 (m, 4H), 4.37 – 4.31 (m, 1H), 4.28 (ddd, $J = 9.7, 6.4, 1.6$ Hz, 1H), 4.18 – 4.11 (m, 2H), 3.90 (dd, $J = 8.5, 6.2$ Hz, 1H), 2.96 (ddd, $J = 15.6, 11.6, 4.2$ Hz, 1H), 2.76 (t, $J = 6.2$ Hz, 2H), 2.56 (ddd, $J = 16.1, 8.1, 2.5$ Hz, 1H), 2.49 (ddd, $J = 14.5, 11.6, 4.4$ Hz, 1H), 2.40 – 2.25 (m, 4H), 2.26 – 2.15 (m, 1H), 1.60 (app. dq, $J = 14.6, 7.8$ Hz, 2H), 1.53 (s, 3H), 1.46 (s, 3H), 1.41 (s, 3H), 1.34–1.27 (s, 27H), 0.88 (t, $J = 6.9$ Hz, 3H). **$^{13}\text{C-NMR}$** (126 MHz d_6 -Acetone) δ [ppm] = 172.1, 134.3, 126.3, 109.4, 103.4, 92.55, 78.9, 78.2, 76.2, 75.9, 69.9, 69.1, 68.5, 67.2, 66.5, 66.2, 65.0, 62.3, 61.8, 60.3, 59.7, 58.4, 40.3, 38.1, 37.4, 34.1, 29.8, 29.5, 29.5, 29.5, 29.4, 29.3, 29.2, 29.2, 25.7, 25.0, 24.9, 24.61, 22.9, 22.4, 19.7, 13.5. **Optical Rotation:** $[\alpha]_D^{23.9} = +25.4$ ($c = 0.45$, C_6H_6). **IR** (film): $\tilde{\nu} = 3459$

(b), 2925 (s), 2854 (m), 1713 (m), 1382 (m), 1223 (s), 1260 (s), 1048 (m).

(2S,6S,7S,8R,10R,11S,12R,13S,14S,15R,16R,17S,18R,22R,23R,E)-6,7,10,11,13,14,15,17,19,19,22-undecachloro-12,16,18,23,24-pentahydroxy-2-(palmitoyloxy)tetracos-3-en-8-yl sulfate



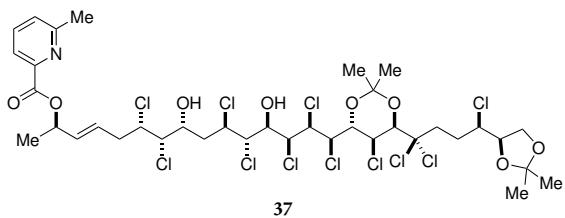
Bis-Acetal **SI-30** (4.5 mg) is transferred to a point bottom flask. To this is then added 600 μ L of a 1:1 v/v mixture of water and TFA.

The solution is stirred for 2.8 h at room temperature before the solvents are evaporated and the residues are quickly charged onto a silica gel column from which the product is eluted with 6 % to 10 % MeOH in CH_2Cl_2 to obtain pentaol **35** as a white foam along with ca. 20% of the epi- $\text{C}_{21}/\text{C}_{22}$ compound (72%, 3.0 mg, 2.6 μ mol).

HR-MS(ESI $^-$): calculated for $\text{C}_{40}\text{H}_{66}\text{Cl}_{11}\text{O}_{11}\text{S}^-$ [M^-]: $m/z = 1143.0852$, found: $m/z = 1143.0895$. **$^1\text{H-NMR}$** (500 MHz d_6 -Acetone) δ [ppm] = 6.29 (d, $J = 6.4$ Hz, 1H), 5.85 (dt, $J = 14.3, 7.0$ Hz, 1H), 5.74 (dd, $J = 15.6, 6.2$ Hz, 1H), 5.60 (d, $J = 6.2$ Hz, 1H), 5.34 (p, $J = 6.2$ Hz, 1H), 5.19 (s, 1H), 5.16 (d, $J = 9.8$ Hz, 1H), 4.94 (dd, $J = 9.5, 1.7$ Hz, 1H), 4.90 – 4.84 (m, 2H), 4.61 (d, $J = 9.8$ Hz, 1H), 4.57 (q, $J = 5.7$ Hz, 1H), 4.54 – 4.45 (m, 1H), 4.45 (d, $J = 6.9$ Hz, 1H), 4.41 (dd, $J = 9.7, 1.9$ Hz, 1H), 4.40 – 4.23 (m, 4H), 4.07 (dd, $J = 9.5, 4.9$ Hz, 1H), 3.88 (dd, $J = 5.5, 3.5$ Hz, 1H), 3.74 – 3.62 (m, 2H), 2.81 – 2.45 (m, 6H), 2.29 (t, $J = 7.5$ Hz, 2H), 2.26 – 2.15 (m, 2H), 1.60 (dt, $J = 14.1, 7.1$ Hz, 2H), 1.36 – 1.24 (m, 2H), 0.88 (t, $J = 6.9$ Hz, 3H). **$^{13}\text{C-NMR}$** (126 MHz d_6 -Acetone) δ [ppm] = 173.0, 135.1, 127.3, 97.4, 79.5, 76.6, 76.0, 74.1, 70.9, 69.6, 69.4, 67.9, 67.5, 66.0, 65.0, 64.2, 62.8, 61.3, 61.0, 59.4, 42.1, 39.0, 35.0, 32.6, 31.3, 30.4, 30.4, 30.2, 30.1, 30.1, 25.7, 23.3, 20.6, 14.4. No optical rotation was measured of the inseparable mixture of diastereomers.

2.7 C-1-21-22 Inverted Diastereomer

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-8-((tert-butyldimethylsilyl)oxy)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-12-hydroxypentadec-3-en-2-yl picolinate

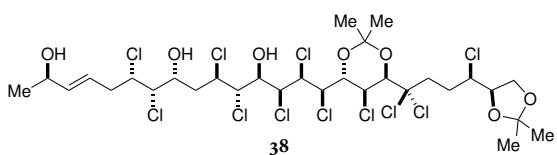


To a Schlenk tube charged with the starting material **34** (40 mg, 44 μ mol) is added 2.45 mL THF, 6-methylpyridine-2-carboxylic acid (24.2 mg, 0.18 mmol), PPh_3 (46.2 mg, 0.18 mmol) and the mixture is cooled to -25°C for 10 min. Then 34.7 μ L diisopropyl

azodicarboxylate (DIAD) in 2.45 mL THF is added dropwise over 3 min. The reaction is allowed to slowly warm to 0 °C over 1 h and then stirred for 100 min at this temperature. After addition of NaHCO₃(aq), the product is extracted three times with methylene chloride and the combined organic phases are washed with brine. Evaporation of the solvent and purification by column chromatography (20% AcOEt in hexane) delivered the product **37** as a colorless foam (18.9 mg, 18 µmol, 42%).

HR-MS(ESI⁺): calculated for C₃₇H₅₁Cl₁₁NO₈ [M+H]: *m/z* = 1024.0156, found: *m/z* = 1024.0177. **¹H - NMR** (500 MHz d₆-Acetone) δ[ppm] = 8.06 (d, *J* = 7.7 Hz, 1H), 7.96 (t, *J* = 7.7 Hz, 1H), 7.58 (d, *J* = 7.7 Hz, 1H), 5.97 (ddd, *J* = 15.4, 8.3, 6.5 Hz, 1H), 5.86 – 5.75 (m, 1H), 5.55 (p, *J* = 6.5 Hz, 1H), 5.13 (dt, *J* = 11.0, 2.1 Hz, 1H), 4.98 (bs, 1H), 4.77 (dd, *J* = 9.5, 1.8 Hz, 1H), 4.72 (dd, *J* = 9.6, 1.5 Hz, 1H), 4.64 (dd, *J* = 9.7, 2.3 Hz, 1H), 4.53 (t, *J* = 8.8 Hz, 1H), 4.47 (bs, 1H), 4.42 (ddd, *J* = 8.3, 5.5, 2.1 Hz, 1H), 4.37 (td, *J* = 6.4, 4.4 Hz, 1H), 4.30 (dd, *J* = 9.3, 5.2 Hz, 1H), 4.16 – 4.09 (m, 2H), 4.07 (ddd, *J* = 10.0, 5.2, 2.3 Hz, 1H), 4.02 (dd, *J* = 7.8, 2.1 Hz, 1H), 3.96 (bs, 1H), 3.90 (dd, *J* = 8.6, 6.0 Hz, 1H), 2.96 (ddd, *J* = 15.1, 11.3, 4.0 Hz, 1H), 2.72 (dd, *J* = 13.7, 8.2 Hz, 1H), 2.69 – 2.62 (m, 1H), 2.61 (s, 3H), 2.36 (ddd, *J* = 14.4, 11.6, 4.4 Hz, 1H), 2.33 – 2.24 (m, 1H), 2.20 – 2.10 (m, 2H), 1.96 (t, *J* = 11.7 Hz, 1H), 1.50 (d, *J* = 6.5 Hz, 3H), 1.46 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.14 (s, 3H). **¹³C - NMR** (126 MHz d₆-Acetone) δ[ppm] = 165.5, 160.5, 147.7, 139.1, 134.9, 130.2, 128.8, 124.1, 110.4, 104.5, 93.6, 79.4, 79.0, 77.9, 74.2, 71.1, 70.3, 69.5, 68.9, 68.6, 66.9, 65.9, 63.0, 61.0, 60.7, 59.7, 59.7, 40.8, 39.2, 36.6, 30.6, 26.5, 25.4, 25.2, 24.1, 23.3, 20.7. **Optical Rotation:** [α]_D^{23.4} = 11.8 (c = 0.5, Me₂CO). **IR** (film): $\tilde{\nu}$ = 3278 (b), 2986 (m), 2928 (m), 1718 (s), 1595 (m), 1455 (m), 1382 (s), 1225 (s), 1094 (m), 852 (m).

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-8-((tert-butyldimethylsilyl)oxy)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)pentadec-3-ene-2,12-diol



A round-bottom flask is charged with the starting material **37** (20.0 mg, 19 µmol) dissolved in 970 µL CHCl₃. To this is then added 970 µL of methanol followed by solid Cu(OAc)₂ (35.4 mg, 0.20 mmol). The mixture is stirred for 10 h at room temperature. An aqueous 0.1 M solution of Na₂EDTA is added

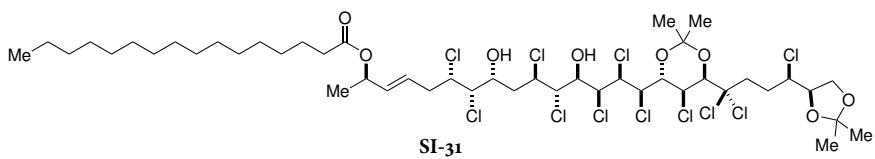
and the mixture is rapidly stirred for 5 min, the phases are separated and the aqueous phase is extracted three times with CH₂Cl₂. The combined organic phases are dried over Na₂SO₄, filtered and the solvent evaporated. Purification by column chromatography (35% AcOEt – hexane) delivered the product **38** as a colorless oil. (15.5 mg, 17 µmol, 85%).⁸

¹H - NMR (500 MHz d₆-Acetone) δ[ppm] = 5.71 (dd, *J* = 15.4, 5.4 Hz, 1H), 5.65 (dt, *J* = 16.1, 6.4 Hz, 1H), 5.04 (dt, *J* = 10.6, 1.5 Hz, 1H), 4.97 (d, *J* = 8.5 Hz, 1H), 4.83 (bs, 1H), 4.78 – 4.73 (m, 2H), 4.70 (dd, *J* = 9.5, 1.6 Hz, 1H), 4.64 (d, *J* = 2.6 Hz, 1H), 4.57 (dd, *J* = 9.8, 2.0 Hz, 1H), 4.42 – 4.34 (m, 3H), 4.27 (td, *J* = 9.9, 1.6 Hz, 1H), 4.26 – 4.20 (m, 2H), 4.20 – 4.13 (m, 2H), 4.13 (dd, *J* = 8.6, 6.8 Hz, 1H),

⁸Acquisition of a high resolution mass for this compound failed.

3.92 (dd, $J = 8.6, 6.0$ Hz, 1H), 3.74 (d, $J = 4.4$ Hz, 1H), 2.99 (ddd, $J = 15.2, 11.6, 4.1$ Hz, 1H), 2.70 (dt, $J = 14.4, 5.8$ Hz, 1H), 2.63 (ddd, $J = 14.3, 7.6, 6.2$ Hz, 1H), 2.49 (ddd, $J = 14.6, 11.7, 4.4$ Hz, 1H), 2.35 (dddd, $J = 14.4, 11.4, 4.4, 2.9$ Hz, 1H), 2.22 – 2.13 (m, 2H), 2.06 (1H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.18 (d, $J = 6.4$ Hz, 3H). ^{13}C -NMR (126 MHz d_6 -Acetone) δ [ppm] = 140.7, 123.9, 110.4, 104.6, 93.6, 79.6, 79.1, 77.7, 71.1, 71.1, 70.3, 68.7, 68.3, 68.1, 66.9, 65.6, 63.1, 63.1, 61.2, 60.7, 59.6, 41.0, 39.7, 37.8, 30.6, 26.5, 25.7, 25.4, 24.1, 23.6. **Optical Rotation:** $[\alpha]_D^{25.6} = 14.3$ ($c = 0.5$, Me₂CO). IR (film): $\tilde{\nu} = 3364$ (b), 2985 (m), 2927 (s), 2855 (m), 1382 (s), 1223 (s), 1094 (m), 1060 (m).

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-8,12-dihydroxypentadec-3-en-2-yl palmitate

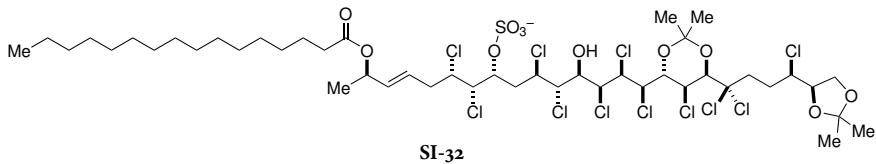


Triol **38** (3.0 mg, 3.3 μmol) was dissolved in 331 μL CH₂Cl₂ and cooled to -78 °C. 40 μL of a stock solution of pyridine

(0.33 mL in 4.7 mL CH₂Cl₂) was added followed by 63 μL of a stock solution of palmitoyl chloride (0.4 mL in 4.6 mL CH₂Cl₂). The solution was stirred at -78 °C for 30 min and then allowed to warm to -40 °C over 1 h. Upon complete conversion, the reaction mixture was then cooled to -78 °C and 20 μL methanol were added and the solution was allowed to reach room temperature over 1 h. After dilution with CH₂Cl₂ and pH₇ NaH₂PO₄/Na₂HPO₄ buffer, the phases were separated and the organic phase was extracted with CH₂Cl₂ thrice. The combined organic phases were dried over Na₂SO₄, filtered and concentrated. The crude mixture is purified by column chromatography (hexane-EtOAc 15% to hexane-EtOAc 20%) to give **SI-31** (71%, 2.7 mg, 1.7 μmol).

HR-MS(ESI⁺): calculated for C₄₆H₇₉Cl₁₁NO₈ [M+NH₄⁺]: $m/z = 1160.2348$, found: $m/z = 1160.2333$. **¹H-NMR** (400 MHz d_6 -Acetone) δ [ppm] = 5.76 (dt, $J = 15.0, 6.3$ Hz, 1H), 5.69 (dd, $J = 15.6, 5.7$ Hz, 1H), 5.31 (p, $J = 6.2$ Hz, 1H), 5.04 (d, $J = 10.9$ Hz, 2H), 4.95 (bd, $J = 6.5$ Hz, 1H), 4.85 (bs, 1H), 4.80 – 4.67 (m, 3H), 4.62 (d, $J = 2.7$ Hz, 1H), 4.57 (dd, $J = 9.7, 1.4$ Hz, 1H), 4.46 – 4.33 (m, 3H), 4.30 – 4.19 (m, 2H), 4.19 – 4.09 (m, 3H), 3.92 (dd, $J = 8.5, 6.1$ Hz, 1H), 3.00 (ddd, $J = 14.8, 11.7, 3.9$ Hz, 1H), 2.78 – 2.60 (m, 2H), 2.49 (ddd, $J = 14.7, 11.8, 4.2$ Hz, 1H), 2.41 – 2.28 (m, 1H), 2.28 (t, $J = 7.5$ Hz, 2H), 2.24 – 2.11 (m, 2H), 2.05 (1H), 1.60 (t, $J = 6.9$ Hz, 2H), 1.54 (s, 3H), 1.44 (s, 3H), 1.41 (s, 3H), 1.32 (s, 3H), 1.36 – 1.23 (m, 24H), 0.88 (t, $J = 7.0$ Hz, 3H). **¹³C-NMR** (101 MHz d_6 -Acetone) δ [ppm] = 173.0, 135.1, 127.7, 110.4, 104.6, 93.7, 79.6, 79.1, 77.8, 71.1, 71.1, 70.8, 70.1, 68.7, 68.2, 66.9, 65.6, 63.1, 62.8, 61.2, 60.6, 59.6, 41.0, 39.6, 37.8, 35.0, 32.7, 30.6, 30.4, 30.1, 26.6, 25.8, 25.7, 25.4, 23.5, 23.4, 20.6, 14.4. **Optical Rotation:** $[\alpha]_D^{23.9} = 21.9$ ($c = 0.3$, Me₂CO). IR (film): $\tilde{\nu} = 3394$ (b), 2989 (w), 2925 (s), 2854 (m), 1711 (m), 1382 /m), 1241 (s), 1224 (s), 1092 (w), 1956 (m), 851 (w).

(2R,6S,7S,8R,10R,11S,12R,13S,14R,15R,E)-6,7,10,11,13,14,15-heptachloro-15-((4R,5S,6R)-5-chloro-2,2-dimethyl-6-((R)-1,1,4-trichloro-4-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)butyl)-1,3-dioxan-4-yl)-12-hydroxy-2-(palmitoyloxy)pentadec-3-en-8-yl sulfate



Diol **SI-31** (8.7 mg, 7.6 μ mol) was dissolved in pyridine (380 μ L) and Na_2SO_4 (87 mg) was added as a solid. To this was then added

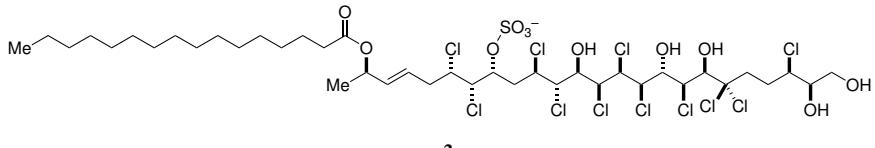
436 μ L of a 0.2 M stock solution of $\text{DMF}\cdot\text{SO}_3$ in DMF (87 μ mol, 11.5 equiv.). The suspension was heated to 40 °C and stirred for 3 h 20 min. The reaction mixture was allowed to cool to room temperature, a small amount of NaHCO_3 (aq) was added and stirred for another 1 h. The phases were separated and the aqueous phase was extracted thrice with CH_2Cl_2 . The combined organic fractions were evaporated and the product was purified by column chromatography (2 % to 5 % MeOH in CH_2Cl_2) to give the sulfate **SI-32** as a white foam (8.4 mg, 6.9 μ mol, 90%).

HR-MS(ESI⁻): calculated for $\text{C}_{46}\text{H}_{74}\text{Cl}_{11}\text{O}_{11}\text{S}^-$ [M^-]: $m/z = 1221.1505$, found: $m/z = 1221.1505$. **¹H-NMR** (600 MHz d₆-Acetone) δ [ppm] = 6.10 (d, $J = 6.0$ Hz, 1H), 5.81 (dtd, $J = 14.0, 6.6, 0.6$ Hz, 1H), 5.74 (ddt, $J = 15.4, 5.7, 0.8$ Hz, 1H), 5.34 (app. p, $J = 6.3$ Hz, 1H), 5.14 (dt, $J = 7.8, 2.2$ Hz, 1H), 5.03 (dd, $J = 9.3, 1.8$ Hz, 1H), 4.86 (ddd, $J = 8.1, 3.5, 1.8$ Hz, 1H), 4.79 (dd, $J = 4.7, 2.5$ Hz, 1H), 4.74 (dd, $J = 9.5, 1.8$ Hz, 1H), 4.66 (d, $J = 2.6$ Hz, 1H), 4.64 (dd, $J = 9.5, 1.5$ Hz, 1H), 4.47 – 4.39 (m, 3H), 4.38 (dd, $J = 9.7, 1.8$ Hz, 1H), 4.35 (dd, $J = 9.3, 4.8$ Hz, 1H), 4.29 (ddd, $J = 9.8, 6.0, 1.8$ Hz, 1H), 4.18 – 4.12 (m, 2H), 3.90 (dd, $J = 8.5, 6.2$ Hz, 1H), 2.96 (ddd, $J = 14.5, 11.6, 4.1$ Hz, 1H), 2.77 (app. t, $J = 6.7$ Hz, 2H), 2.58 (ddd, $J = 16.3, 8.0, 2.6$ Hz, 1H), 2.49 (ddd, $J = 14.7, 11.7, 4.5$ Hz, 1H), 2.37–2.29 (m, 2H), 2.29 (td, $J = 7.3, 1.5$ Hz 2H), 2.21 (dddd, $J = 13.9, 11.7, 9.7, 4.1$ Hz, 1H), 1.60 (app. p, $J = 7.4$ Hz, 2H), 1.53 (s, 3H), 1.46 (s, 3H), 1.41 (s, 3H), 1.33 (s, 3H), 1.34 – 1.25 (m, 27H), 0.89 – 0.87 (m, 3H). **¹³C-NMR** (151 MHz d₆-Acetone) δ [ppm] = 173.0, 135.2, 127.1, 110.3, 104.3, 93.4, 79.8, 79.1, 77.0, 76.7, 70.7, 69.9, 69.5, 68.1, 67.7, 67.1, 65.9, 63.2, 63.0, 61.2, 60.6, 59.3, 41.2, 38.8, 38.5, 35.0, 32.7, 30.7, 30.4, 30.4, 30.4, 26.6, 25.9, 25.8, 25.5, 23.8, 23.3, 20.6, 14.4. **Optical Rotation:** $[\alpha]_D^{23.8} = +25.1$ ($c = 0.29$, Me_2CO). **IR** (film): $\tilde{\nu} = 3401$ (b), 2987 (w), 2926 (s), 2854 (m), 1712 (m), 1457 (w), 1381 (m), 1258 (s), 1223 (s), 1050 (m), 906 (w), 579 (w).

(2R,6S,7S,8R,10R,11S,12R,13S,14S,15R,16R,17S,18R,22R,23R,E)-6,7,10,11,13,14,15,17,19,19,22-undecachloro-12,16,18,23,24-pentahydroxy-2-(palmitoyloxy)tetracos-3-en-8-yl sulfate

Bis-Acetal **SI-32** (8.0 mg) is divided into three portions and each portion is transferred to a point bottom flask. To this is then added 400 μ L of a 1:1 v/v mixture of water and TFA. The solution is stirred for 3.5 h at room temperature before the solvents are evaporated and the residues are quickly charged onto a silica gel column from which the product is eluted with 6 % to 10 % MeOH

in CH_2Cl_2 to obtain pentaol **2** as a white foam (79%, 6.2 mg, 5.4 μmol).



HR-MS(ESI⁻): calculated for $\text{C}_{40}\text{H}_{66}\text{Cl}_{11}\text{O}_{11}\text{S}^-$ [M^-]: $m/z = 1145.0826$, found: $m/z = 1145.0859$.
¹H-NMR (600 MHz d_6 -Acetone) δ [ppm] = 6.41 (bs, 1H),

5.84 (dddd, $J = 15.0, 7.3, 6.2, 1.2$ Hz, 1H), 5.75 (ddt, $J = 15.5, 5.9, 1.0$ Hz, 1H), 5.64 (bs, 1H), 5.35 (p, $J = 6.0$ Hz, 1H), 5.19 (d, $J = 1.1$ Hz, 1H), 5.16 (dt, $J = 8.2, 1.7$ Hz, 1H), 5.01 (bs, 1H), 4.94 (dd, $J = 9.5, 1.6$ Hz, 1H), 4.86 (ddd, $J = 8.7, 3.7, 1.8$ Hz, 1H), 4.61 (dd, $J = 9.5, 1.6$ Hz, 1H), 4.58 (ddd, $J = 7.5, 5.6, 4.5$ Hz, 1H), 4.47 (s, 1H), 4.43 – 4.38 (m, 2H), 4.35 – 4.30 (m, 2H), 4.30 – 4.24 (m, 2H), 4.07 (d, $J = 10.1$ Hz, 1H), 3.86 (bs, 1H), 3.80 (bs, 1H), 3.69 – 3.62 (m, 2H), 2.80 – 2.68 (m, 3H), 2.61 (ddd, $J = 14.2, 11.7, 4.5$ Hz, 1H), 2.55 (ddd, $J = 16.3, 8.7, 1.7$ Hz, 1H), 2.53 – 2.46 (m, 1H), 2.29 (td, $J = 7.5, 2.9$ Hz, 2H), 2.28 – 2.22 (m, 1H), 2.22 – 2.18 (m, 1H), 1.60 (p, $J = 7.5$ Hz, 2H), 1.35 – 1.25 (m, 27H), 0.90 – 0.85 (t, $J = 7.0$ Hz, 3H). **¹³C-NMR** (151 MHz d_6 -Acetone) δ [ppm] = 173.1, 135.1, 127.0, 97.5, 79.5, 76.6, 76.0, 74.1, 70.7, 69.6, 69.4, 67.9, 67.3, 66.0, 65.1, 64.3, 62.7, 61.3, 61.0, 59.4, 42.1, 39.1, 38.6, 35.0, 32.6, 31.3, 30.4, 30.4, 30.4, 30.2, 30.1, 30.1, 25.8, 23.3, 20.6, 14.4. **Optical Rotation:** $[\alpha]_D^{24.1} = +26$ ($c = 0.2$, MeOH). **IR** (film): $\tilde{\nu} = 3422$ (b), 2925 (s), 2854 (m), 1710 (m), 1260 (m), 1054 (w), 906 (w).

Preparation of Peracetylated Compounds

1 mg of the respective diastereomer **4a**, **4b**, **35** or **2** were dissolved in 90 μL pyridine. To this solution were added 8 mL acetic anhydride and the solution was stirred at room temperature for 2-3 days. Subsequently 20 μL MeOH were added, stirred for 20 min, the volatiles were removed under reduced pressure and the crude product was purified by column chromatography. For NMR data see the tables below.

27 HR-MS(ESI⁻): calculated for $\text{C}_{50}\text{H}_{76}\text{Cl}_{11}\text{O}_{16}\text{S}^-$ [M^-]: $m/z = 1355.1360$, found: $m/z = 1355.1383$.

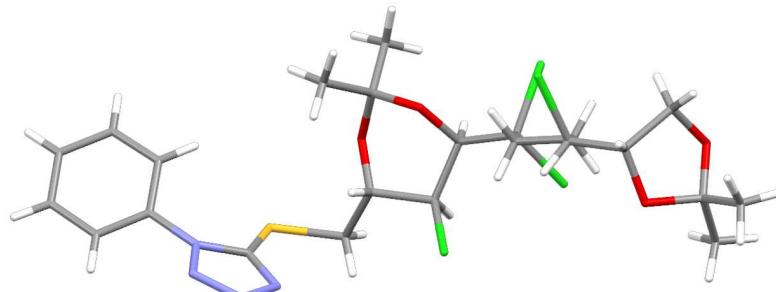
31 HR-MS(ESI⁻): calculated for $\text{C}_{50}\text{H}_{76}\text{Cl}_{11}\text{O}_{16}\text{S}^-$ [M^-]: $m/z = 1355.1360$, found: $m/z = 1355.1357$.

36 HR-MS(ESI⁻): calculated for $\text{C}_{50}\text{H}_{76}\text{Cl}_{11}\text{O}_{16}\text{S}^-$ [M^-]: $m/z = 1349.1428$, found: $m/z = 1349.1478$.

39 HR-MS(ESI⁻): calculated for $\text{C}_{50}\text{H}_{76}\text{Cl}_{11}\text{O}_{16}\text{S}^-$ [M^-]: $m/z = 1355.1360$, found: $m/z = 1355.1338$.

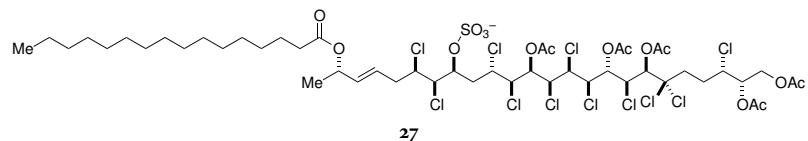
2.8 Crystallographic Data

2.8.1 Crystallographic Data of 12

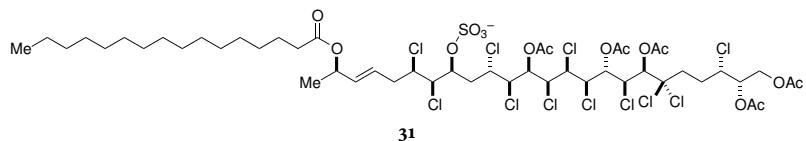


Bond precision: C-C = 0.0058 Å	Wavelength=1.54184	
Cell:	a=9.1145(2)	b=8.7921(1)
	alpha=90	c=17.1460(3)
Temperature:	100 K	beta=94.197(2)
		gamma=90
Volume	Calculated	Reported
Space Group	1370.32 (4)	1370.32(4)
Hall Group	P 21	P 1 21 1
Moiety formula	P 2yb	P 2yb
Sum formula	C ₂₃ H ₃₀ Cl ₄ N ₄ O ₄ S	C ₂₃ H ₃₀ Cl ₄ N ₄ O ₄ S
Mr	C ₂₃ H ₃₀ Cl ₄ N ₄ O ₄ S	C ₂₃ H ₃₀ Cl ₄ N ₄ O ₄ S
Dx,g cm ⁻³	600.37	600.37
Z	1.455	1.455
Mu (mm ⁻¹)	2	2
Foo ₀₀	4.951	4.951
Foo ₀₀₋	624.0	624.0
h,k,lmax	629.01	
Nref	11,11,21	11,11,21
Tmin,Tmax	5957[3177]	6562
Tmin'	0.447,0.816	0.367,1.000
Data completeness=	0.07/1.10	Theta(max)= 79.629
R(reflections)=	0.0342(6485)	wR ₂ (reflections)= 0.0951(6562)
S =	1.047	Npar= 330
Correction method=	# Reported	T Limits: Tmin=0.367 Tmax=1.000 AbsCorr = GAUSSIAN

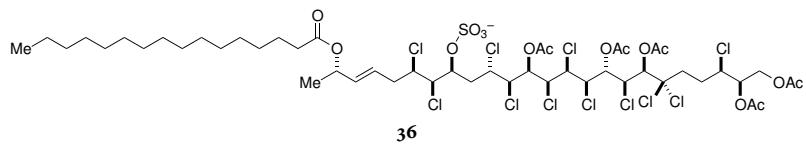
2.9 NMR Data for Final Products



Position	Natural PerOAc		27		$\Delta\delta_H$	$\Delta\delta_C$
	δ_H	δ_C	δ_H	δ_C		
Palm-1	-	172.8	-	nd	-	-
Palm-2	2.24, m	30.6	2.29	35.1	+0.05	+5.5
Palm-3	1.53, m 7,3 Hz	25.4	1.59	25.8	+0.06	+0.4
Palm-4-14	1.32	20.3	1.29	30.5	+0.03	+10.2
Palm-15	1.25	20.1	1.29	23.4	+0.04	+3.3
Palm-16	0.89, t 7.4 Hz	14.1	0.88	14.4	-0.01	+0.3
1-Me	1.29	19.8	1.30	20.7	+0.01	+0.9
1	5.29, pent 6.5 Hz	70.5	5.32	71.1	+0.03	+0.6
2	5.65, dd 6.5, 15.3 Hz	134.3	5.69	134.9	+0.04	+0.6
3	5.74, dt 6.6, 6.6, 15.3	127.5	5.81	128.0	+0.07	+0.5
4	2.77, m	39.7	2.79/2.68	39.9	+0.02/-0.09	+0.2
5	4.54, m	60.8	4.61	61.1	+0.07	+0.3
6	4.58, dd 2.8, 1.2 Hz	65.2	4.66	65.4	+0.08	+0.2
7	4.72, ddd 1.2, 3.3, 9.0 Hz	74.3	4.77	74.6	+0.05	+0.3
8	2.18/2.14, m	35.8	-	-	-	-
9	4.92, ddd 1.1, 2.0, 9.6 Hz	58.6	5.00	59.1	+0.08	+0.5
10	4.61, dd 2.0, 9.7 Hz	66.3	4.68	66.8	+0.07	+0.5
11	5.33, 2.4, 9.7 Hz	70.7	5.39	71.2	+0.06	+0.5
12	4.82, dd 2.4, 8.9 Hz	64.7	4.87	65.1	+0.05	+0.4
13	4.42, dd 1.6, 8.9 Hz	62.7	4.47	63.1	+0.05	+0.4
14	5.05, dd 1.6, 9.5 Hz	59.7	5.08	60.2	+0.03	+0.5
15	5.50, dd 1.8, 9.5 Hz	76.7	5.54	77.2	+0.04	+0.5
16	5.18, br s	57.2	5.22	57.6	+0.04	+0.4
17	5.83, s	73.4	5.86	73.7	+0.03	+0.3
18	-	94.2	-	94.4 From HMBC	-	+0.2
19	2.55, m	41.1	2.65/2.48	40.7	+0.10/-0.07	-0.4
20	2.35/2.18, m	30.2	2.32	31.0	-0.03/+0.14	+0.8
21	4.43, ddd 1.8, 7.5, 1,8 Hz	61.2	4.57	61.3	+0.14	+0.1
22	5.36, ddd 1.8, 4.0, 5.3 Hz	72.8	5.37	72.6	+0.01	+0.2
23a	4.30, m	63.4	4.35	64.0	+0.05	+0.6
23b	4.25, m	-	4.29	-	+0.04	-
CO-11	-	171.3	-	171.7 From HMBC	-	+0.4
CO-15	-	168.3	-	168.7 From HMBC	-	+0.4
CO-17	-	168.6	-	169.0 From HMBC	-	+0.4
CO-22	-	170.5	-	170.7 From HMBC	-	+0.2
CO-23	-	170.3	-	170.6 From HMBC	-	+0.3

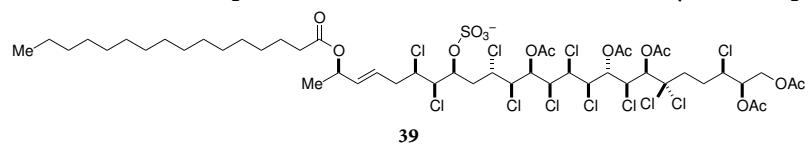


Position	Natural PerOAc			31		
	δ_{H}	δ_{C}	δ_{H}	δ_{C}	$\Delta\delta_{\text{H}}$	$\Delta\delta_{\text{C}}$
Palm-1	-	172.8	-	173.1	-	+0.3
Palm-2	2.24, m	30.6	2.29	35.0	+0.05	+5.4
Palm-3	1.53, m 7.3 Hz	25.4	1.60	25.8	+0.07	+0.04
Palm-4–14	1.32	20.3	1.29	30.4	+0.03	+10.1
Palm-15	1.25	20.1	1.29	23.3	+0.04	+3.2
Palm-16	0.89, t 7.4 Hz	14.1	0.88	14.4	+0.01	+0.3
1-Me	1.29	19.8	1.31	20.5	+0.02	+0.7
1	5.29, pent 6.5 Hz	70.5	5.34	70.7	+0.05	+0.2
2	5.65, dd 6.5, 15.3 Hz	134.3	5.72	134.7	+0.07	+0.4
3	5.74, dt 6.6, 6.6, 15.3	127.5	5.80	127.6	+0.06	+0.1
4	2.77, m	39.7	2.77/2.70	40.1	-/-0.07	+0.4
5	4.54, m	60.8	4.60	61.0	+0.06	+0.2
6	4.58, dd 2.8, 1.2 Hz	65.2	4.67	65.3	+0.09	+0.1
7	4.72, ddd 1.2, 3.3, 9.0 Hz	74.3	4.77	74.6	+0.05	+0.3
8	2.18/2.14, m	35.8	2.19/(2.15)	36.0	+0.01/+0.01	+0.2
9	4.92, ddd 1.1, 2.0, 9.6 Hz	58.6	4.98	59.1	+0.06	+0.5
10	4.61, dd 2.0, 9.7 Hz	66.3	4.68	66.6	+0.07	+0.3
11	5.33, 2.4, 9.7 Hz	70.7	5.39	71.2	+0.06	+0.5
12	4.82, dd 2.4, 8.9 Hz	64.7	4.87	65.0	+0.05	+0.3
13	4.42, dd 1.6, 8.9 Hz	62.7	4.48	63.0	+0.06	+0.3
14	5.05, dd 1.6, 9.5 Hz	59.7	5.08	60.1	+0.03	+0.4
15	5.50, dd 1.8, 9.5 Hz	76.7	5.55	77.0	+0.05	+0.3
16	5.18, br s	57.2	5.22	57.5	+0.04	+0.3
17	5.83, s	73.4	5.86	73.6	+0.03	+0.2
18	-	94.2	-	94.3	-	+0.1
19	2.55, m	41.1	2.63/2.48	40.8	+0.8/-0.7	+0.3
20	2.35/2.18, m	30.2	2.32	31.2	-0.03/+0.14	+1.0
21	4.43, ddd 1.8, 7.5, 1.8 Hz	61.2	4.56	61.2	+0.13	-
22	5.36, ddd 1.8, 4.0, 5.3 Hz	72.8	5.38	72.4	+0.02	-0.4
23a	4.30, m	63.4	4.29	63.9	-0.01	+0.5
23b	4.25, m	-	4.36	-	+0.11	-
CO-11	-	171.3	-	171.6	-	+0.3
CO-15	-	168.3	-	168.6	-	+0.3
CO-17	-	168.6	-	168.9	-	+0.3
CO-22	-	170.5	-	170.7	-	+0.2
CO-23	-	170.3	-	170.6	-	+0.3



Position	Natural PerOAc		36		$\Delta\delta_H$	$\Delta\delta_C$
	δ_H	δ_C	δ_H	δ_C		
Palm-1	-	172.8	-	173.1	-	0.3
Palm-2	2.24, m	30.6	2.29	35.0	+0.05	+4.4
Palm-3	1.53, m 7,3 Hz	25.4	1.59	25.8	+0.06	+0.4
Palm-4-14	1.32	20.3	1.29	30.4	+0.03	+10.1
Palm-15	1.25	20.1	1.29	23.4	+0.04	+3.3
Palm-16	0.89, t 7.4 Hz	14.1	0.88	14.4	+0.01	+0.3
1-Me	1.29	19.8	1.30	20.6	+0.01	+0.8
1	5.29, pent 6.5 Hz	70.5	5.32, p, 6.4 Hz	71.1	+0.03	+0.6
2	5.65, dd 6.5, 15.3 Hz	134.3	5.69, dd, 15.6, 6.5 Hz	134.8	+0.04	+0.5
3	5.74, dt 6.6, 6.6, 15.3	127.5	5.79, dt 15.1, 6.9 Hz	127.9	+0.05	+0.4
4	2.77, m	39.7	2.79/2.69, m	40.0	+0.02/-0.08	+0.3
5	4.54, m	60.8	4.59, m	61.2	+0.05	+0.4
6	4.58, dd 2.8, 1.2 Hz	65.2	4.61, m	65.7	+0.03	+0.5
7	4.72, ddd 1.2, 3.3, 9.0 Hz	74.3	4.77, m	74.5	+0.05	+0.2
8	2.18/2.14, m	35.8	2.18, m	36.4	-/+0.04	+0.6
9	4.92, ddd 1.1, 2.0, 9.6 Hz	58.6	4.98, ddd 7.0, 4.8, 2.2 Hz	59.0	+0.06	+0.4
10	4.61, dd 2.0, 9.7 Hz	66.3	4.67, m	66.6	+0.06	+0.3
11	5.33, 2.4, 9.7 Hz	70.7	5.37, m	71.0	+0.04	+0.3
12	4.82, dd 2.4, 8.9 Hz	64.7	4.88, m	65.1	+0.06	+0.4
13	4.42, dd 1.6, 8.9 Hz	62.7	4.47, dd 8.4, 2.1 Hz	63.0	+0.05	+0.3
14	5.05, dd 1.6, 9.5 Hz	59.7	5.09, dd 9.2, 2.1 Hz	60.1	+0.04	+0.4
15	5.50, dd 1.8, 9.5 Hz	76.7	5.55, dd 9.2, 2.4 Hz	77.0	+0.05	+0.3
16	5.18, br s	57.2	5.23, 2.3, 1.1 Hz	57.6	+0.05	+0.4
17	5.83, s	73.4	5.87, d 1.3 Hz	73.6	+0.04	+0.2
18	-	94.2	-	93.4	-	0.02
19	2.55, m	41.1	2.59, m	41.3	+0.04	+0.2
20	2.35/2.18, m	30.2	2.40/2.18	31.1	+0.05/-	+0.9
21	4.43, ddd 1.8, 7.5, 1.8 Hz	61.2	4.48, m	61.5	+0.05	0.03
22	5.36, ddd 1.8, 4.0, 5.3 Hz	72.8	5.40, m	73.2	+0.04	+0.4
23a	4.30, m	63.4	4.38, dd 11.8, 4.2 Hz	63.8	+0.08	+0.4
23b	4.25, m	-	4.30, dd 11.7, 7.2 Hz	-	+0.05	-
CO-11	-	171.3	-	171.6	-	+0.3
CO-15	-	168.3	-	168.6	-	+0.3
CO-17	-	168.6	-	168.9	-	+0.3
CO-22	-	170.5	-	170.8	-	+0.3
CO-23	-	170.3	-	170.6	-	+0.3

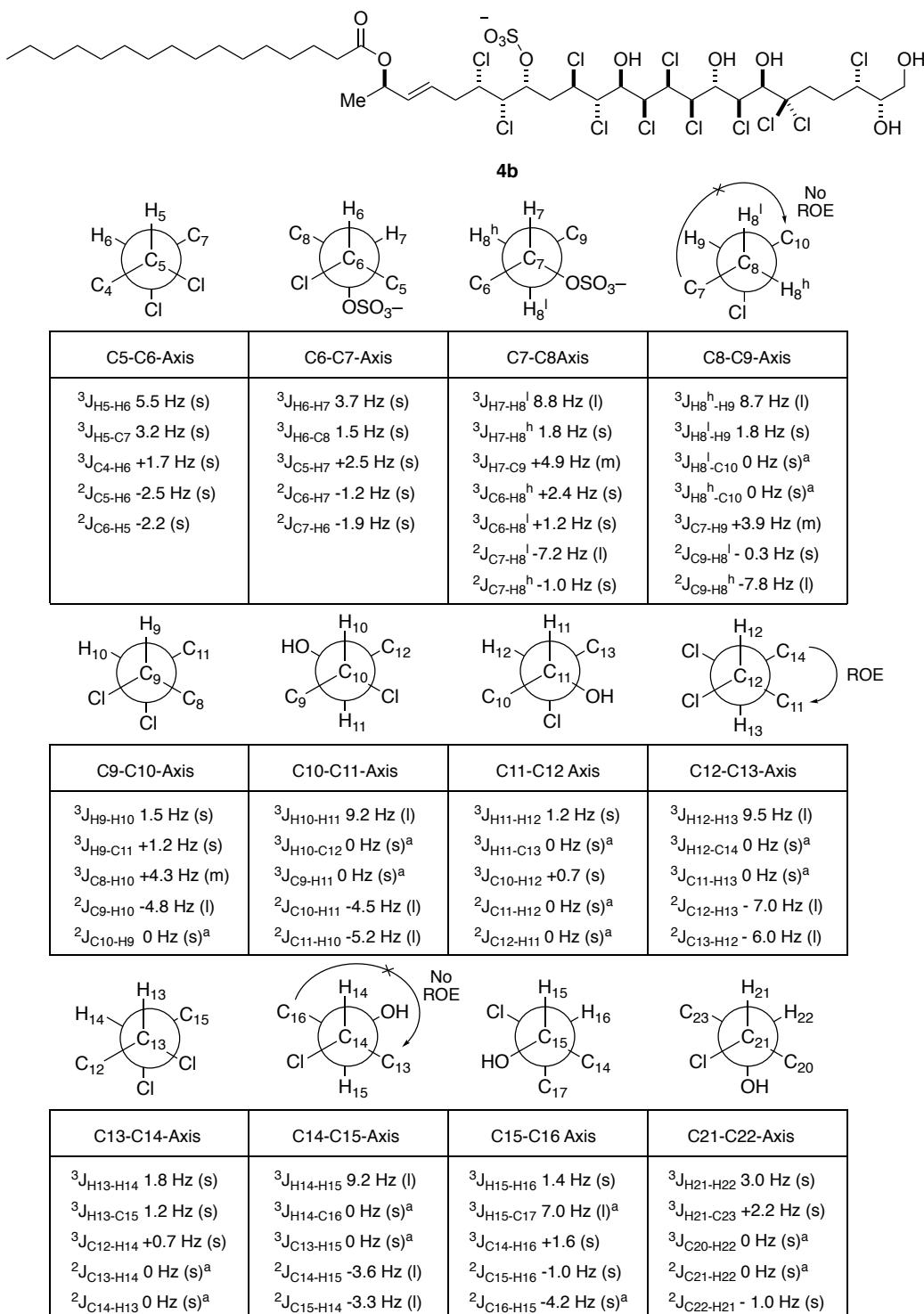
Observed deviations are observed for signals likely to have been extracted from 2D spectra and the deviations may arise from lack of referencing and misassigning peaks. This is supported by the match of the ¹³C-NMR spectrum of **39** with that of the naturally derived peracetate.



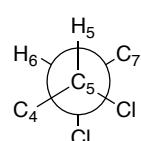
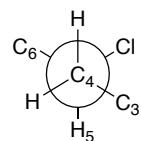
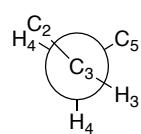
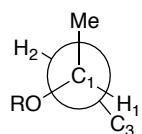
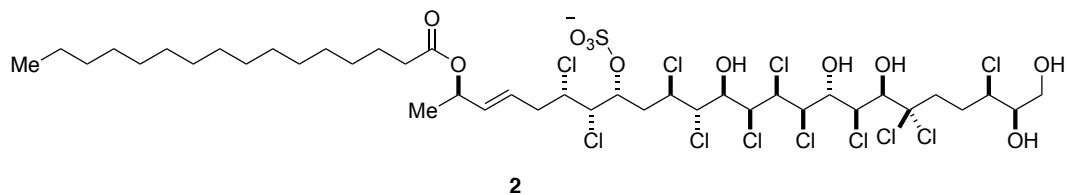
Position	Natural PerOAc		39		$\Delta\delta_{\text{H}}$	$\Delta\delta_{\text{C}}$
	δ_{H}	δ_{C}	δ_{H}	δ_{C}		
Palm-1	-	172.8	-	173.1	-	+0.3
Palm-2	2.24, m	30.6	2.29, app. td, 7.4, 3.0 Hz	35.0	+0.05	+4.4
Palm-3	1.53, m 7.3 Hz	25.4	1.59, p 7.4 Hz	25.8	+0.06	+0.4
Palm-4-14	1.32	20.3	1.29	30.5	-0.03	+10.2
Palm-15	1.25	20.1	1.29	23.4	+0.04	+3.3
Palm-16	0.89, t 7.4 Hz	14.1	0.88, t 6.49 Hz	14.4	-0.01	+0.3
1-Me	1.29	19.8	1.31	20.5	+0.02	+0.7
1	5.29, pent 6.5 Hz	70.5	5.34, p 6.2 Hz	70.8	+0.05	+0.3
2	5.65, dd 6.5, 15.3 Hz	134.3	5.72, dd 15.6, 5.9 Hz	134.6	+0.07	+0.3
3	5.74, dt 6.6, 6.6, 15.3	127.5	5.79, t 15.5, 6.7 Hz	127.8	+0.05	+0.3
4	2.77, m	39.7	2.73, m	40.1	-0.04	+0.4
5	4.54, m	60.8	4.60, m	61.3	+0.06	+0.5
6	4.58, dd 2.8, 1.2 Hz	65.2	4.64, t 4.0 Hz	65.7	+0.06	+0.5
7	4.72, ddd 1.2, 3.3, 9.0 Hz	74.3	4.78, ddd 9.4, 4.0, 2.0 Hz	74.5	+0.06	+0.2
8	2.18/2.14, m	35.8	2.22, 2.17, m	36.2	+0.04/+0.03	+0.4
9	4.92, ddd 1.1, 2.0, 9.6 Hz	58.6	4.99, dt 9.7, 2.3 Hz	59.0	+0.07	+0.4
10	4.61, dd 2.0, 9.7 Hz	66.3	4.67, dd 10.0, 2.1 Hz	66.7	+0.06	+0.4
11	5.33, 2.4, 9.7 Hz	70.7	5.37, dd 10.2, 0.9 Hz	71.1	+0.04	+0.4
12	4.82, dd 2.4, 8.9 Hz	64.7	4.88, 8.7, 1.2 Hz	65.1	+0.06	+0.4
13	4.42, dd 1.6, 8.9 Hz	62.7	4.47, dd 8.7, 1.7 Hz	63.0	+0.05	+0.3
14	5.05, dd 1.6, 9.5 Hz	59.7	5.10, dd 9.3, 2.1 Hz	60.1	+0.05	+0.4
15	5.50, dd 1.8, 9.5 Hz	76.7	5.55, dd 9.2, 2.3 Hz	77.0	+0.05	+0.3
16	5.18, br s	57.2	5.23, dd 2.3, 1.2 Hz	57.6	+0.05	+0.4
17	5.83, s	73.4	5.89, d 0.6 Hz	73.6	+0.06	+0.2
18	-	94.2	-	94.2	-	-
19	2.55, m	41.1	2.59, m	41.3	+0.04	+0.2
20	2.35/2.18, m	30.2	2.41, 2.18	31.2	+0.06/-	+1.0
21	4.43, ddd 1.8, 7.5, 1,8 Hz	61.2	4.49, dt 10.0, 3.7 Hz	61.6	+0.06	+0.4
22	5.36, ddd 1.8, 4.0, 5.3 Hz	72.8	5.41, dt 7.7, 4.1 Hz	73.2	+0.05	+0.4
23a	4.30, m	63.4	4.38, dd 11.8, 4.2 Hz	63.8	+0.08	+0.4
23b	4.25, m	-	4.31, dd 11.8, 7.2 Hz	-	+0.06	-
CO-11	-	171.3	-	171.6	-	+0.3
CO-15	-	168.3	-	168.6	-	+0.3
CO-17	-	168.6	-	168.9	-	+0.3
CO-22	-	170.5	-	170.8	-	+0.3
CO-23	-	170.3	-	170.6	-	+0.3

2.10 J-Based Conformational Analysis

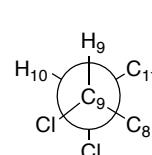
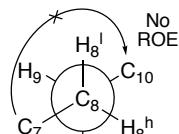
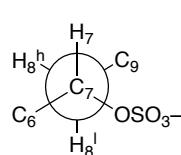
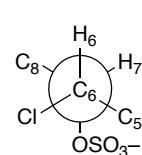
Homo- and hetero-nuclear coupling constants were extracted from ^1H -NMR, HSQC-HECADE[3] and PS-HMBC[4] spectra in combination with HSQC, HMBC and COSY spectra for assignments of individual signals. ROE interactions were extracted from a 2D-ROESY spectrum.



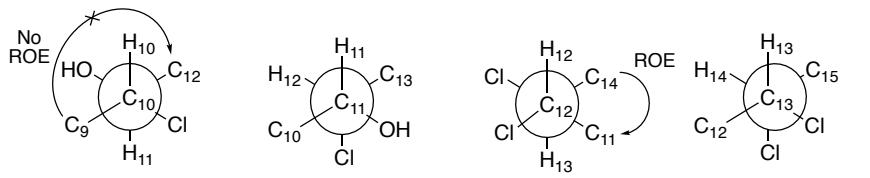
ROE indications refer to the respective ¹H-¹H interactions. ^a Measured by HMBC



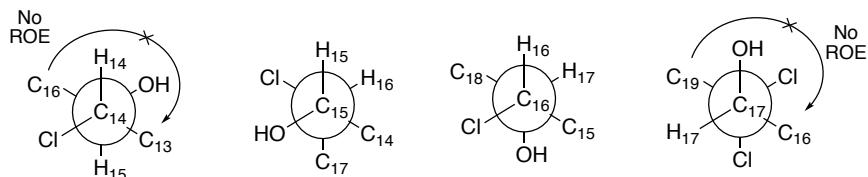
C5-C6-Axis	C6-C7-Axis	C7-C8Axis	C5-C6-Axis
$^3J_{H_1-H_2}$ 5.9 Hz (l) $^2J_{H_2-C_1}$ +4.2 Hz (l)	$^3J_{H_3-H_4}$ 6.5 Hz (l) $^3J_{H_3-H_4}$ 6.5 Hz (l)	$^3J_{H_4-H_5}$ 7.5 Hz (l) $^3J_{H_4-H_5}$ 5.6 Hz (m) $^3J_{H_5-C_3}$ -5.8 Hz (l) $^2J_{H_4-C_5}$ -4.3 Hz (l)	$^3J_{H_5-H_6}$ 4.6 Hz (m) $^3J_{H_5-C_7}$ 0 Hz (s) ^a $^3J_{C_4-H_6}$ +2.0 Hz (s) $^2J_{C_5-H_6}$ -2.0 Hz (s) $^2J_{C_6-H_5}$ -1.8 (s)



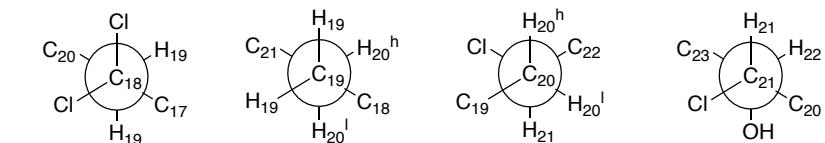
C6-C7-Axis	C7-C8Axis	C8-C9-Axis	C9-C10-Axis
$^3J_{H_6-H_7}$ 3.7 Hz (s) $^3J_{H_6-C_8}$ 0 Hz (s) ^a $^3J_{C_5-H_7}$ +2.3 Hz (s) $^2J_{C_6-H_7}$ -1.1 Hz (s) $^2J_{C_7-H_6}$ -1.3 Hz (s)	$^3J_{H_7-H_8^l}$ 8.7 Hz (l) $^3J_{H_7-H_8^h}$ 1.8 Hz (s) $^3J_{H_7-C_9}$ +4.5 Hz (m) $^3J_{C_6-H_8^h}$ 0 Hz (s) ^a $^3J_{C_6-H_8^l}$ +2.0 (s) $^2J_{C_7-H_8^l}$ -6.7 Hz (l) $^2J_{C_7-H_8^h}$ -1.2 Hz (s)	$^3J_{H_8^h-H_9}$ 8.2 Hz (l) $^3J_{H_8^l-H_9}$ 1.7 Hz (s) $^3J_{H_8^l-C_10}$ 0 Hz (s) ^a $^3J_{H_8^h-C_10}$ 0 Hz (s) ^a $^3J_{C_7-H_9}$ +4.3 Hz (s) $^2J_{C_9-H_8^l}$ -0.5 Hz (s) $^2J_{C_9-H_8^h}$ -7.6 Hz (l)	$^3J_{H_9-H_{10}}$ 1.8 Hz (s) $^3J_{H_9-C_{11}}$ 0 Hz (s) ^a $^3J_{C_8-H_{10}}$ +4.5 Hz (m) $^2J_{C_9-H_{10}}$ 4.6 Hz (l) ^a $^2J_{C_{10}-H_9}$ 0 Hz (s) ^a



C10-C11-Axis	C11-C12 Axis	C12-C13-Axis	C13-C14-Axis
$^3J_{H10-H11}$ 9.5 Hz (l)	$^3J_{H11-H12}$ 1.6 Hz (s)	$^3J_{H12-H13}$ 9.5 Hz (l)	$^3J_{H13-H14}$ 1.6 Hz (s)
$^3J_{H10-C12}$ 0 Hz (s) ^a	$^3J_{H11-C13}$ +2.6 Hz (s)	$^3J_{H12-C14}$ 0 Hz (s) ^a	$^3J_{H13-C15}$ 0.4 Hz (s)
$^3J_{C9-H11}$ 0 Hz (s) ^a	$^3J_{C10-H12}$ +0.4 (s)	$^3J_{C11-H13}$ 0 Hz (s) ^a	$^3J_{C12-H14}$ +0.6 Hz (s)
$^2J_{C10-H11}$ -4.3 Hz (l)	$^2J_{C11-H12}$ 0 Hz (s) ^a	$^2J_{C12-H13}$ -5.6 Hz (l)	$^2J_{C13-H14}$ 0 Hz (s) ^a
$^2J_{C11-H10}$ -5.7 Hz (l)	$^2J_{C12-H11}$ 0 Hz (s) ^a	$^2J_{C13-H12}$ -6.2 Hz (l)	$^2J_{C14-H13}$ 0 Hz (s) ^a



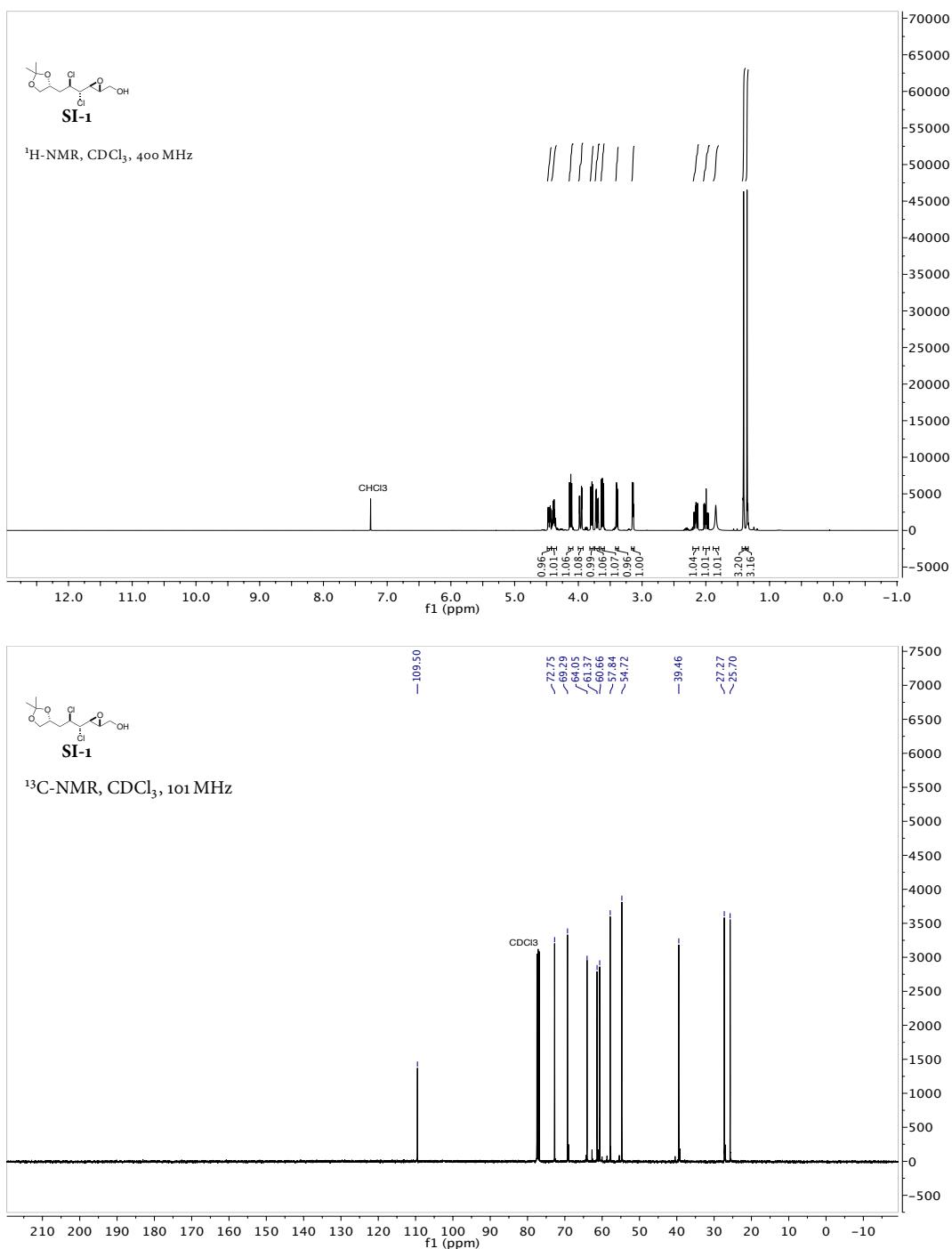
C14-C15-Axis	C15-C16 Axis	C16-C17 Axis	C17-C18 Axis
$^3J_{H14-H15}$ 9.3 Hz (l)	$^3J_{H15-H16}$ 1.3 Hz (s)	$^3J_{H16-H17}$ 1.3 Hz (s)	$^3J_{H17-C19}$ +2.4 Hz (s)
$^3J_{H14-C16}$ 0 Hz (s) ^a	$^3J_{H15-C17}$ 6.2 Hz (l)	$^3J_{H17-C15}$ 0 Hz (s) ^a	$^2J_{H17-C18}$ 0 Hz (s) ^a
$^3J_{C13-H15}$ 0.5 Hz (s)	$^3J_{C14-H16}$ +1.5 (s)	$^3J_{H16-C18}$ 2.5 Hz (s) ^a	
$^2J_{C14-H15}$ -8.5 Hz (l)	$^2J_{C15-H16}$ -1.2 Hz (s)	$^2J_{H17-C16}$ 0 Hz (s) ^a	
$^2J_{C15-H14}$ -6.5 Hz (l)	$^2J_{C16-H15}$ 4.5 Hz (l) ^a	$^2J_{H16-C17}$ -1.4 Hz (s)	



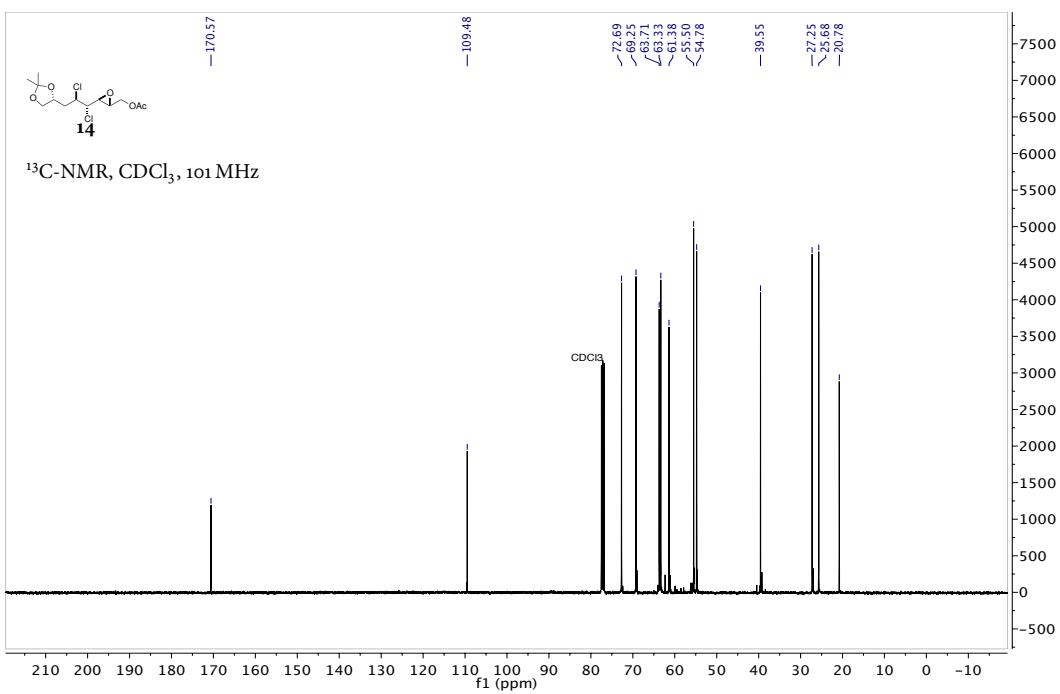
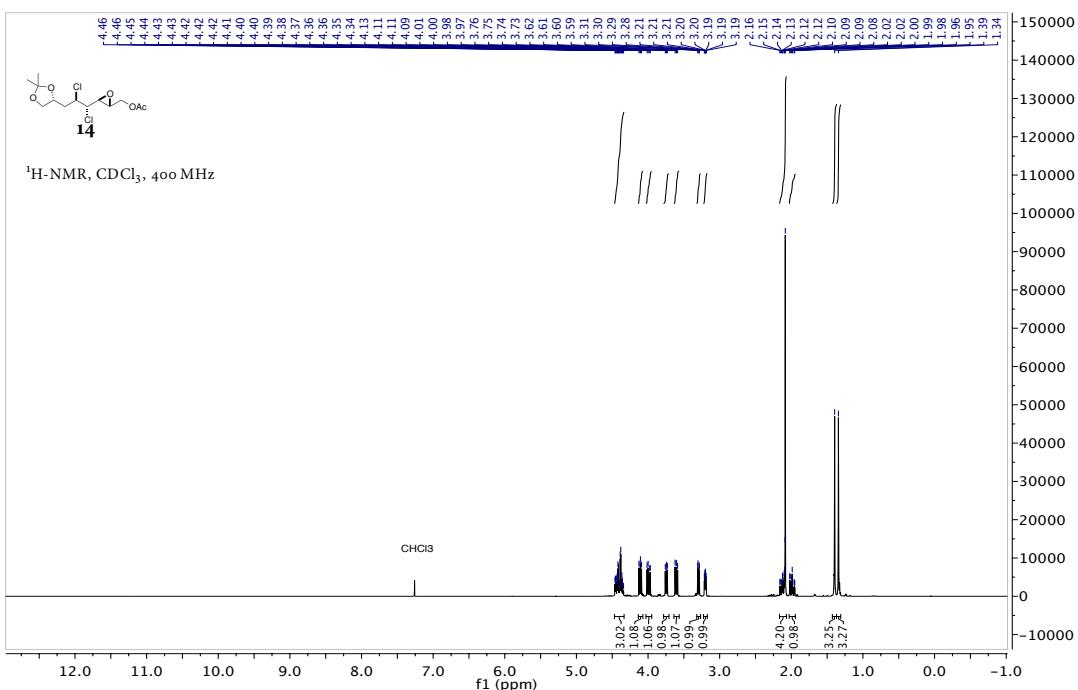
			C21-C22-Axis
$^3J_{C17-H19}$ 0 Hz (s) ^a	$^3J_{H19-C21}$ +2.5 Hz (s)	$^3J_{H20^l-H21}$ 5.1 Hz (s)	$^3J_{H21-H22}$ 2.8 Hz (s)
$^3J_{C17-H19}$ +2.5 Hz (s)	$^3J_{H19-C21}$ +1.4 Hz (s)	$^3J_{H20^h-H21}$ 8.6 Hz (l)	$^3J_{H21-C23}$ +3.3 Hz (s)
$^2J_{H19-C18}$ 2.2 Hz (s) ^a	$^3J_{H20^h-C18}$ 2.3 Hz (s) ^a	$^3J_{H21-C19}$ +2.3 Hz (s)	$^3J_{C20-H22}$ 0 Hz (s) ^a
	$^2J_{H19-H20^l}$ 11.9 Hz (l)	$^2J_{H20^h-C21}$ -7.7 Hz (l)	$^2J_{C21-H22}$ 0 Hz (s) ^a
	$^2J_{H19-H20^h}$ 12.5 Hz (l)	$^2J_{H20^l-C21}$ -2.4 Hz (s)	$^2J_{C22-H21}$ 2.3 Hz (s) ^a
	$^2J_{H19-H20^l}$ 4.8 Hz (s)		
	$^2J_{H19-H20^h}$ 3.6 Hz (s)		

ROE indications refer to the respective 1H - 1H interactions. ^a Measured by HMBC

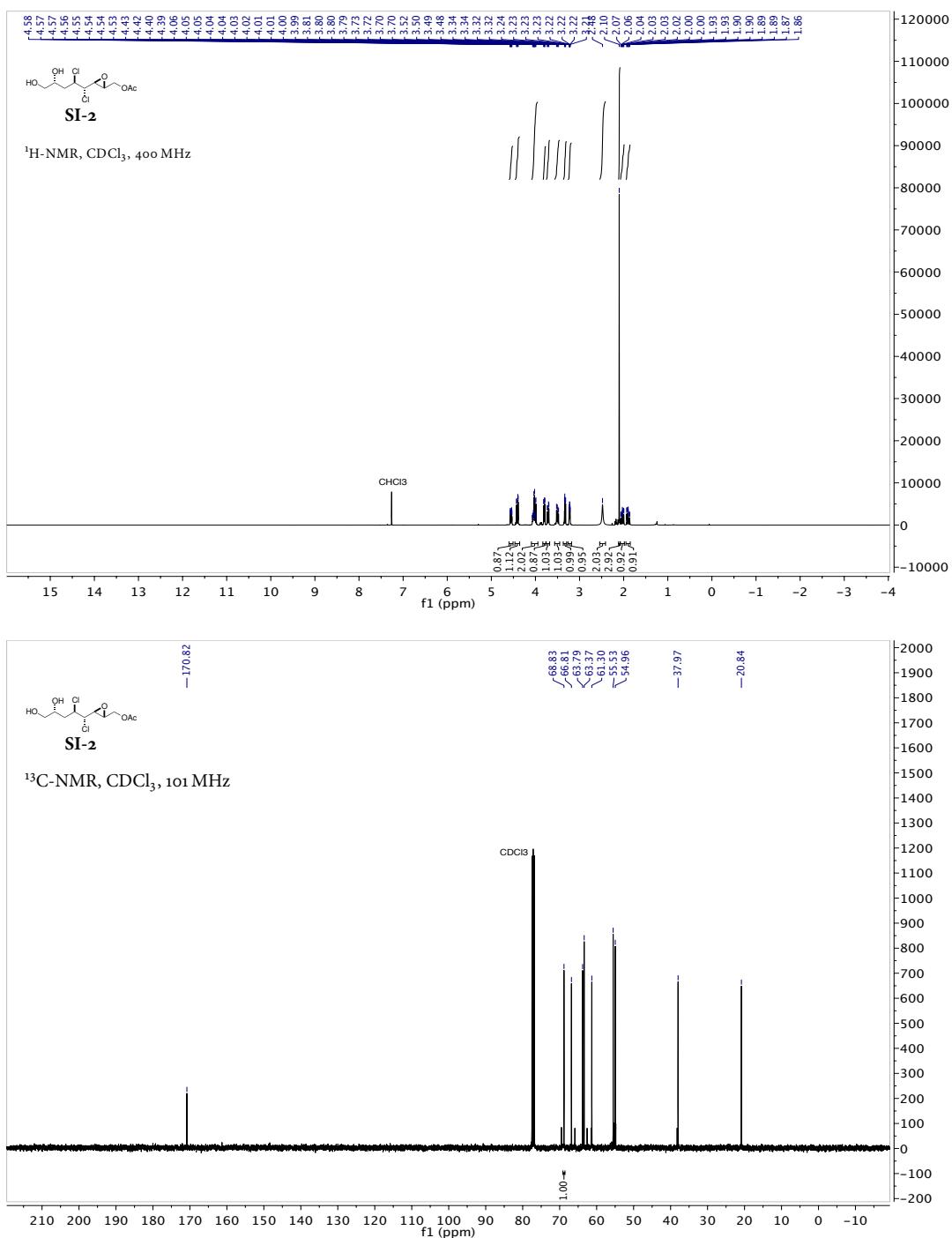
3 NMR Spectra



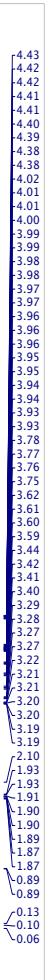
Chapter 3. NMR Spectra



Chapter 3. NMR Spectra

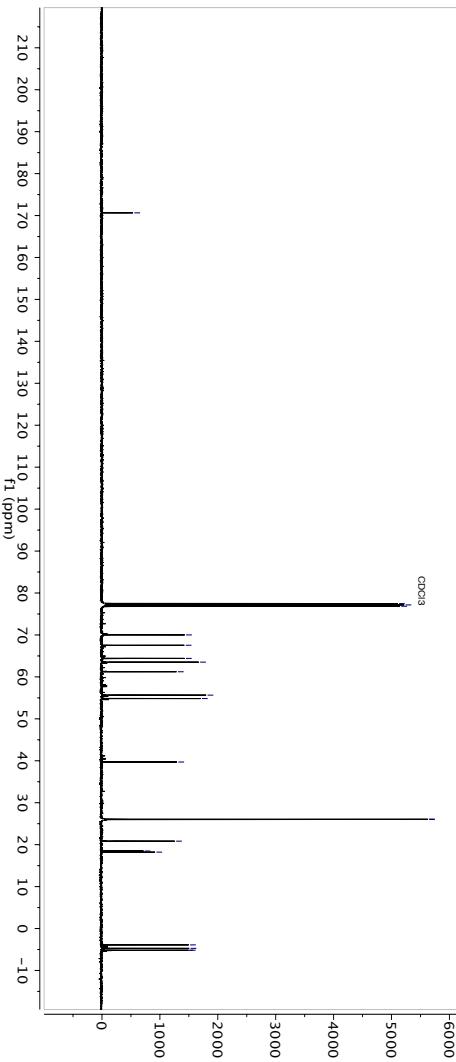
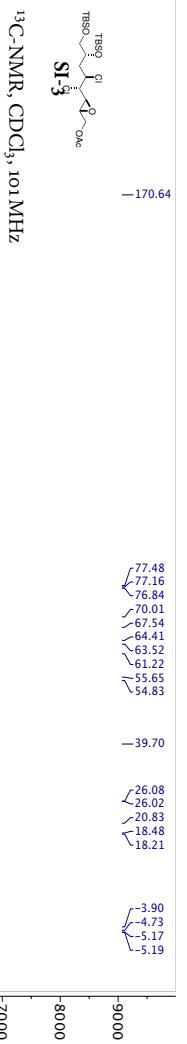
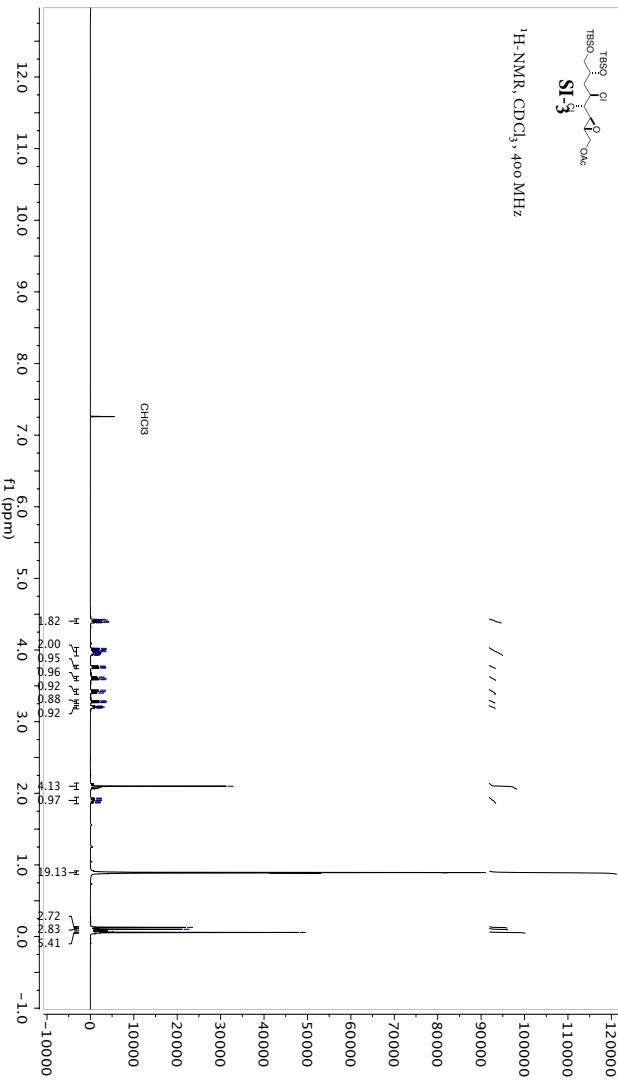


Chapter 3. NMR Spectra

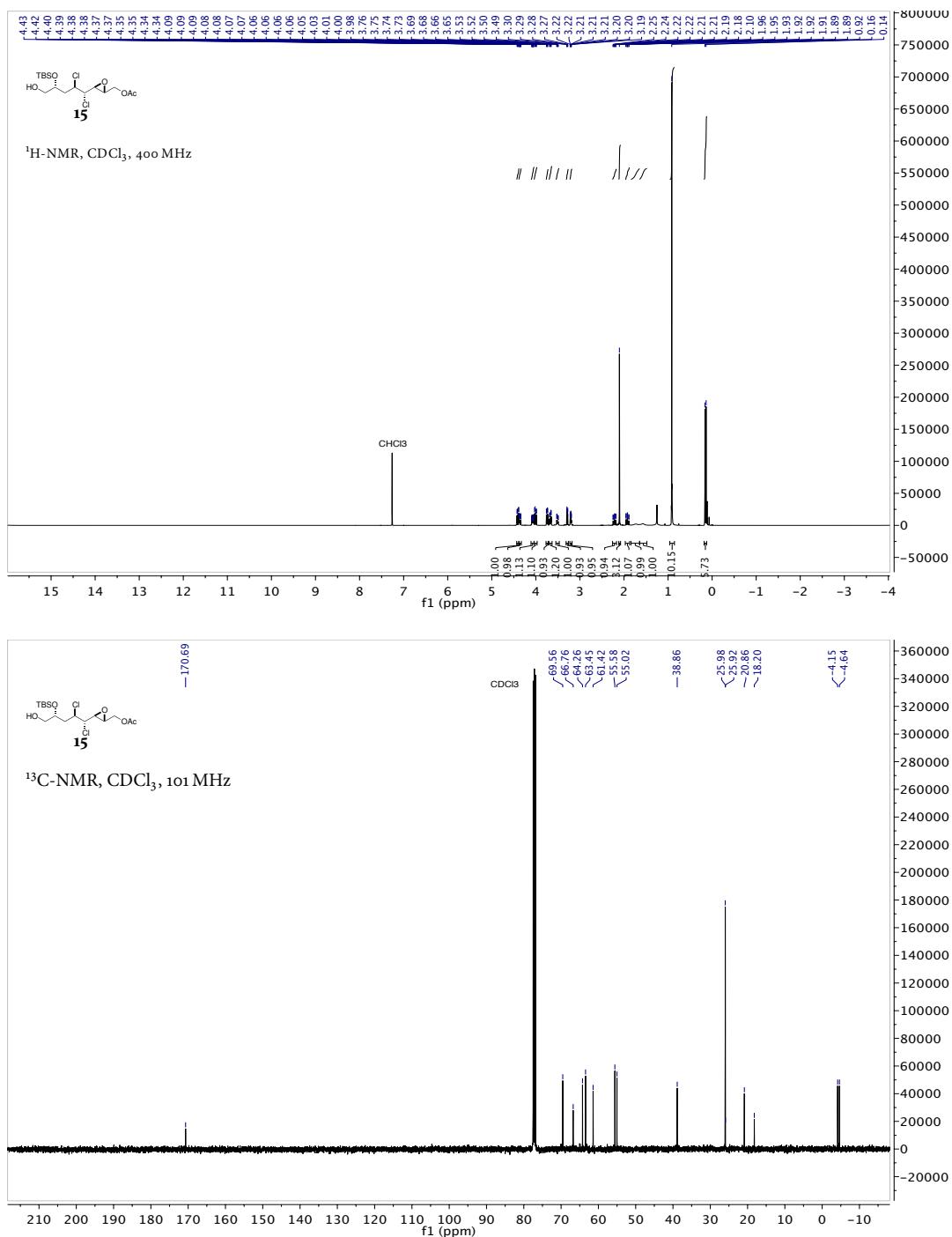


¹H-NMR, CDCl₃, 400 MHz

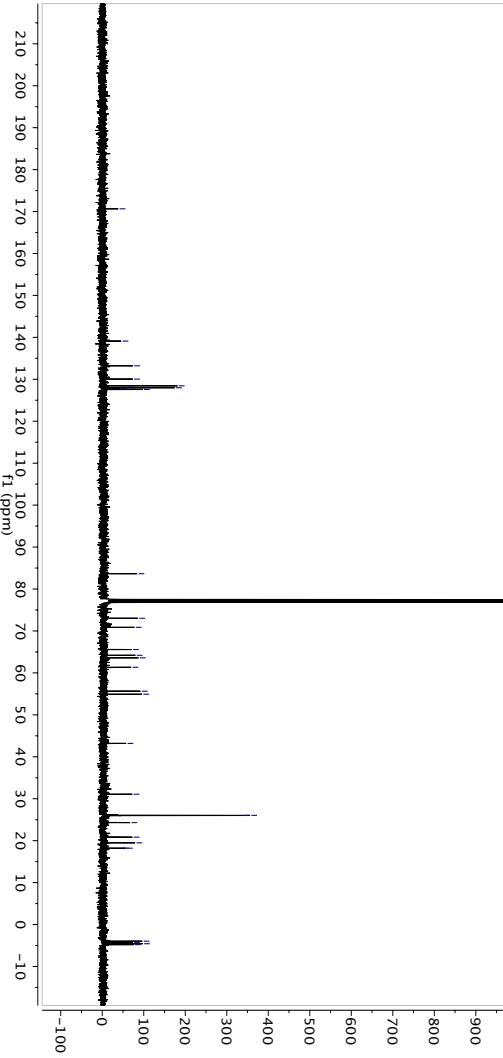
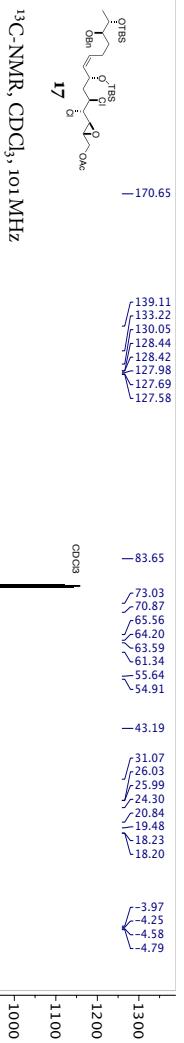
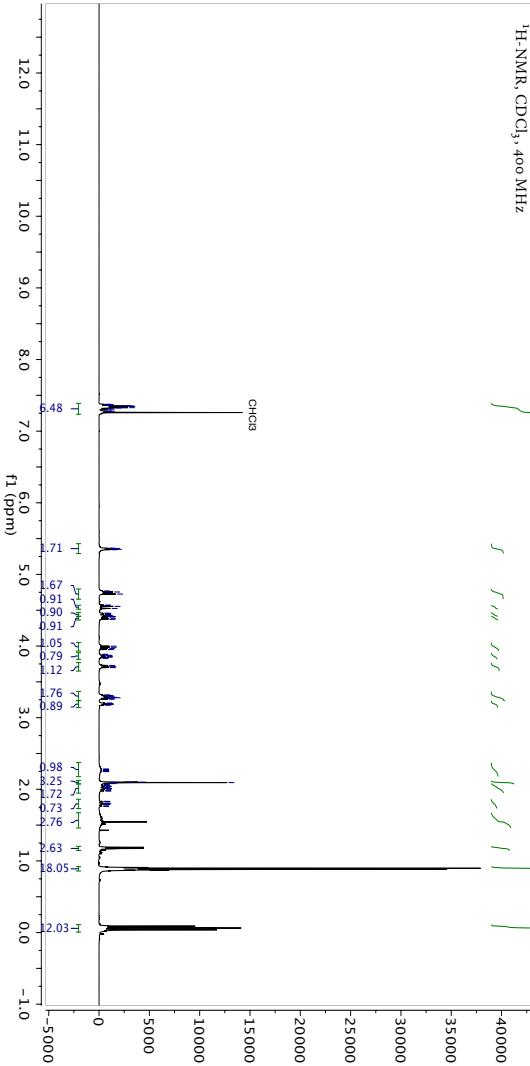
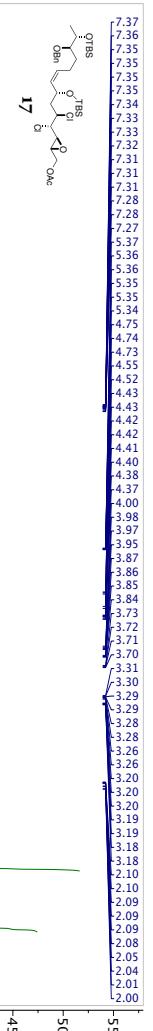
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0.06



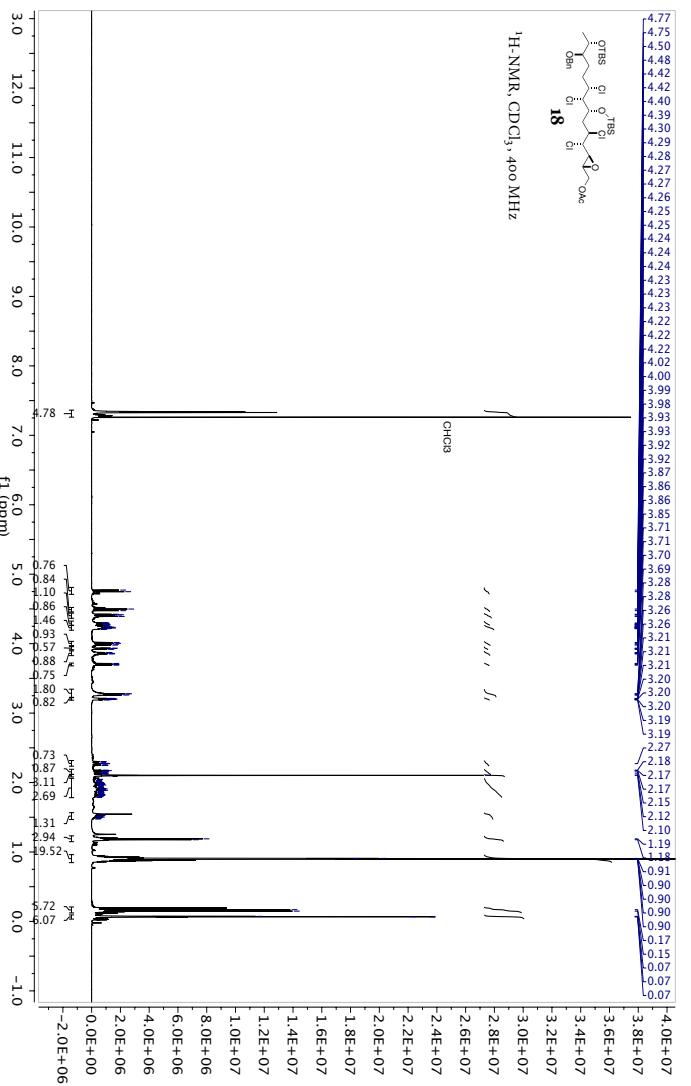
Chapter 3. NMR Spectra



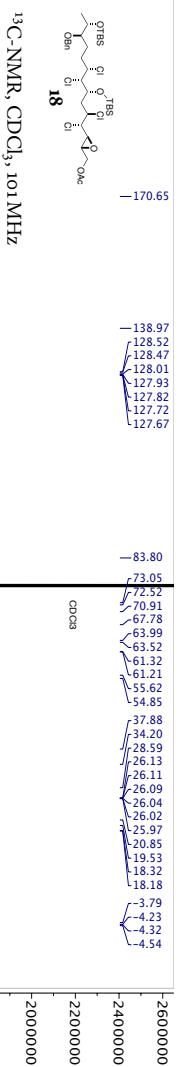
Chapter 3. NMR Spectra



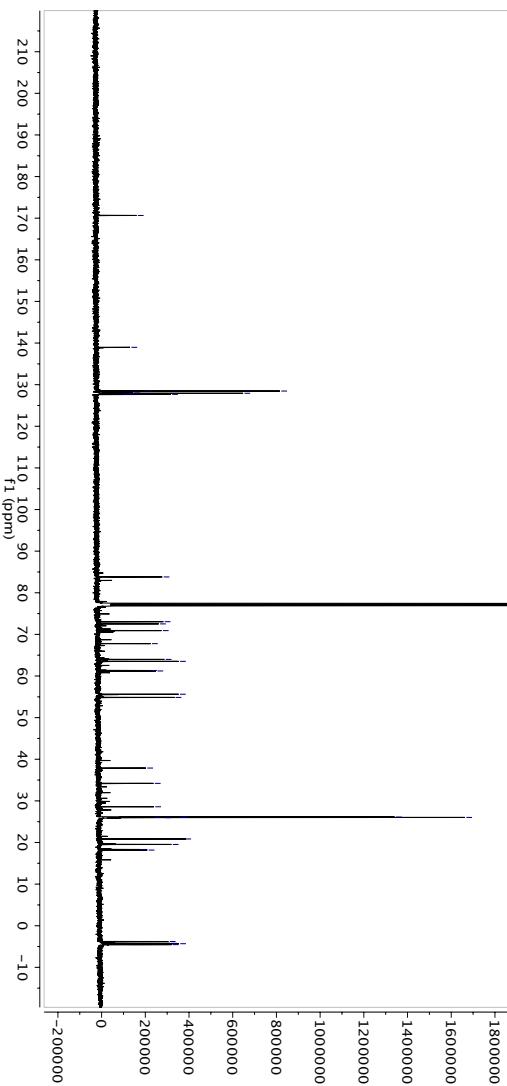
Chapter 3. NMR Spectra



¹H-NMR, CDCl₃, 400 MHz

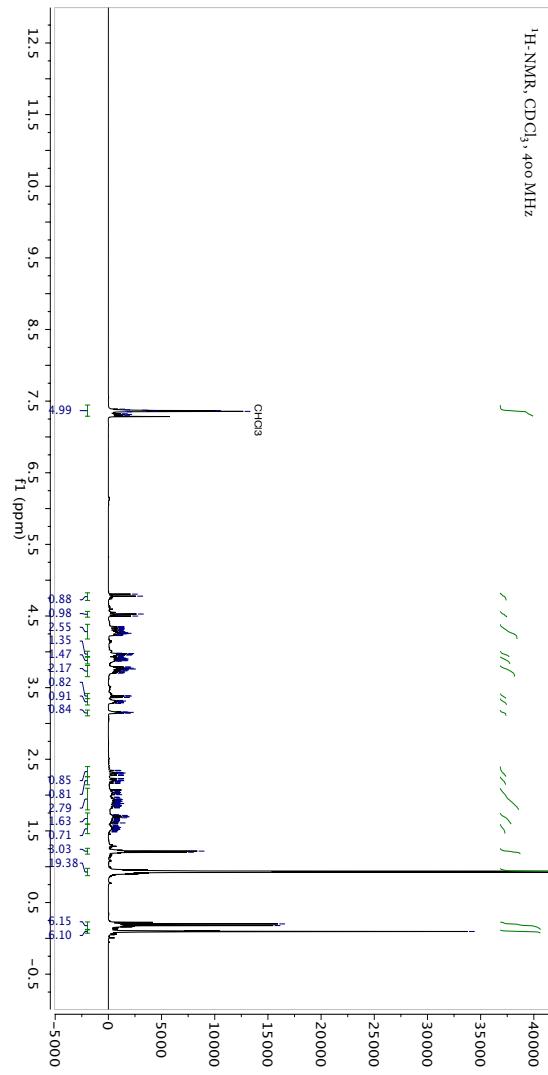
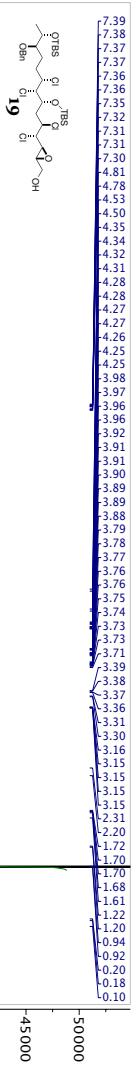


¹³C-NMR, CDCl₃, 101MHz

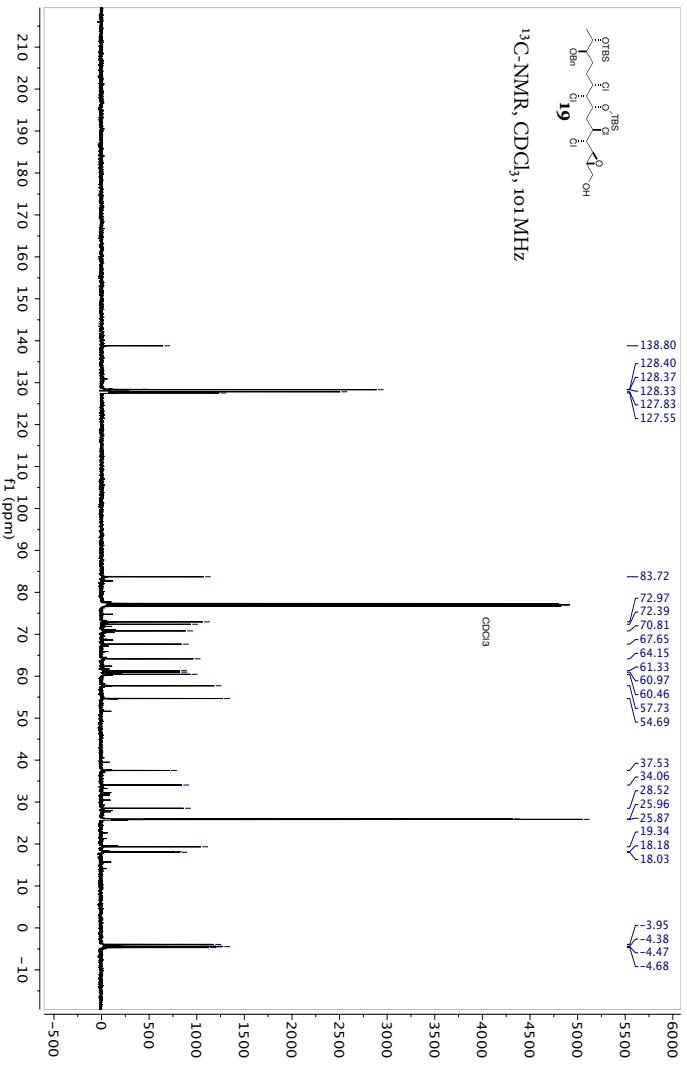


¹H-NMR, CDCl₃, 400 MHz

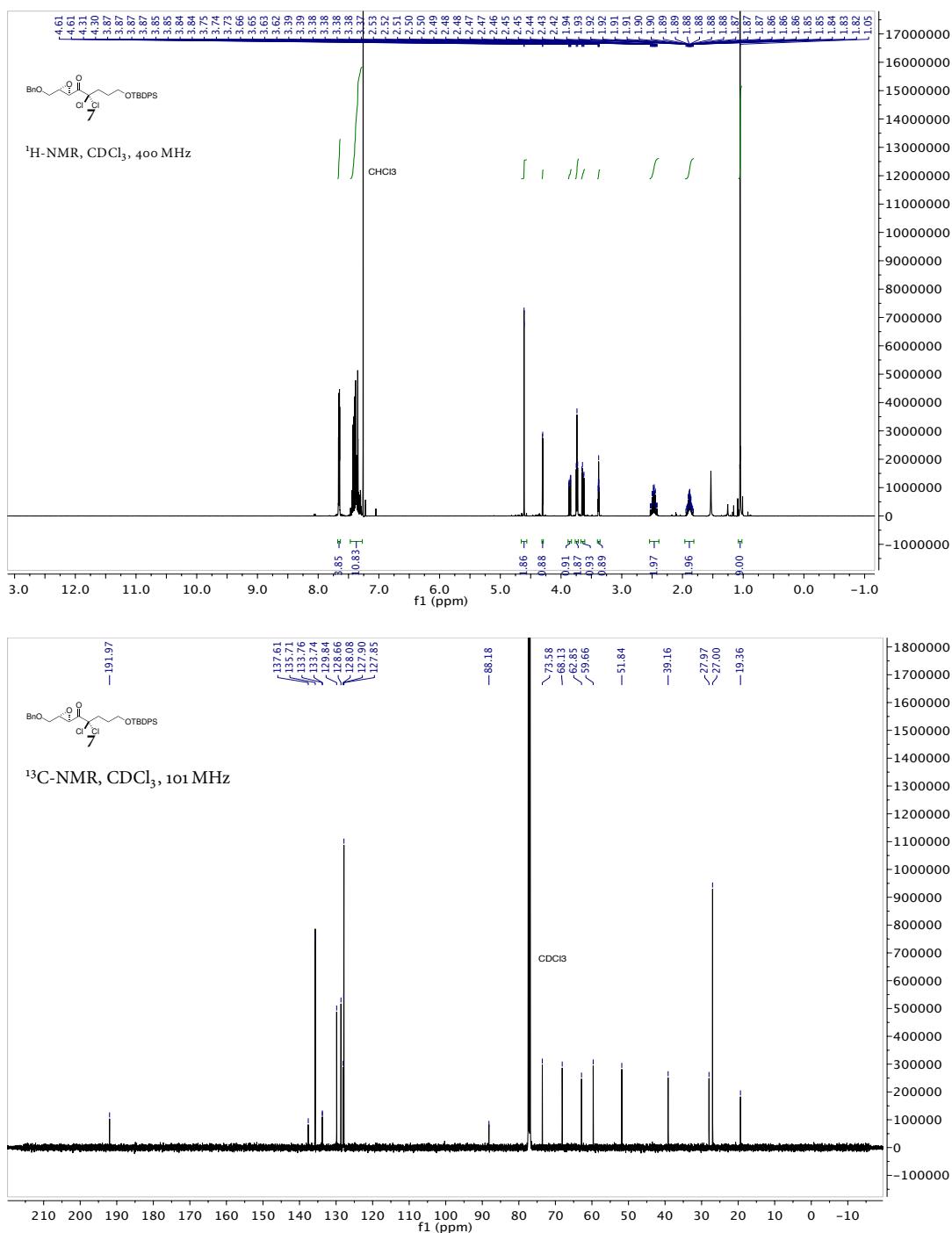
Chapter 3. NMR Spectra



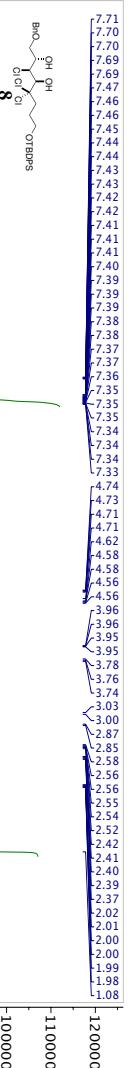
$^{13}\text{C-NMR}$, CDCl_3 , 101MHz



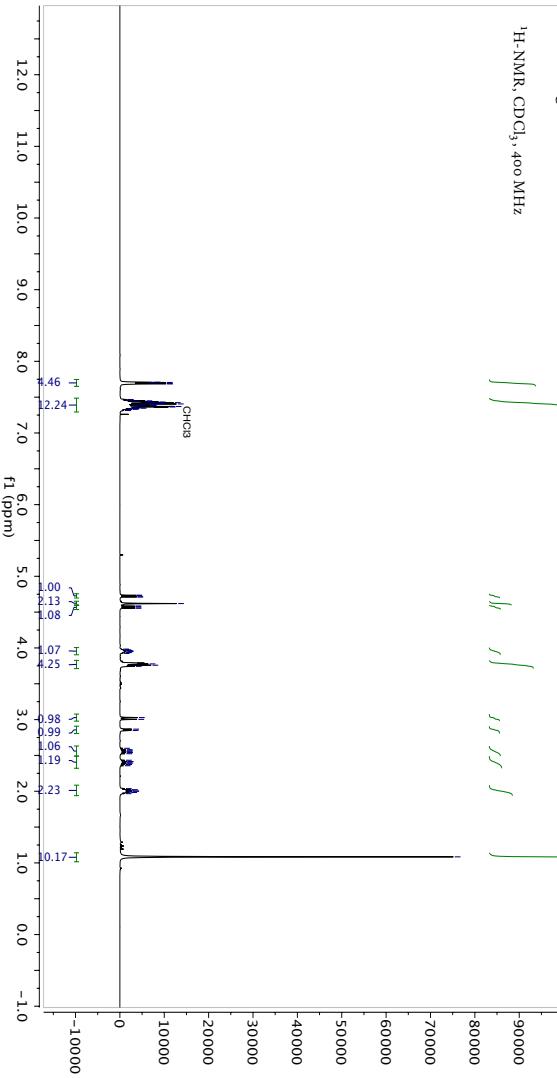
Chapter 3. NMR Spectra



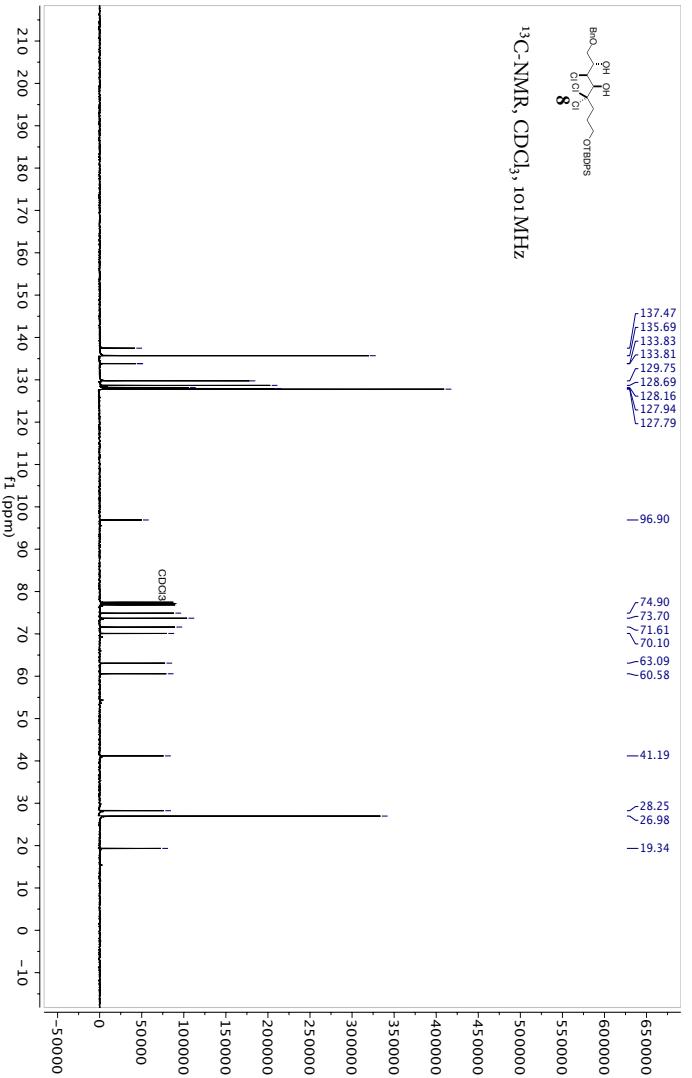
Chapter 3. NMR Spectra

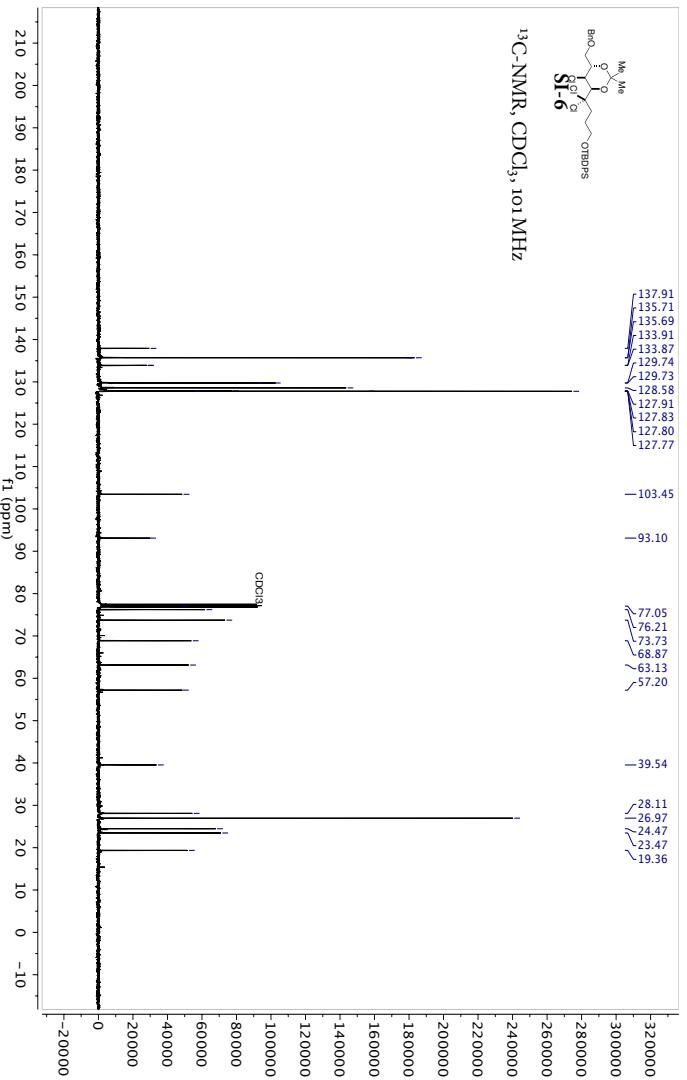
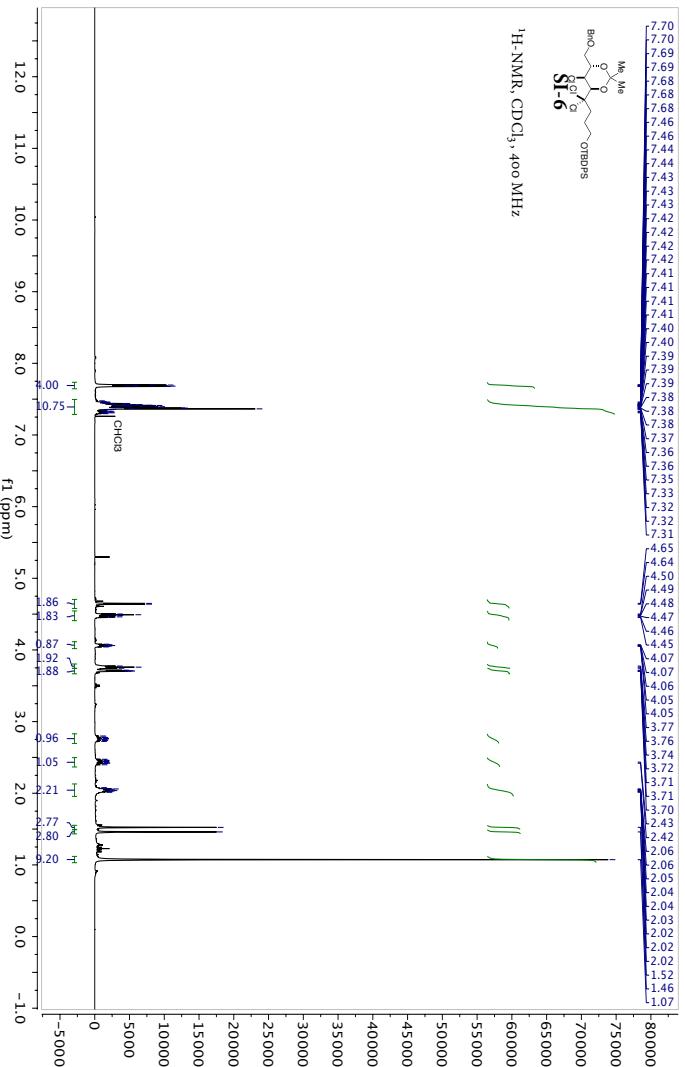


¹H-NMR, CDCl₃, 400 MHz

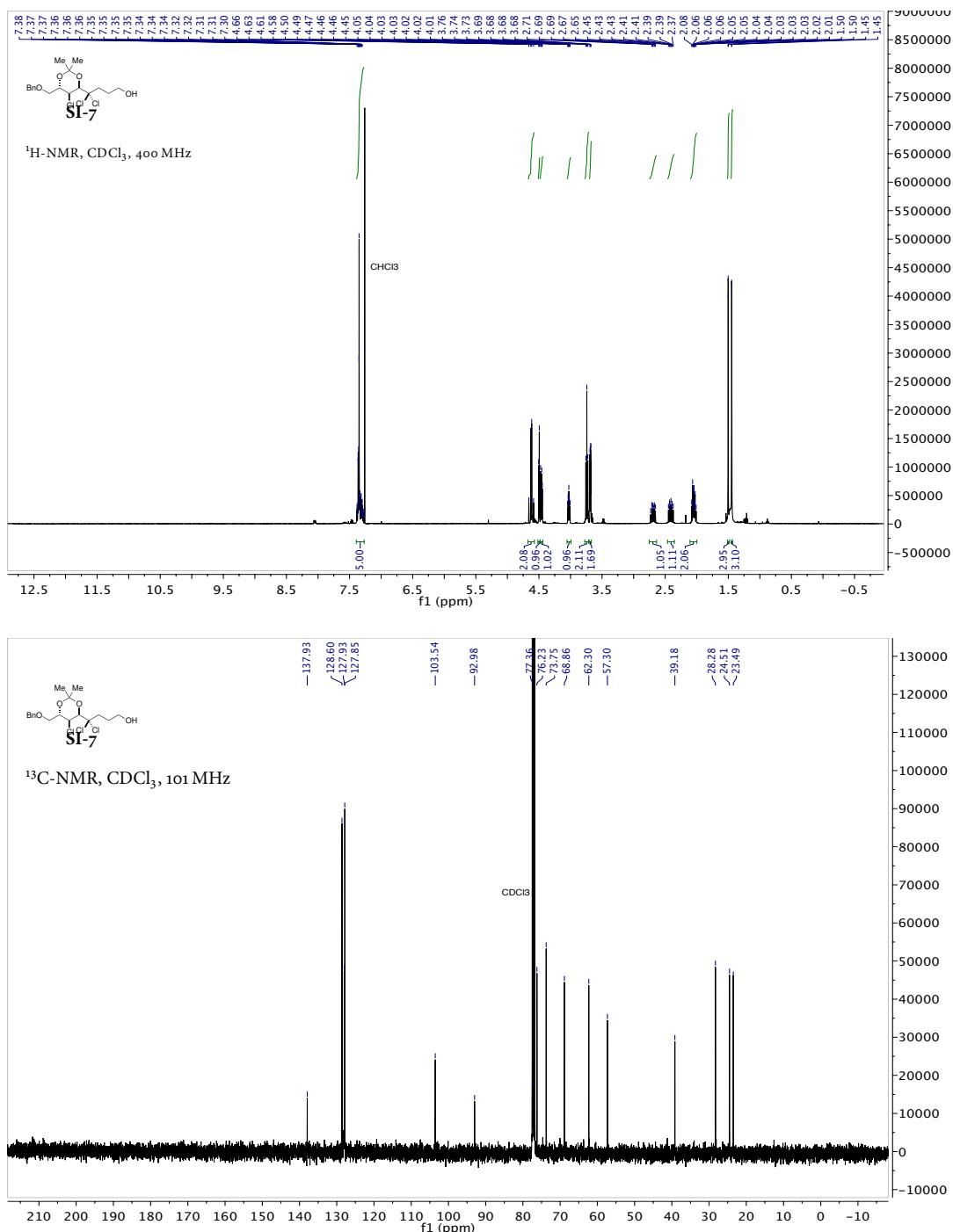


¹³C-NMR, CDCl₃, 101MHz

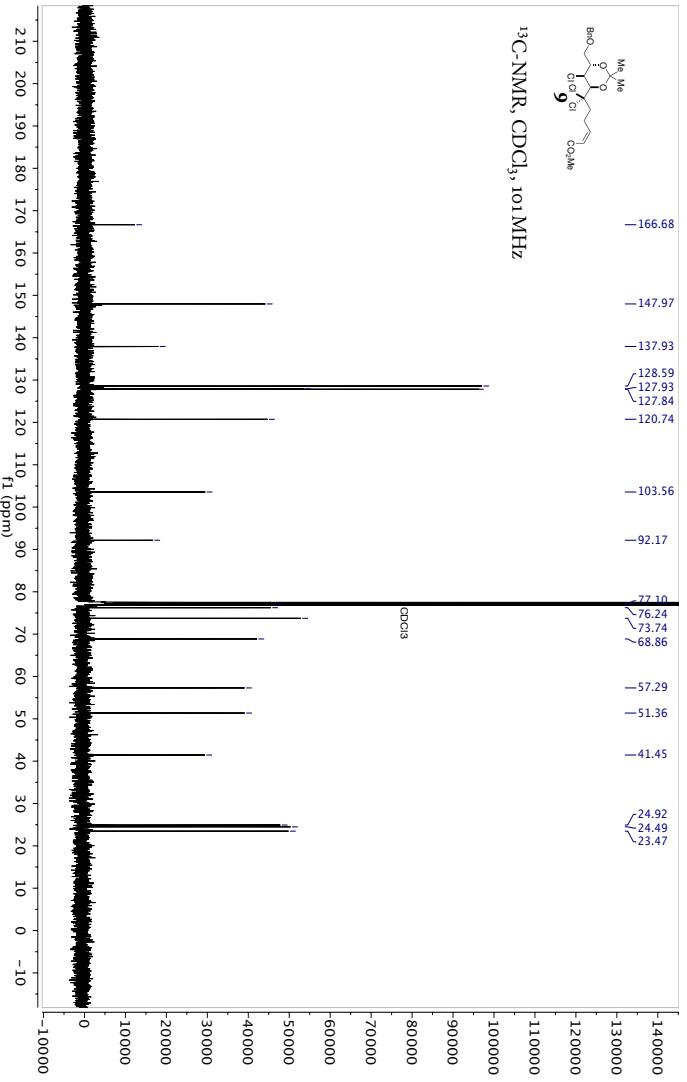
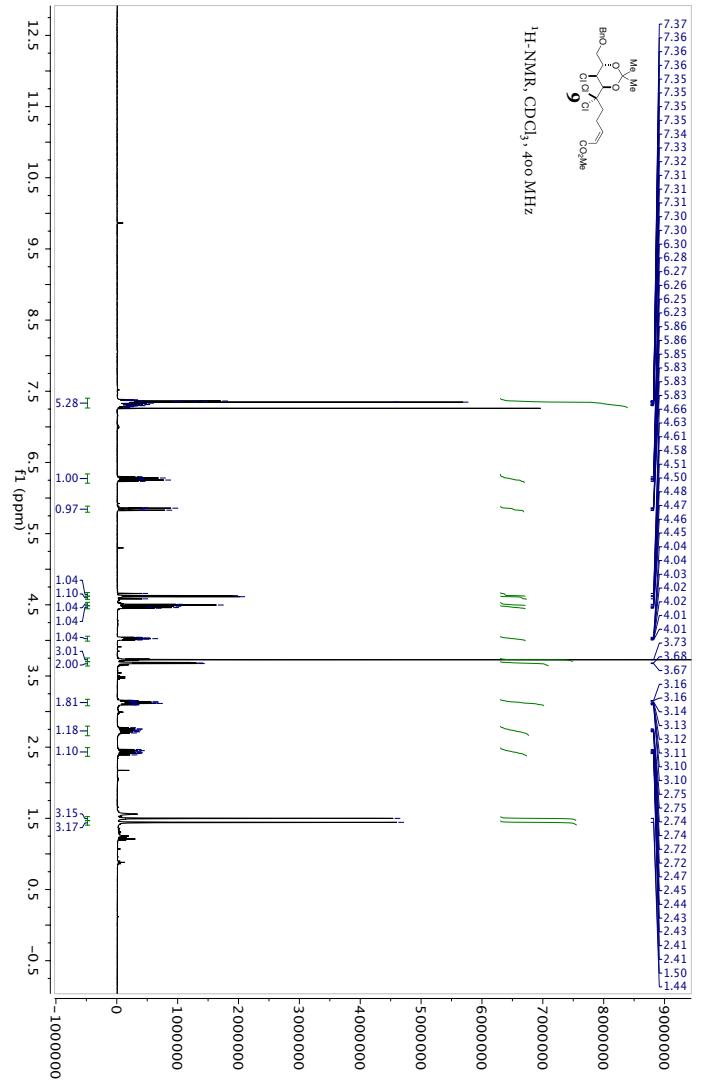




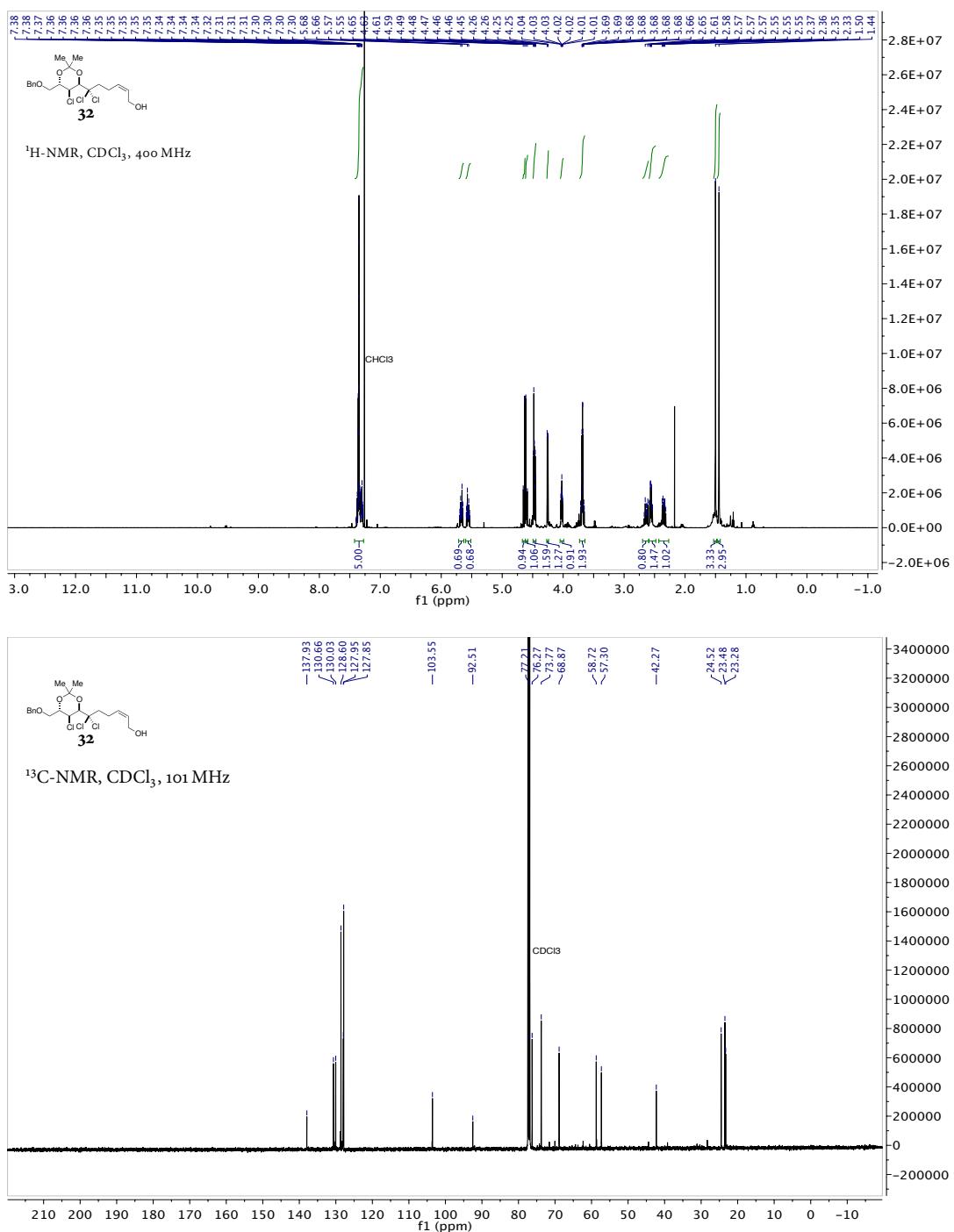
Chapter 3. NMR Spectra



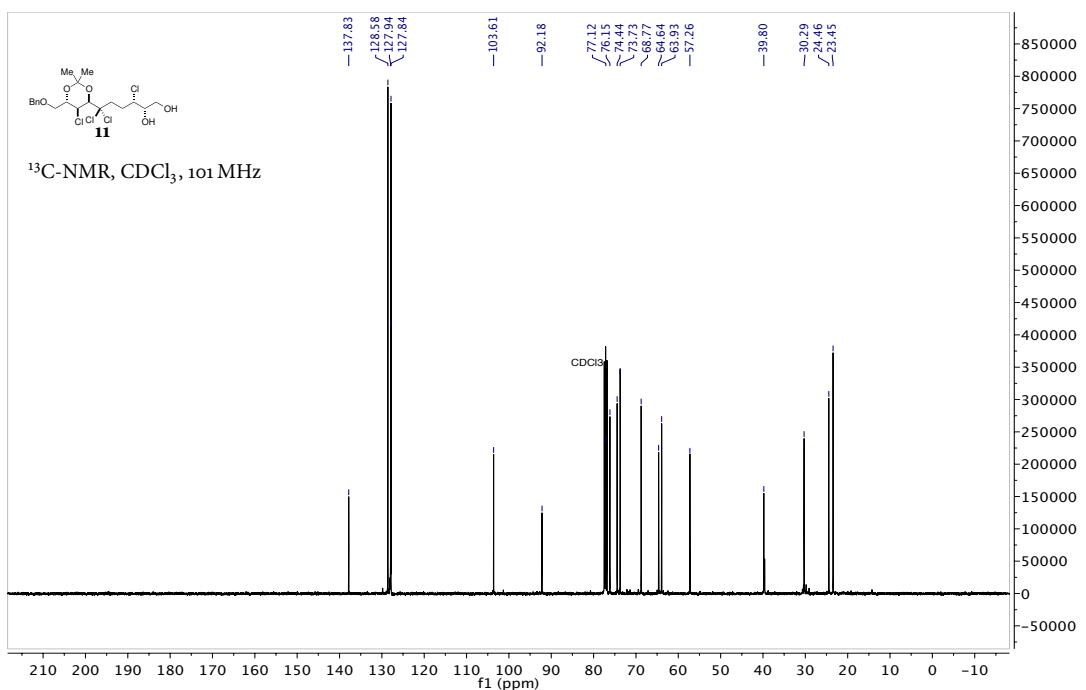
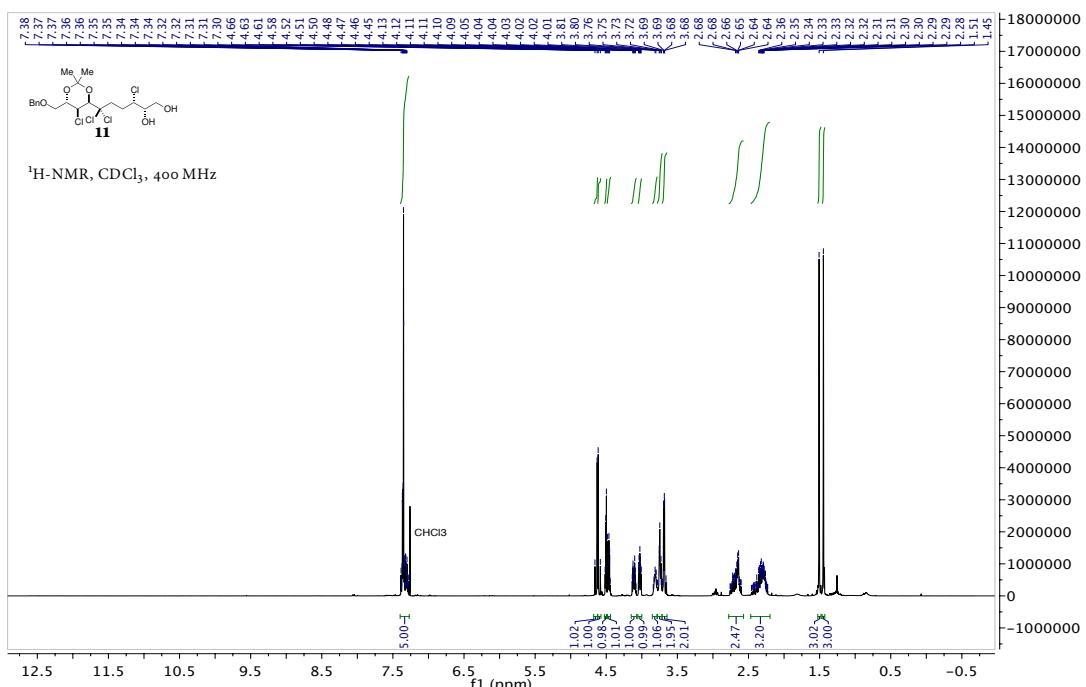
Chapter 3. NMR Spectra



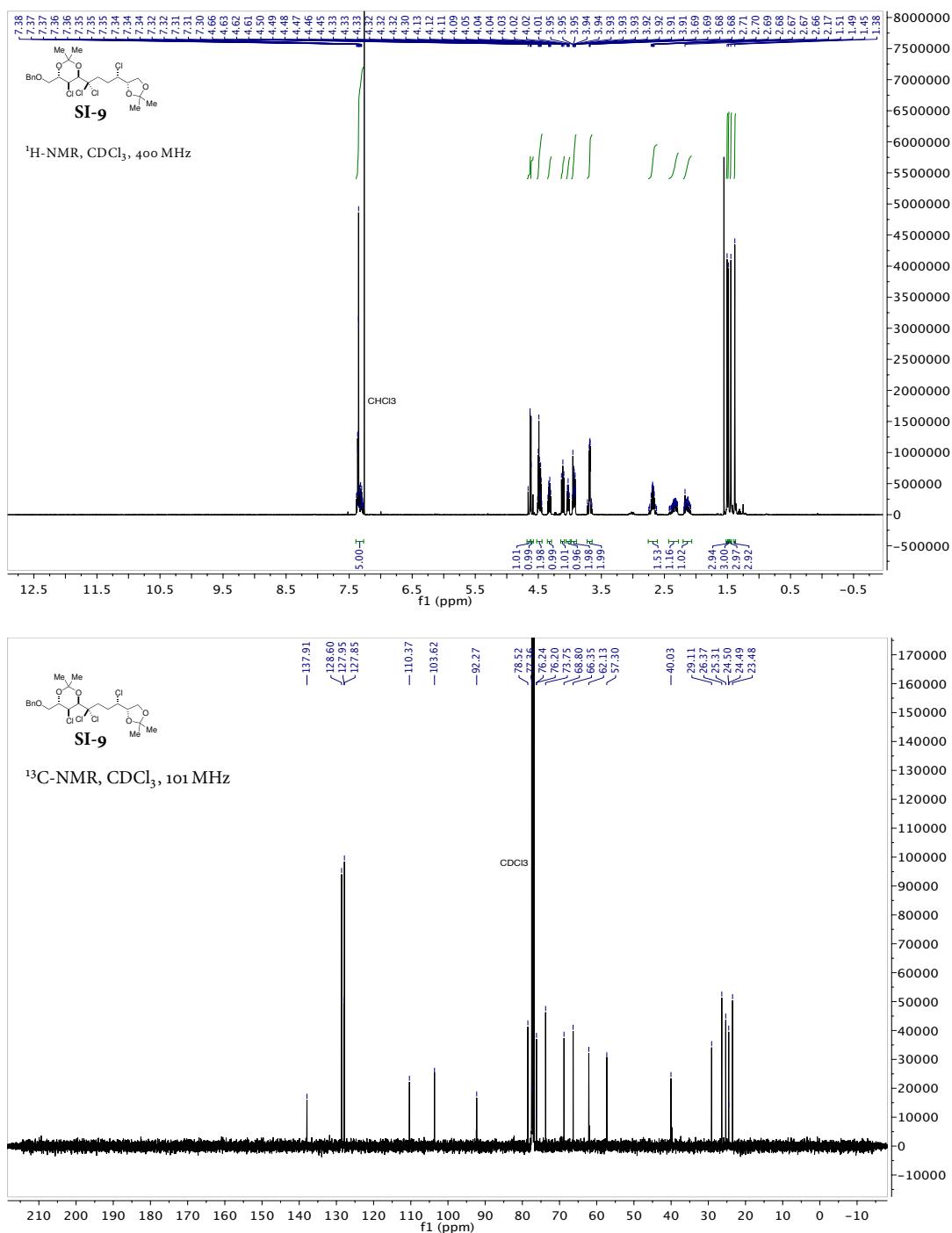
Chapter 3. NMR Spectra



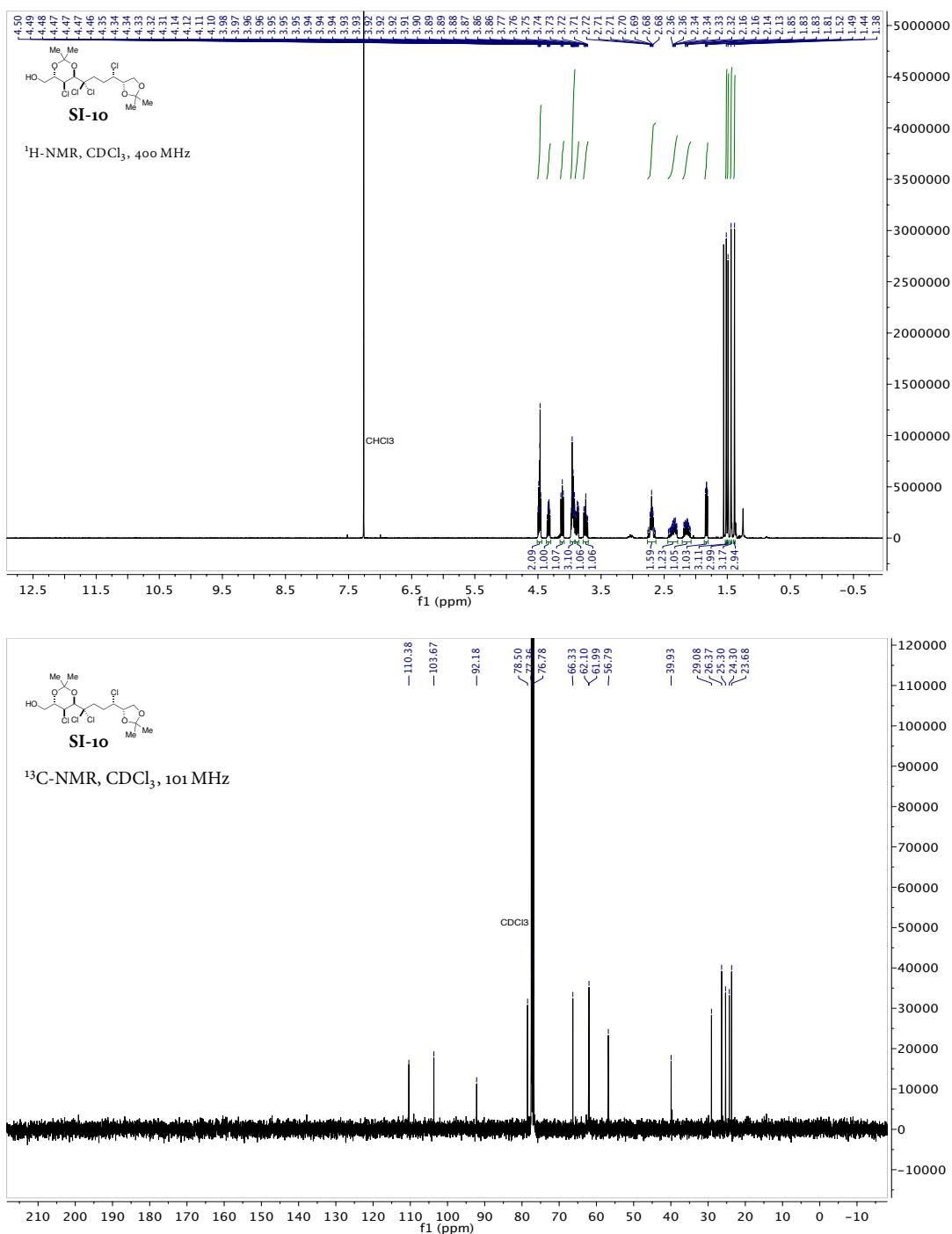
Chapter 3. NMR Spectra



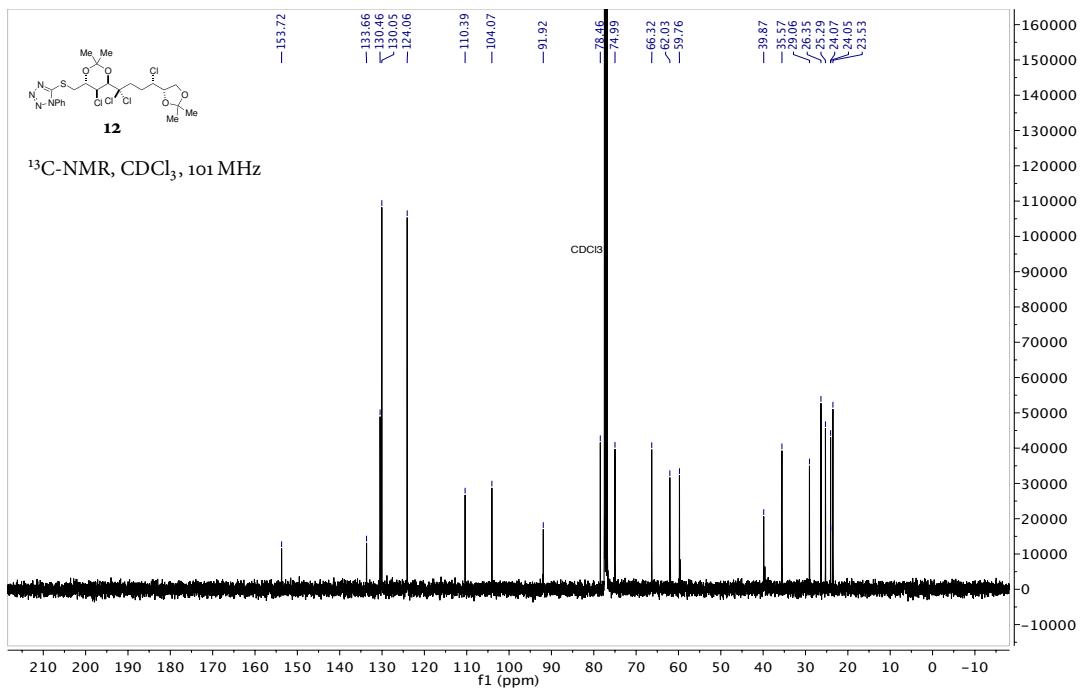
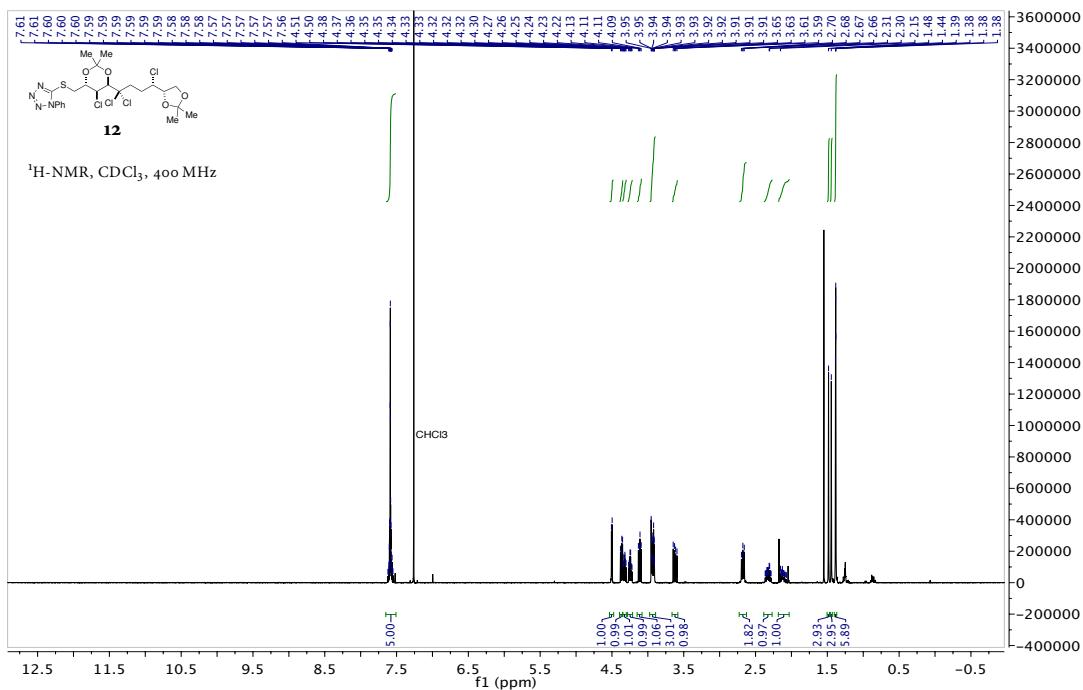
Chapter 3. NMR Spectra



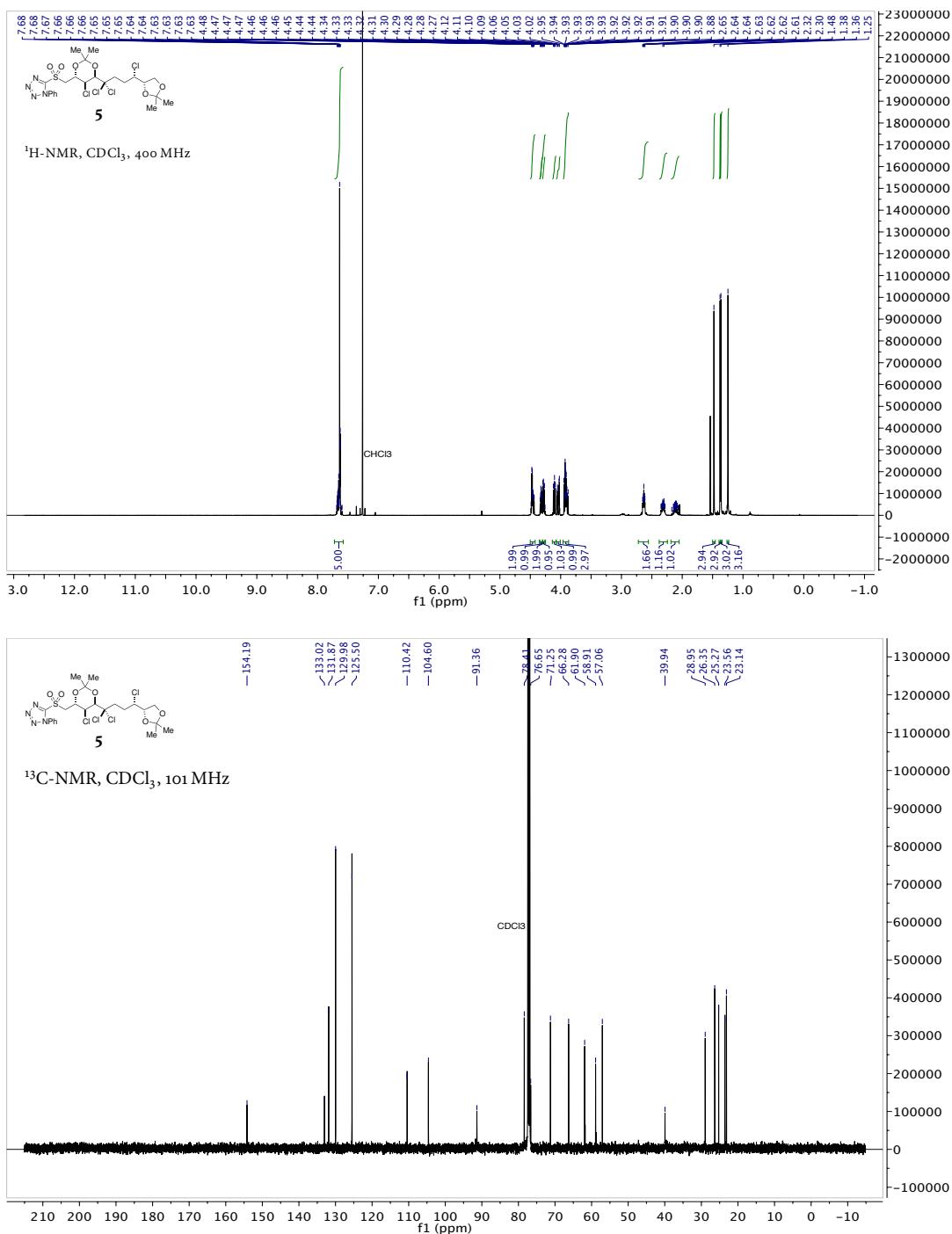
Chapter 3. NMR Spectra



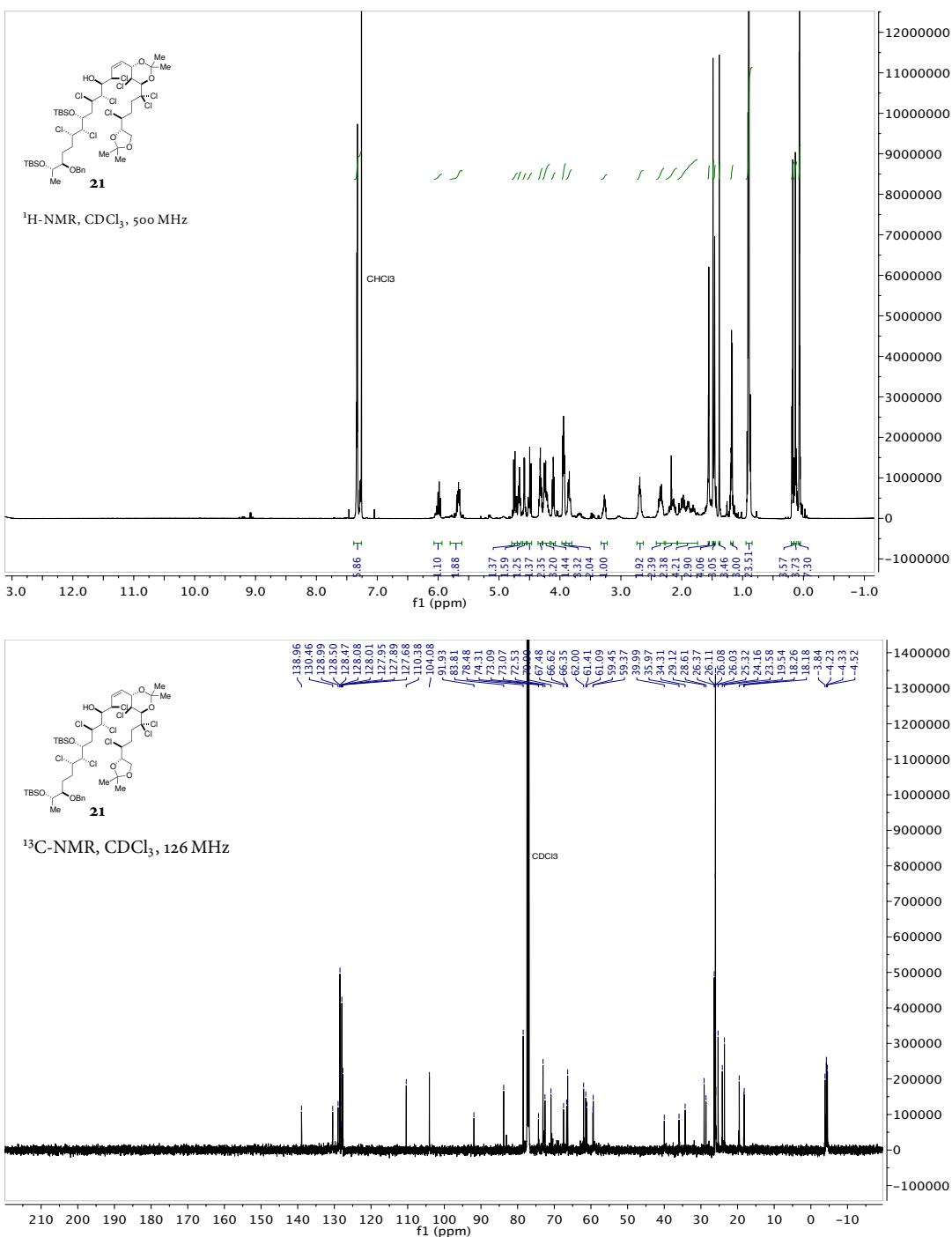
Chapter 3. NMR Spectra

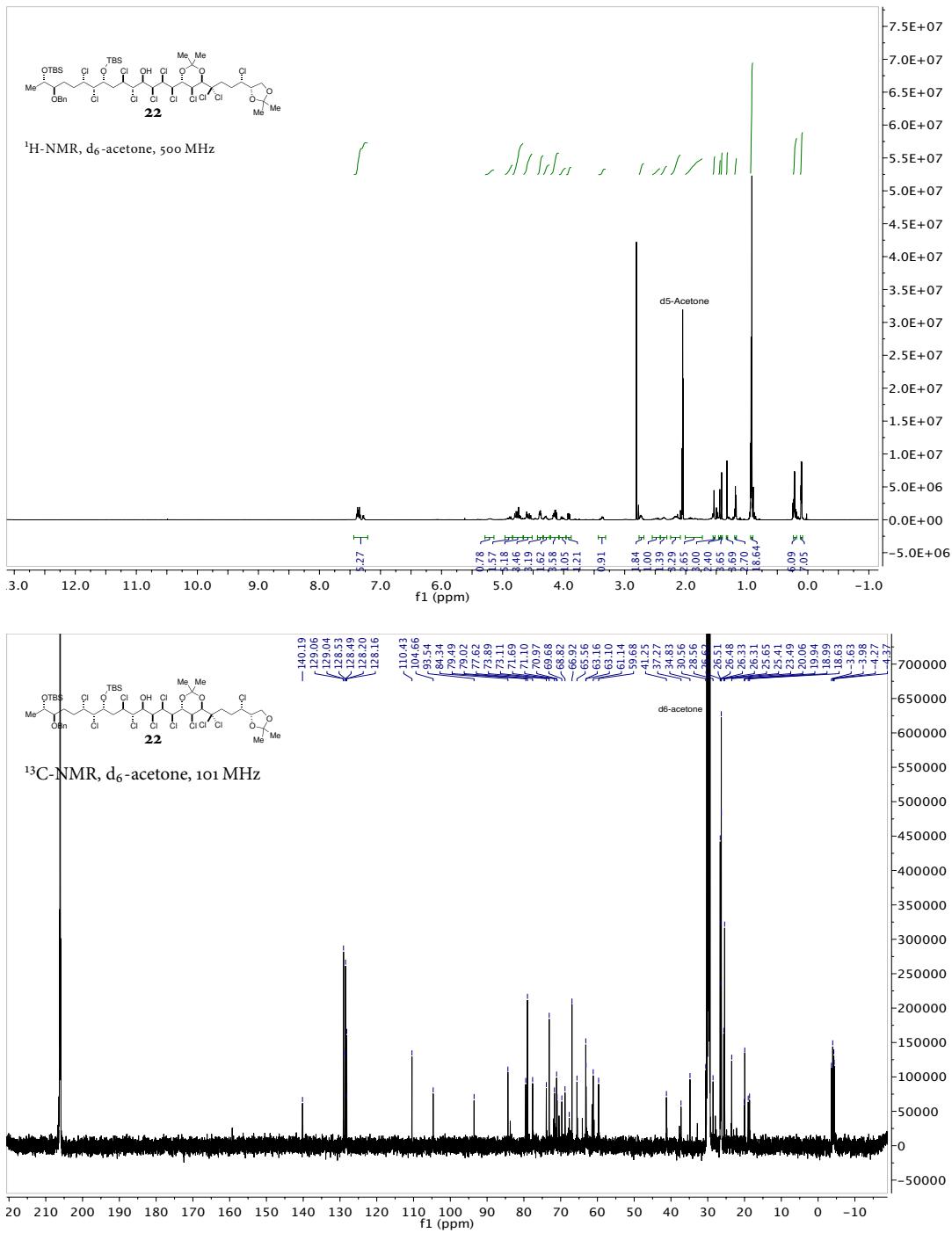


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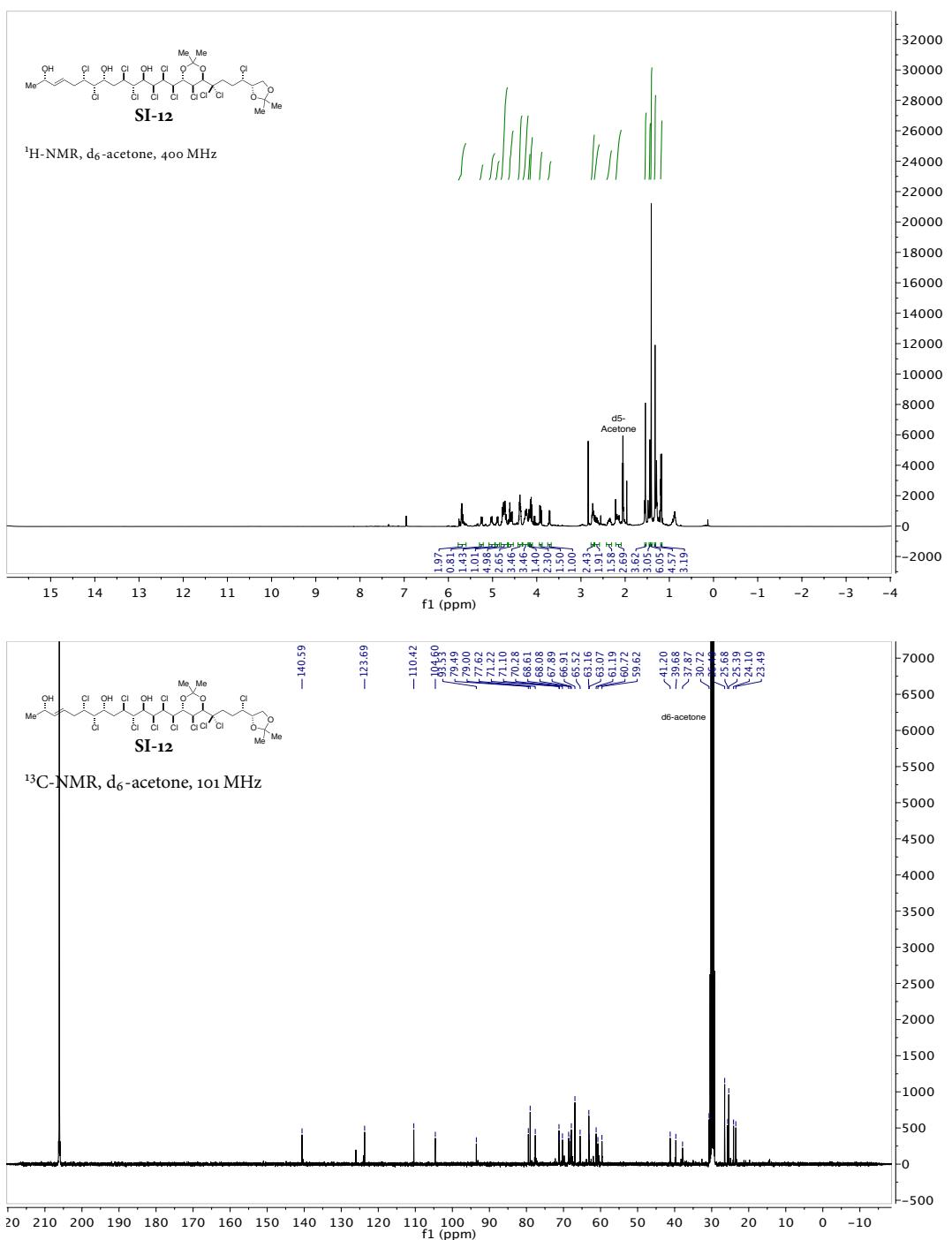


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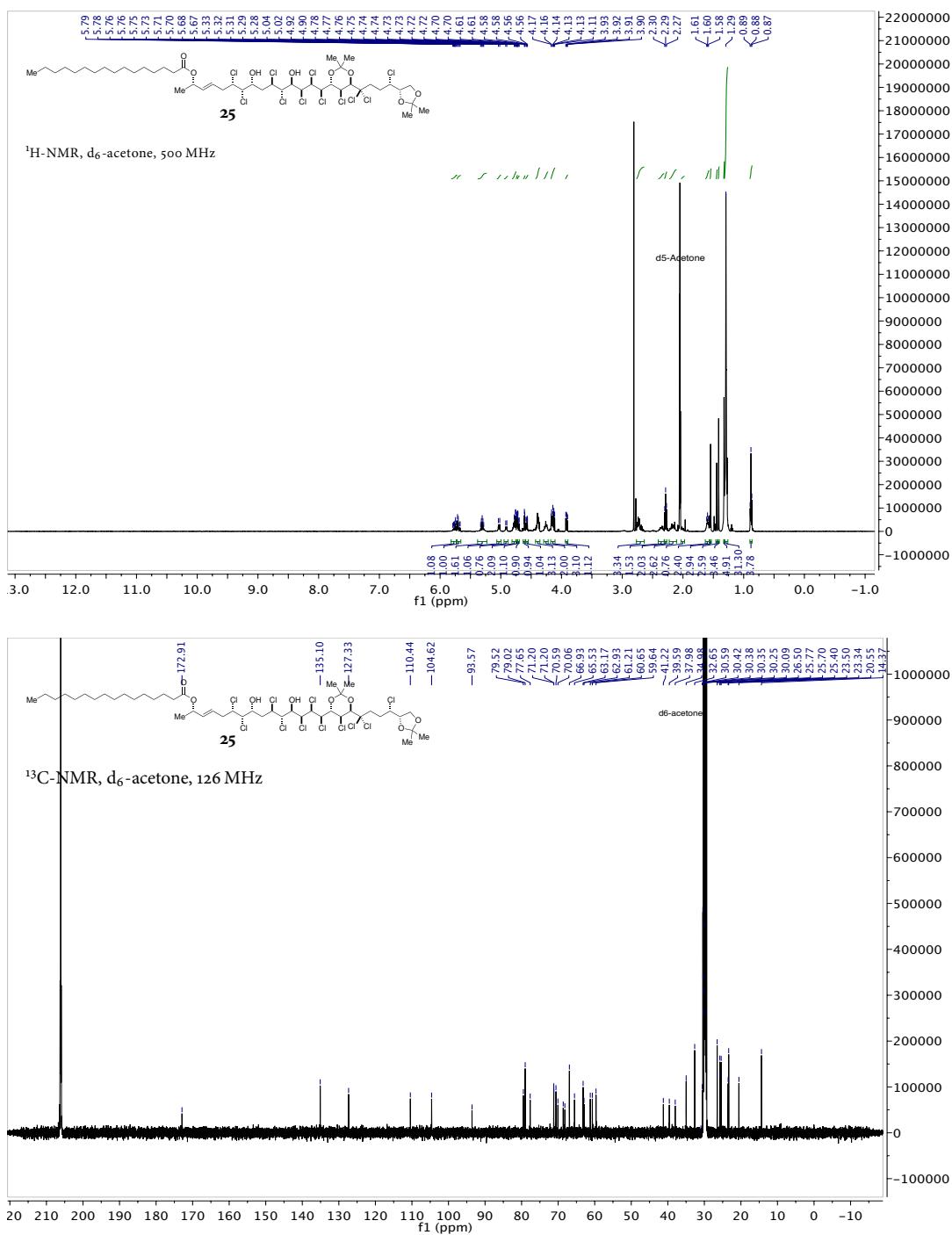


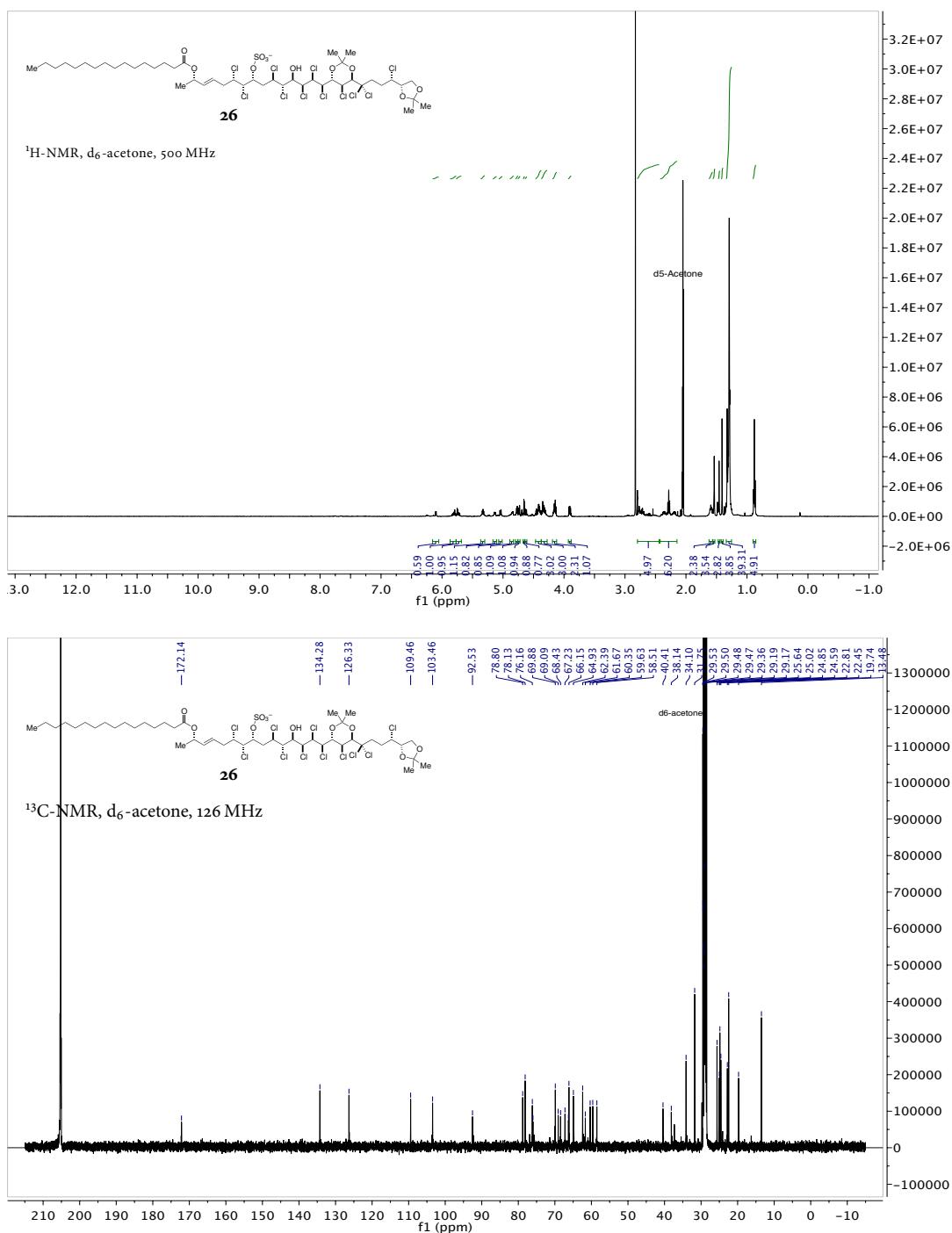


Chapter 3. NMR Spectra

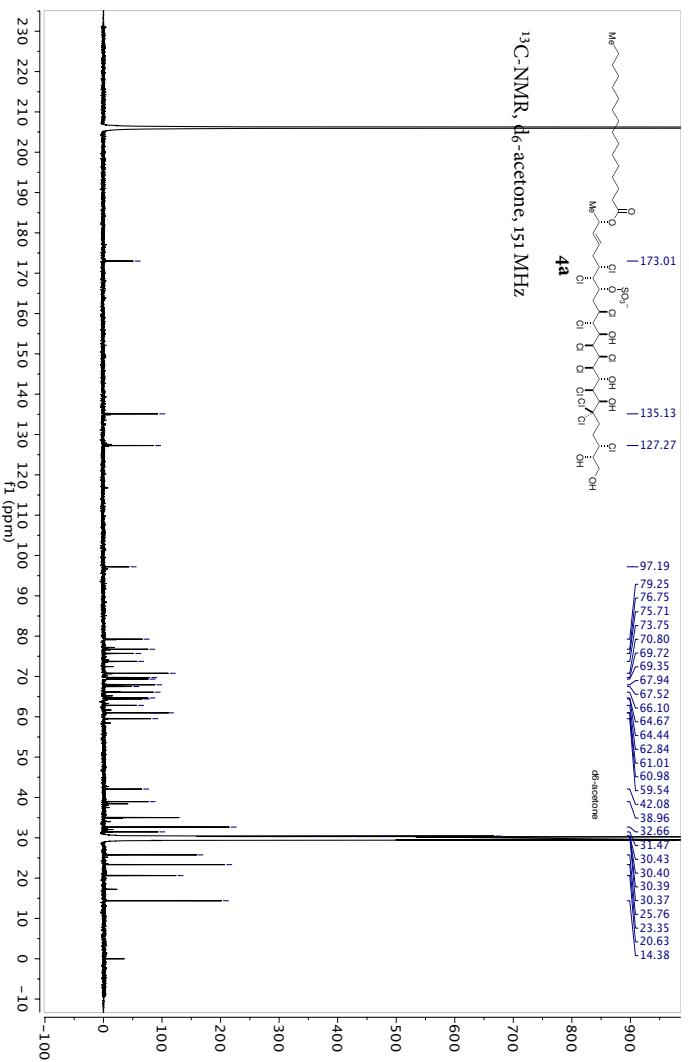
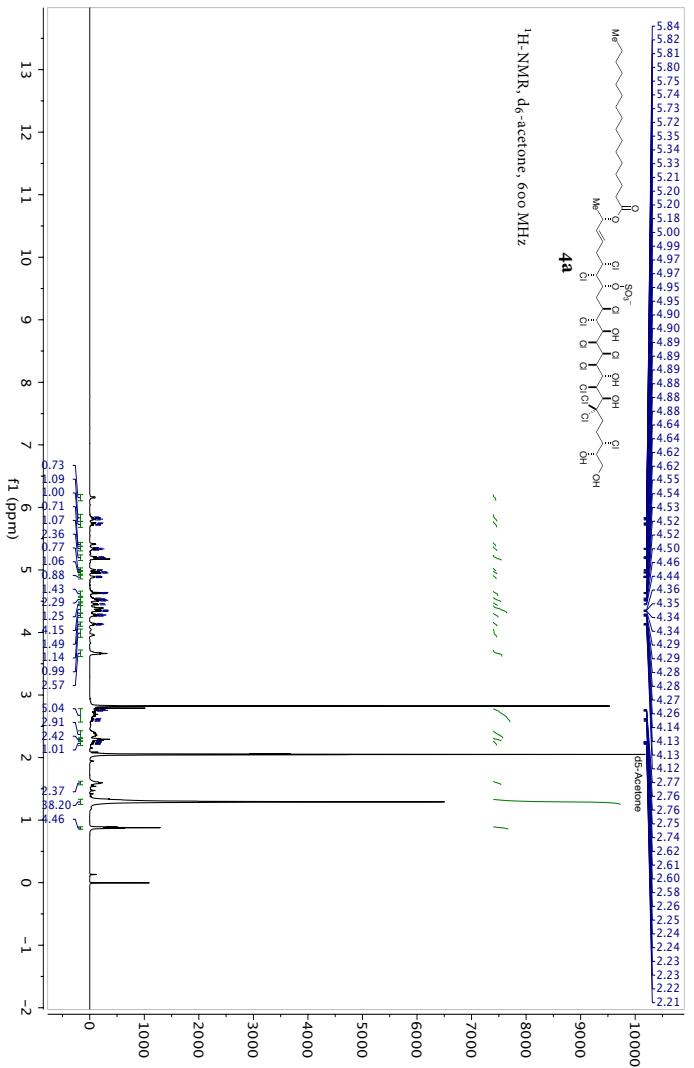


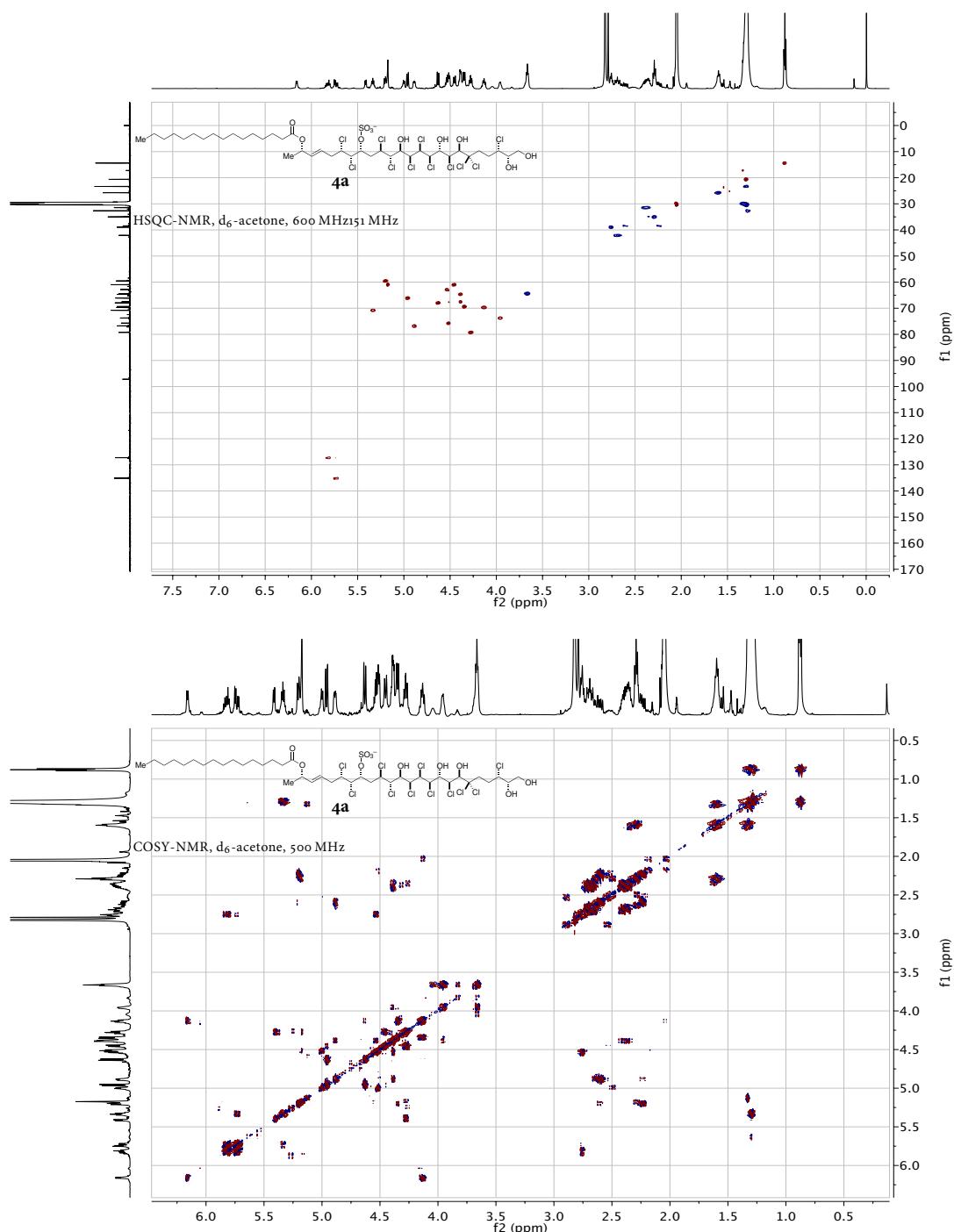
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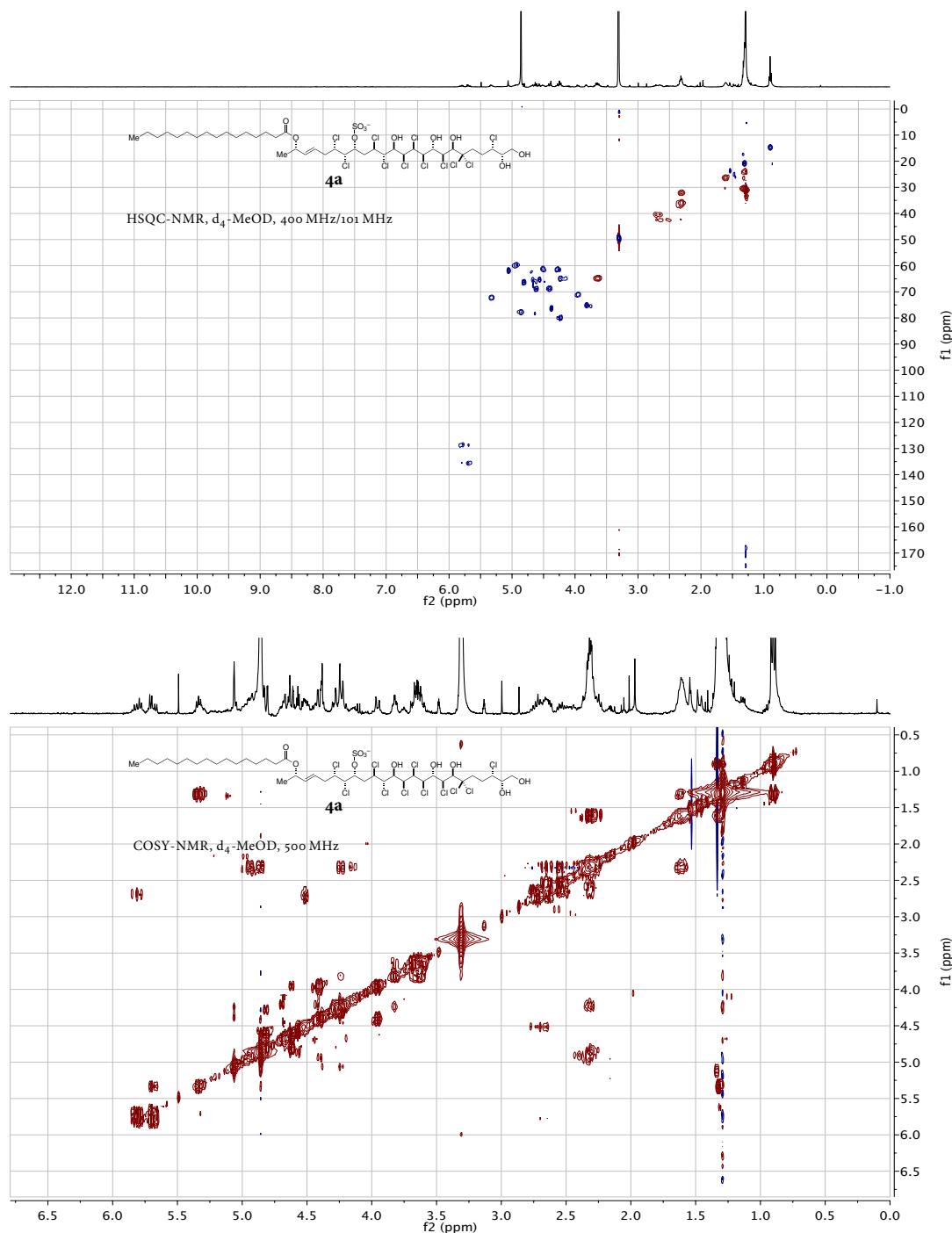




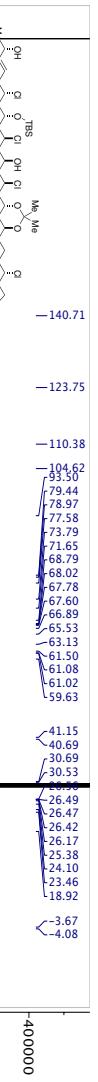
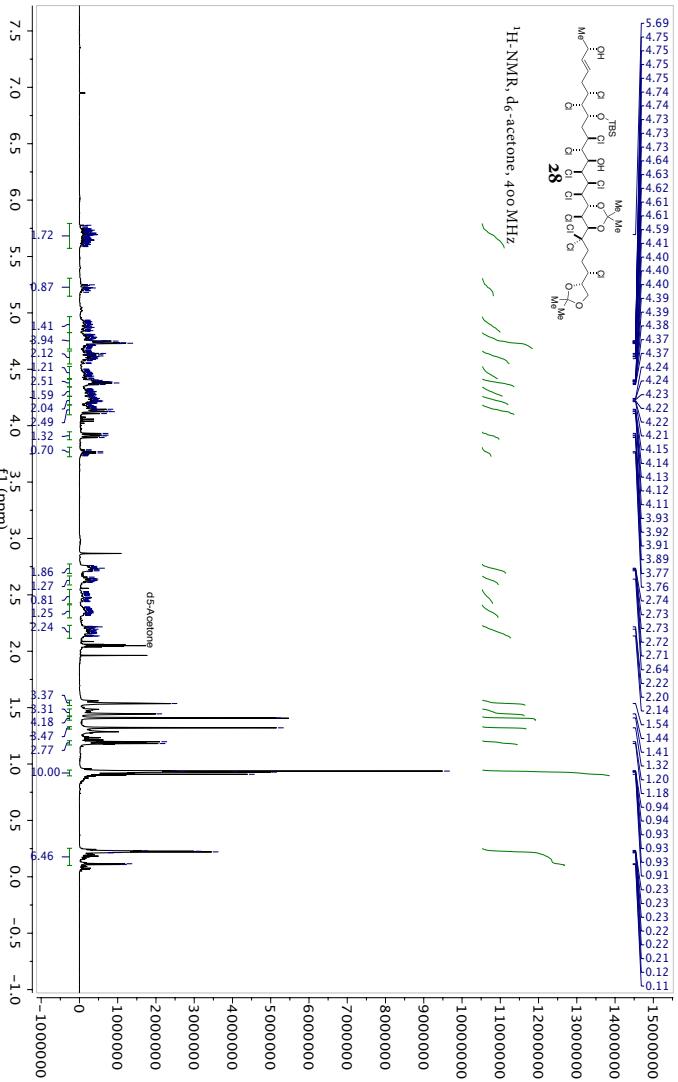
Chapter 3. NMR Spectra



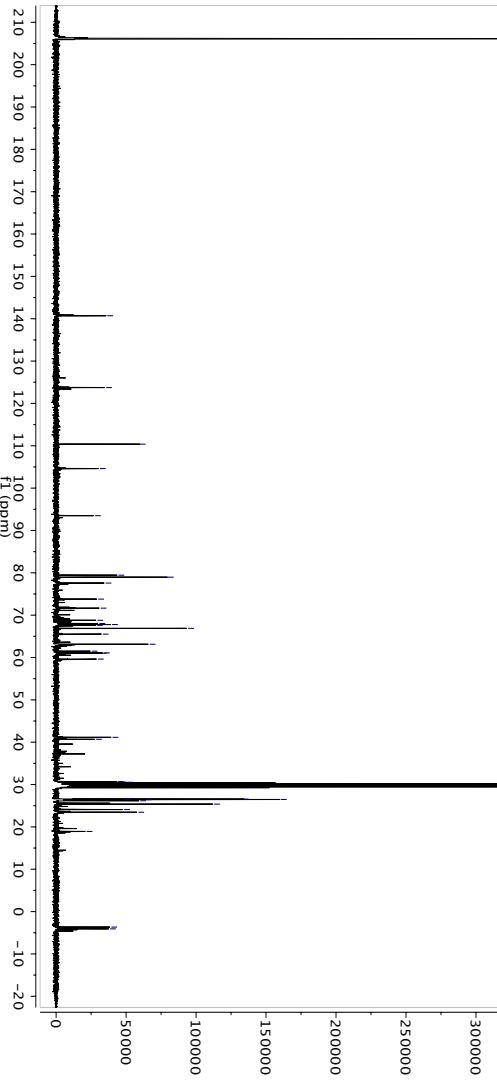




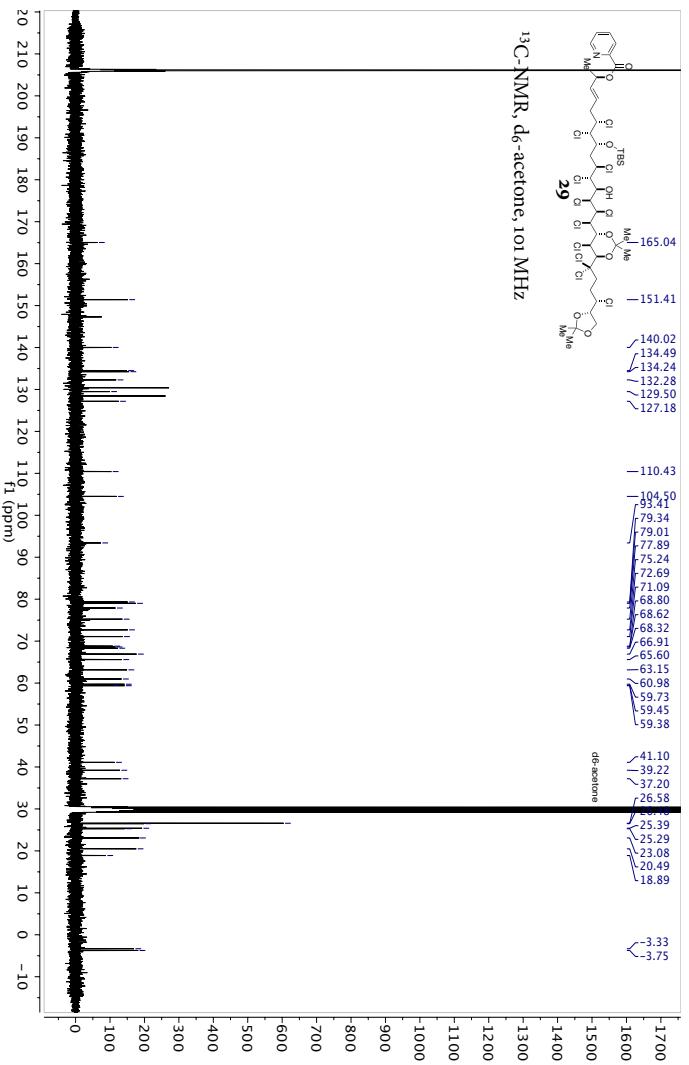
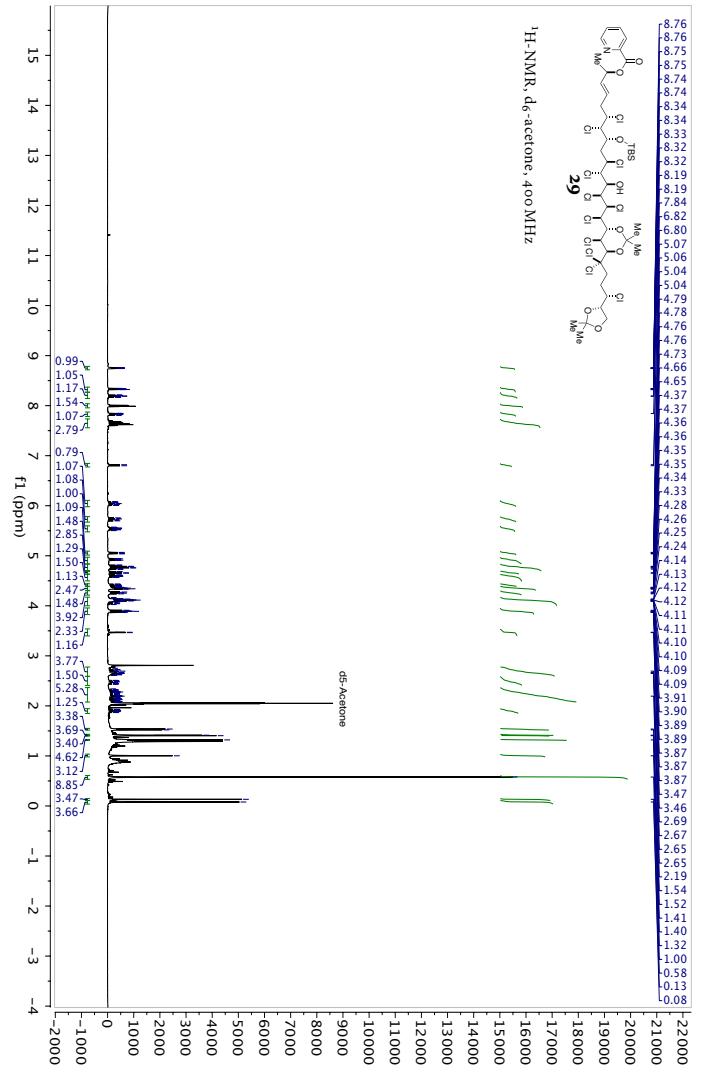
Chapter 3. NMR Spectra



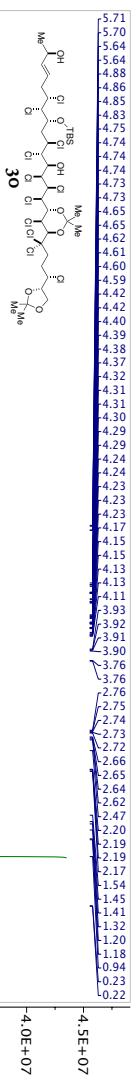
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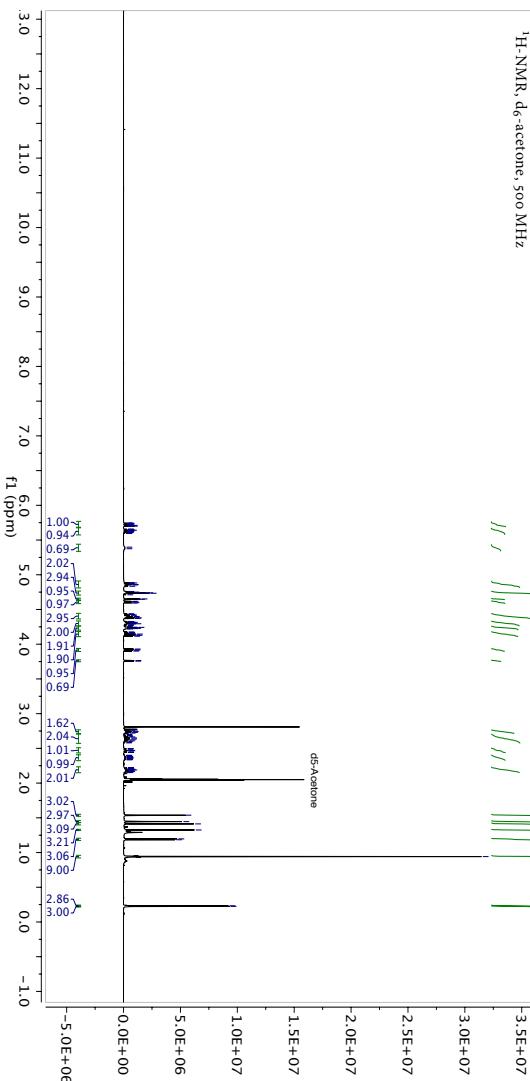
^{13}C -NMR, d_6 -acetone, 101 MHz



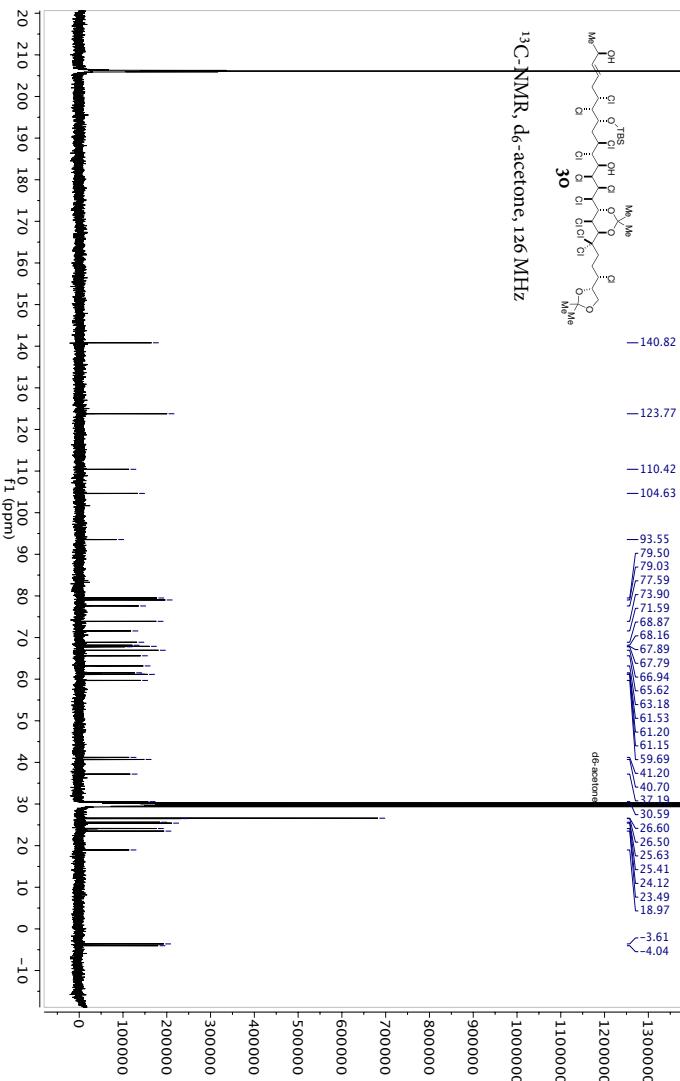
Chapter 3. NMR Spectra



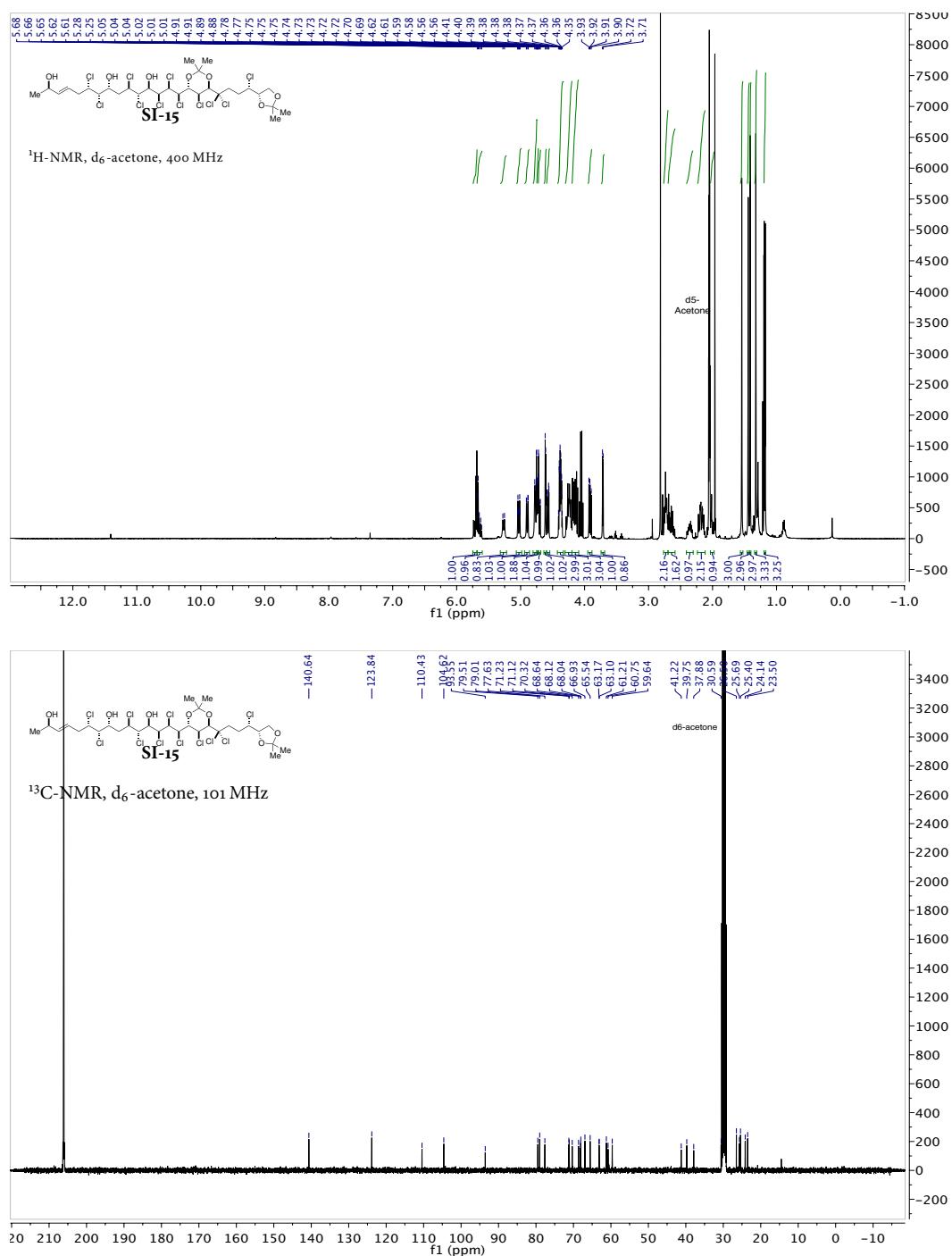
^1H -NMR, d_6 -acetone, 500 MHz



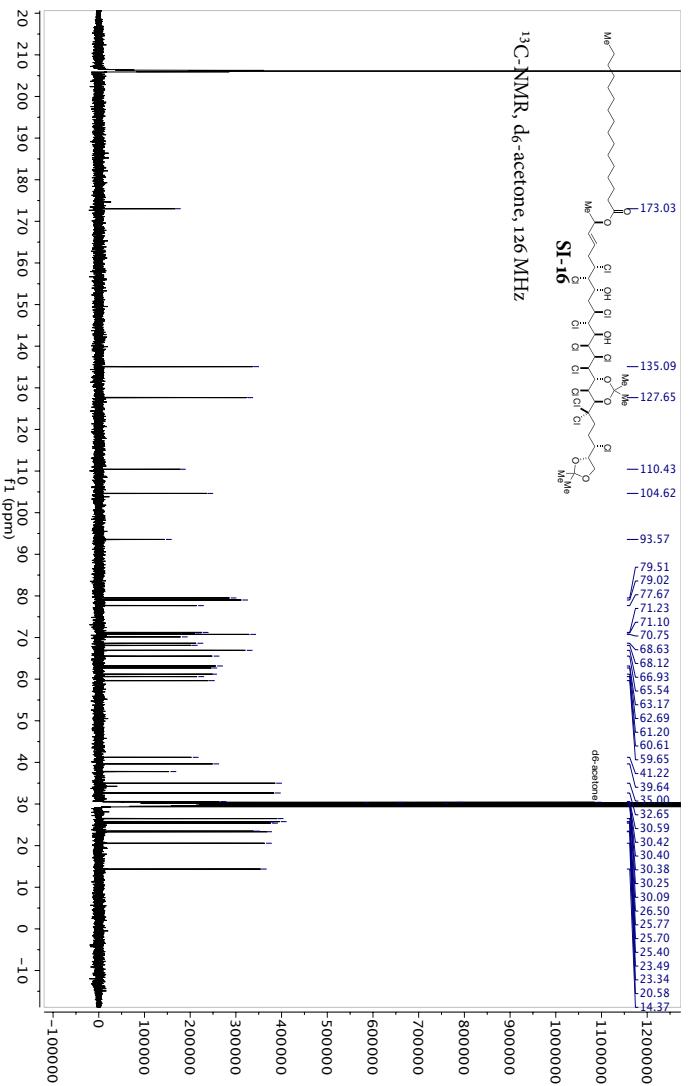
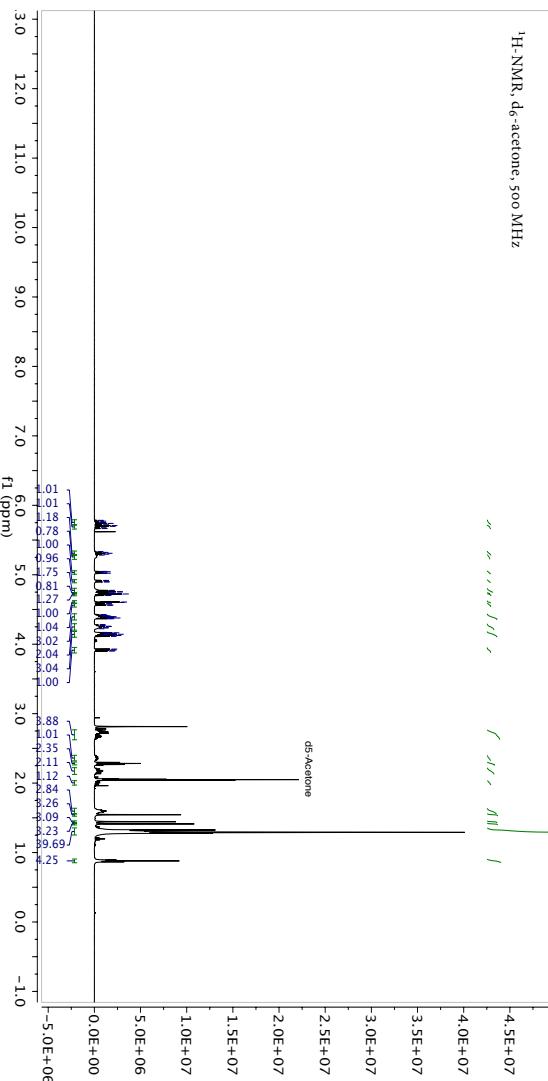
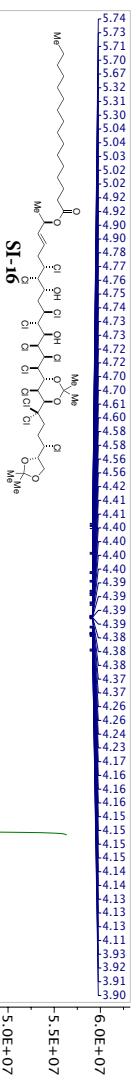
^{13}C -NMR, d_6 -acetone, 126 MHz



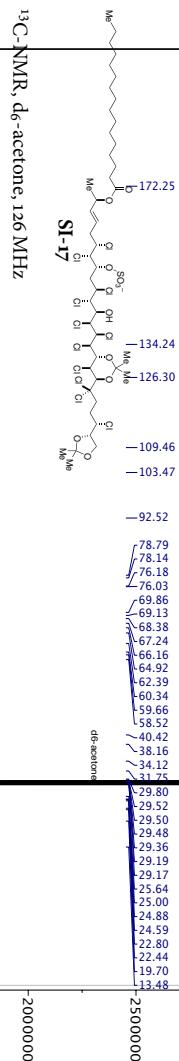
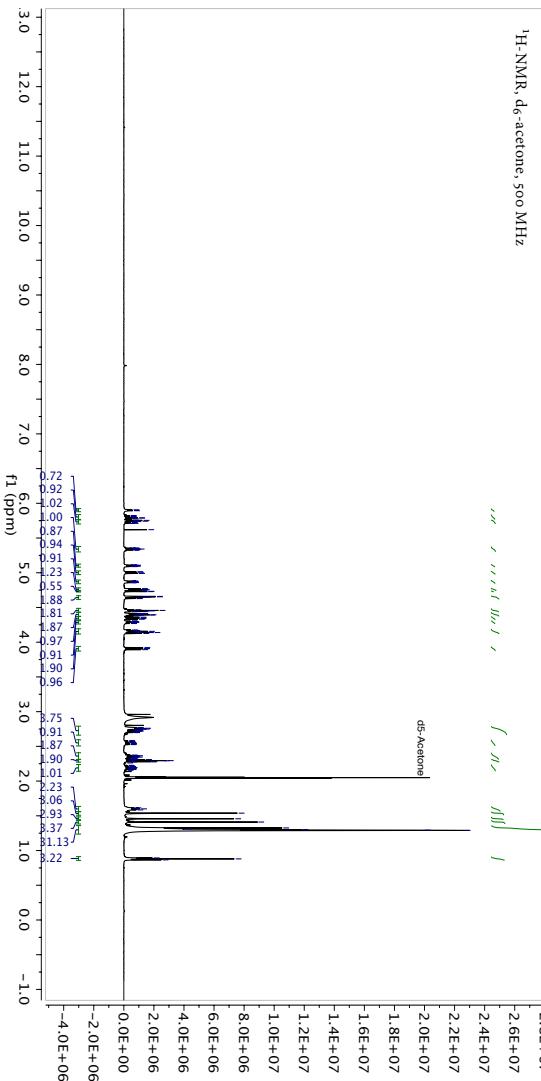
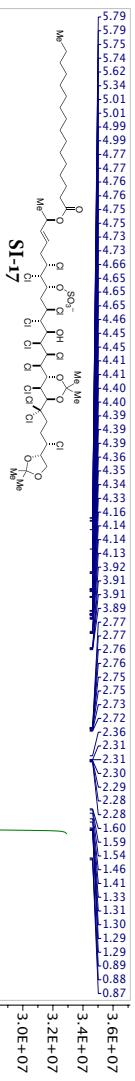
Chapter 3. NMR Spectra



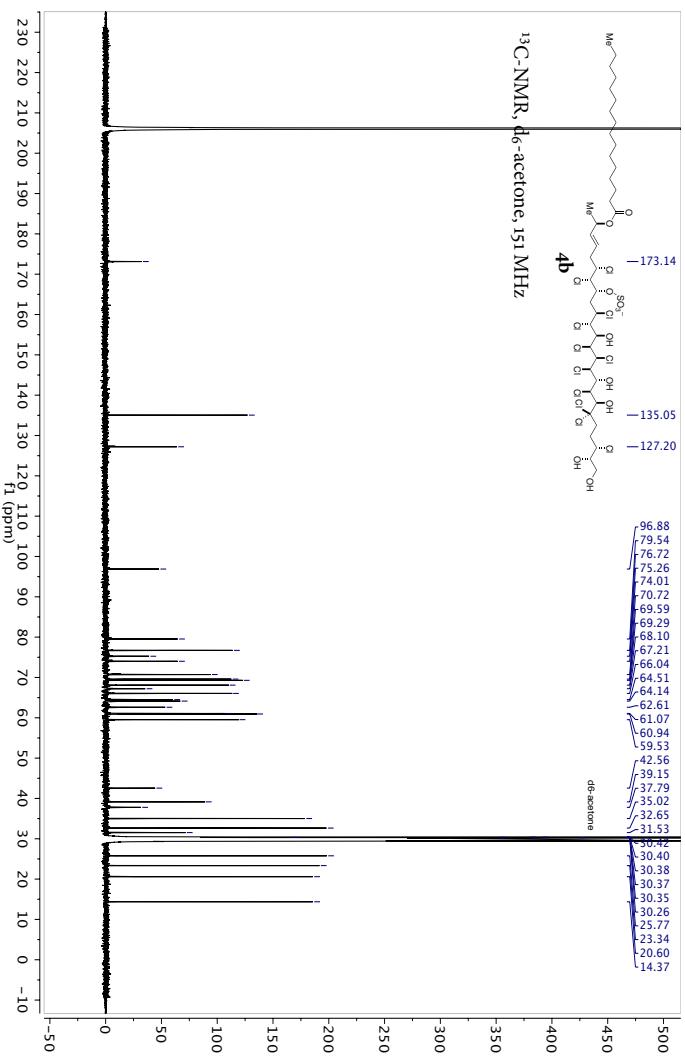
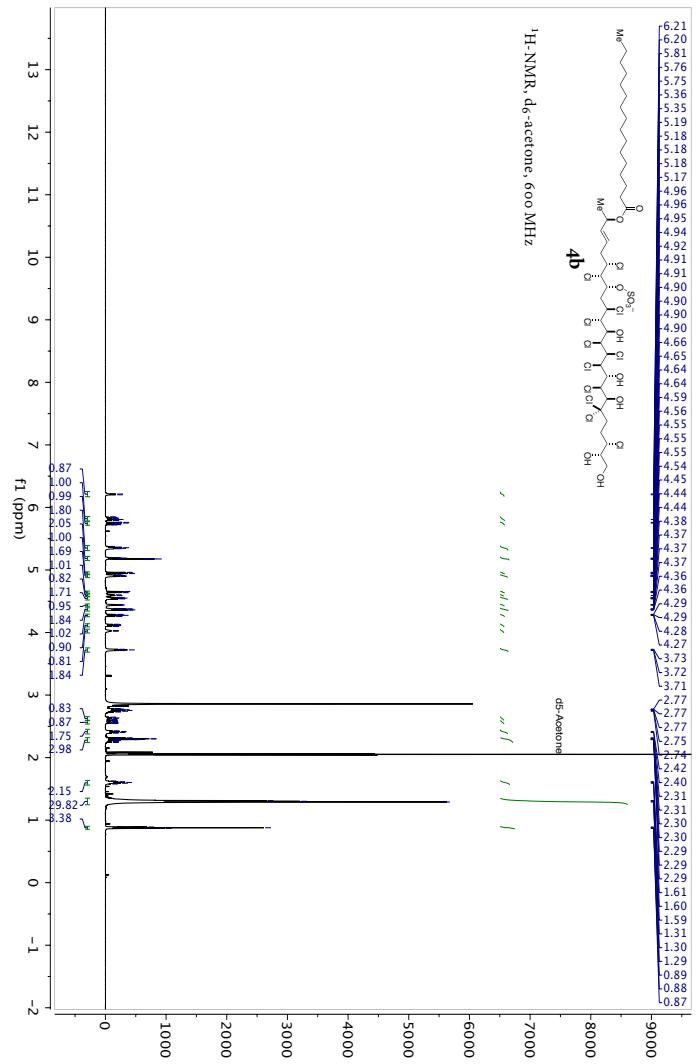
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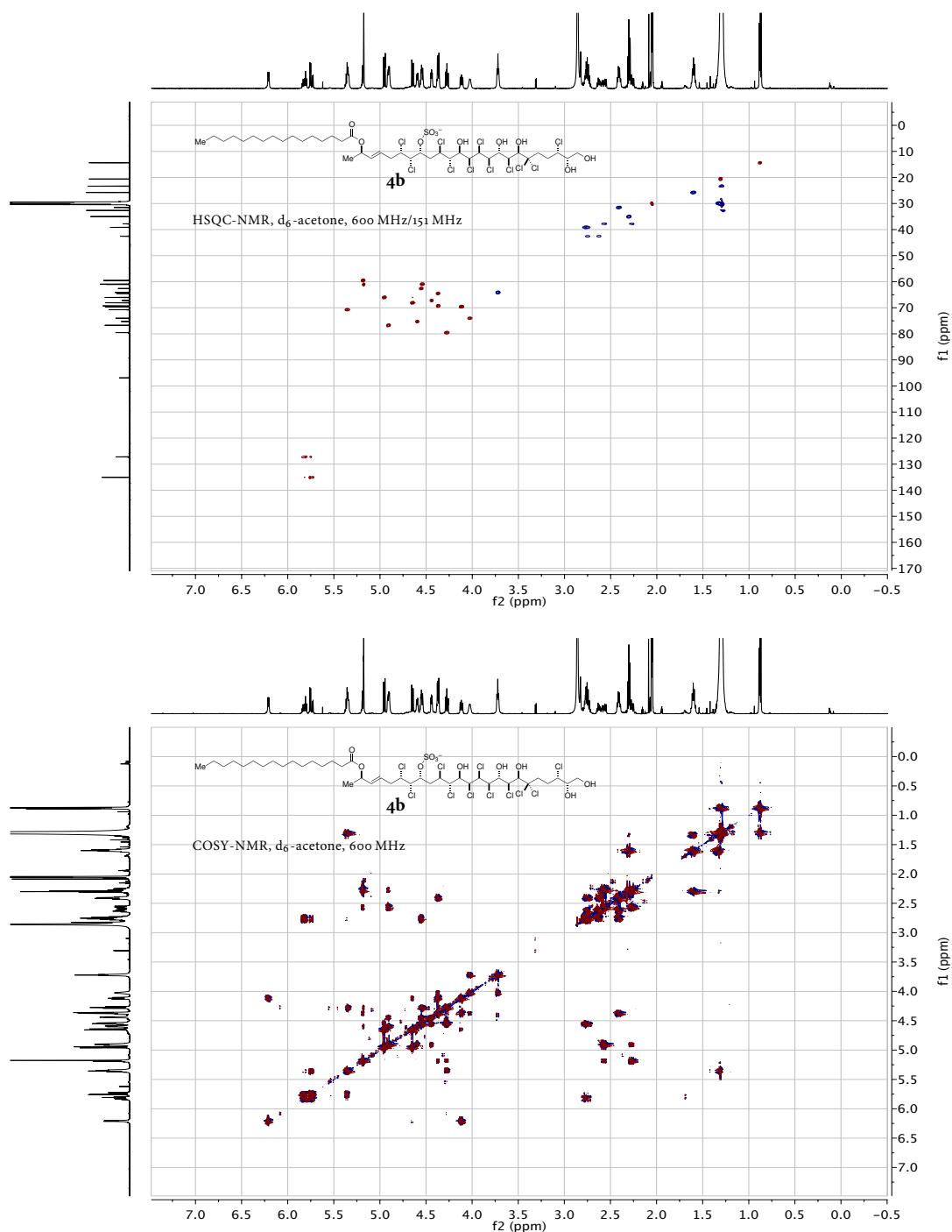


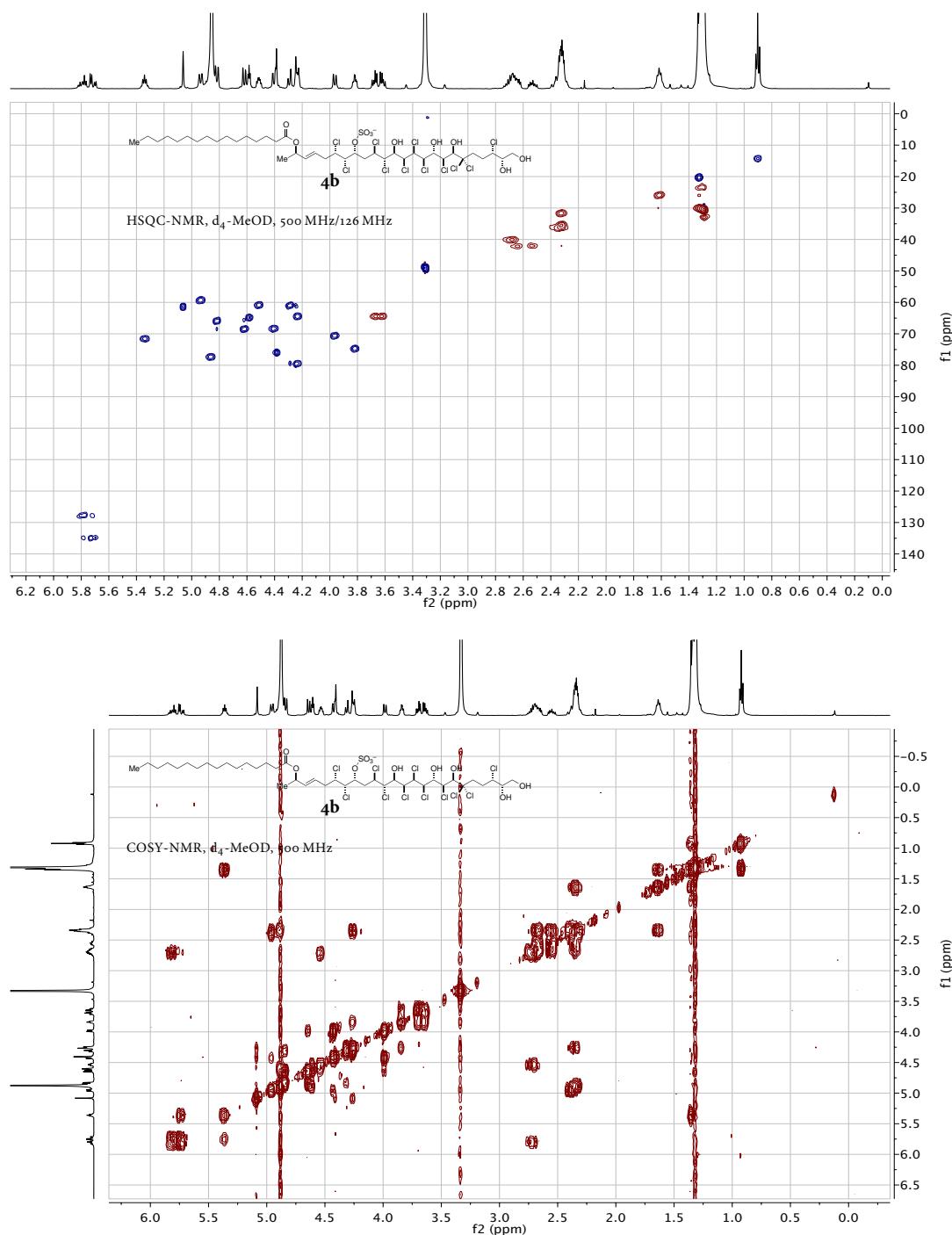
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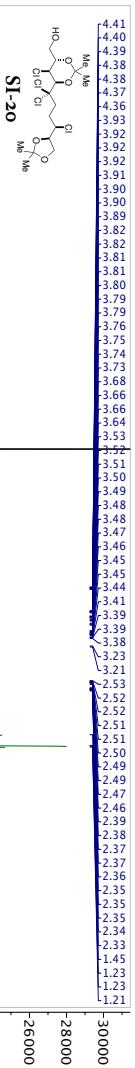
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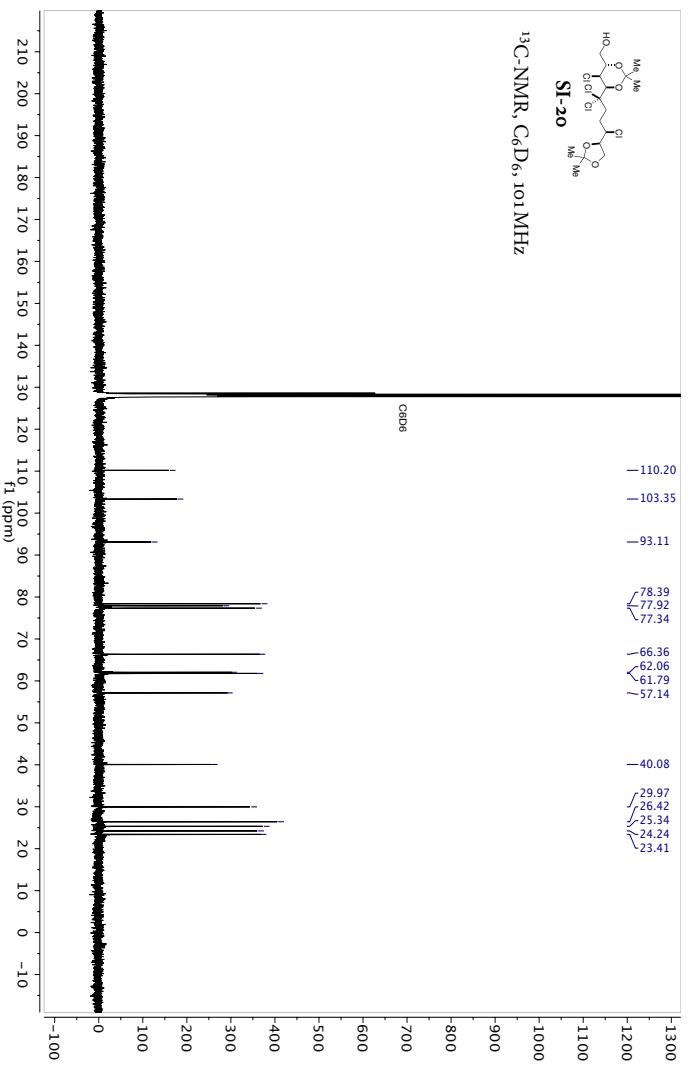
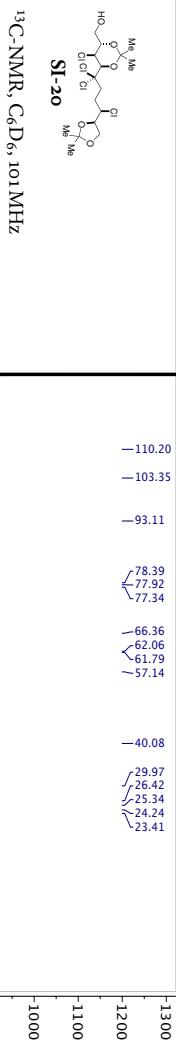
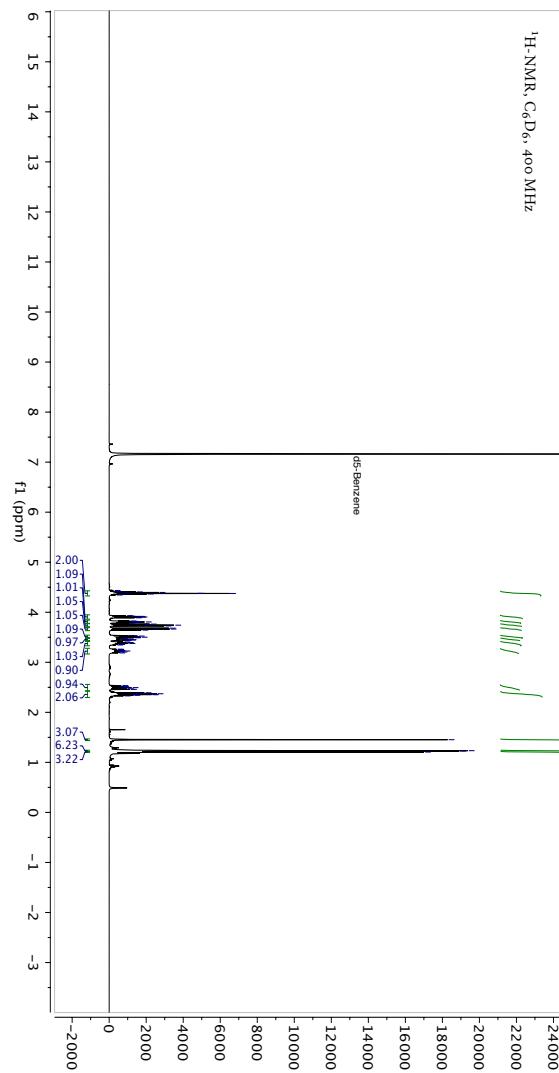




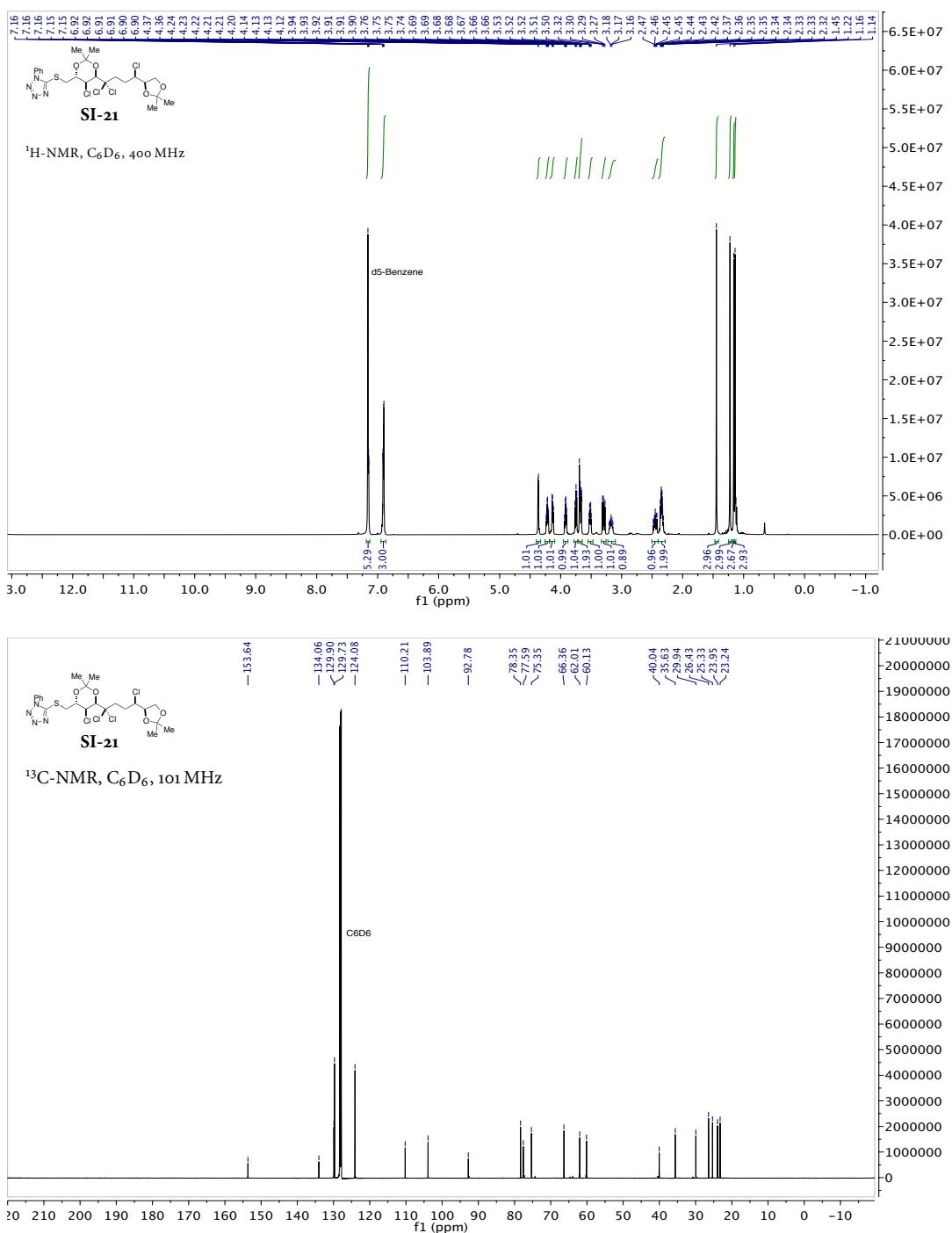
Chapter 3. NMR Spectra



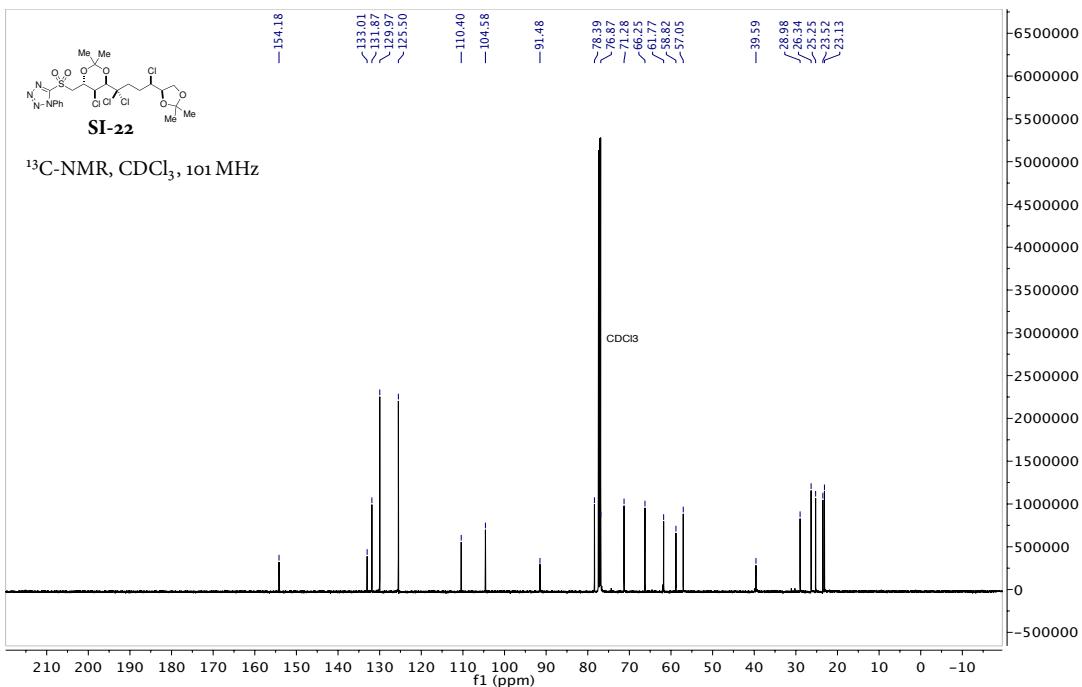
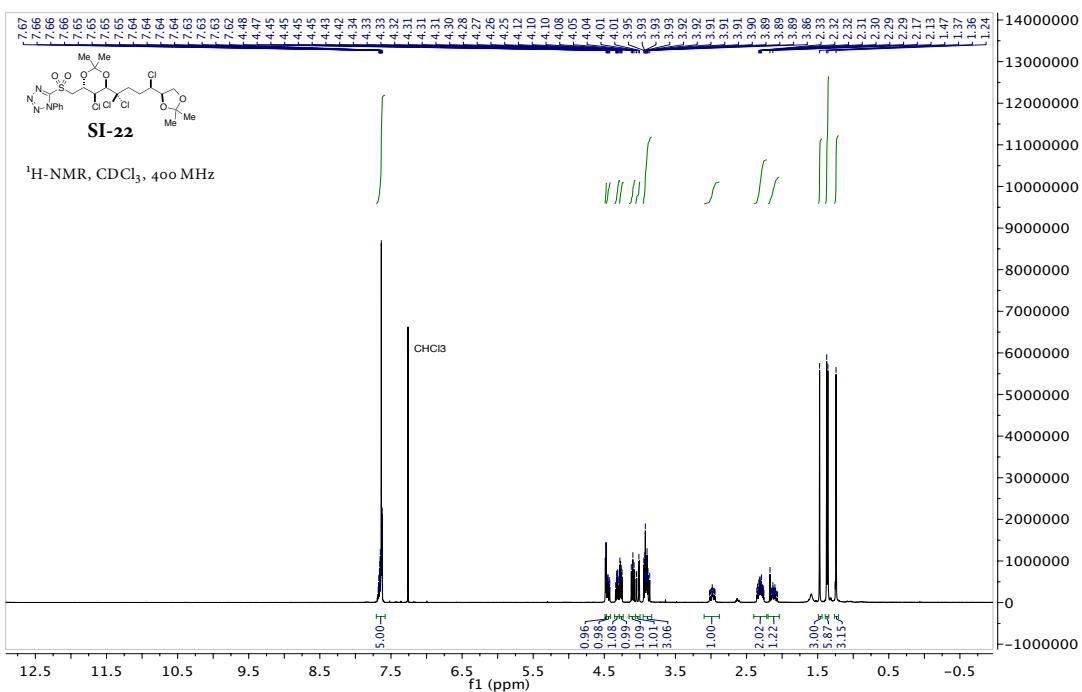
¹H-NMR, C₆D₆, 400 MHz



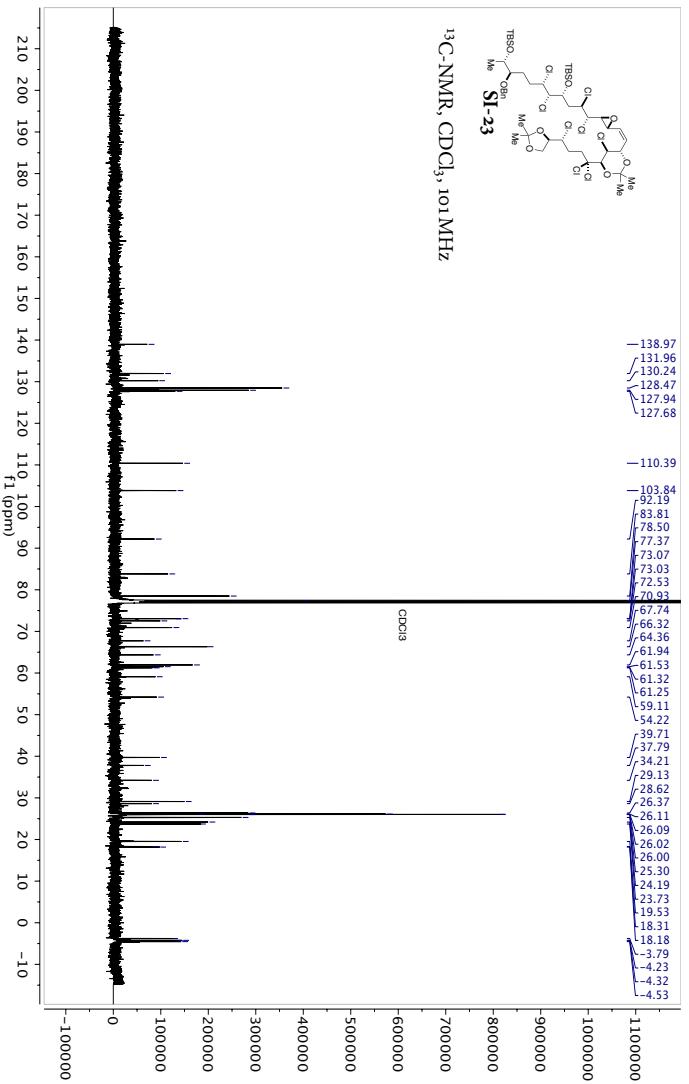
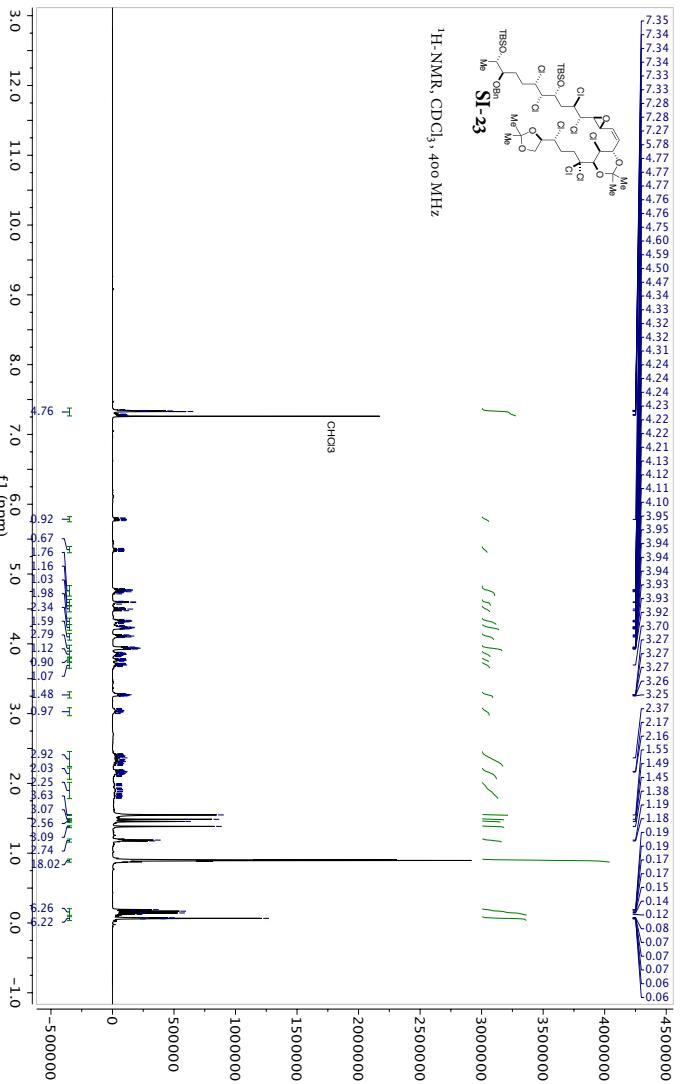
Chapter 3. NMR Spectra

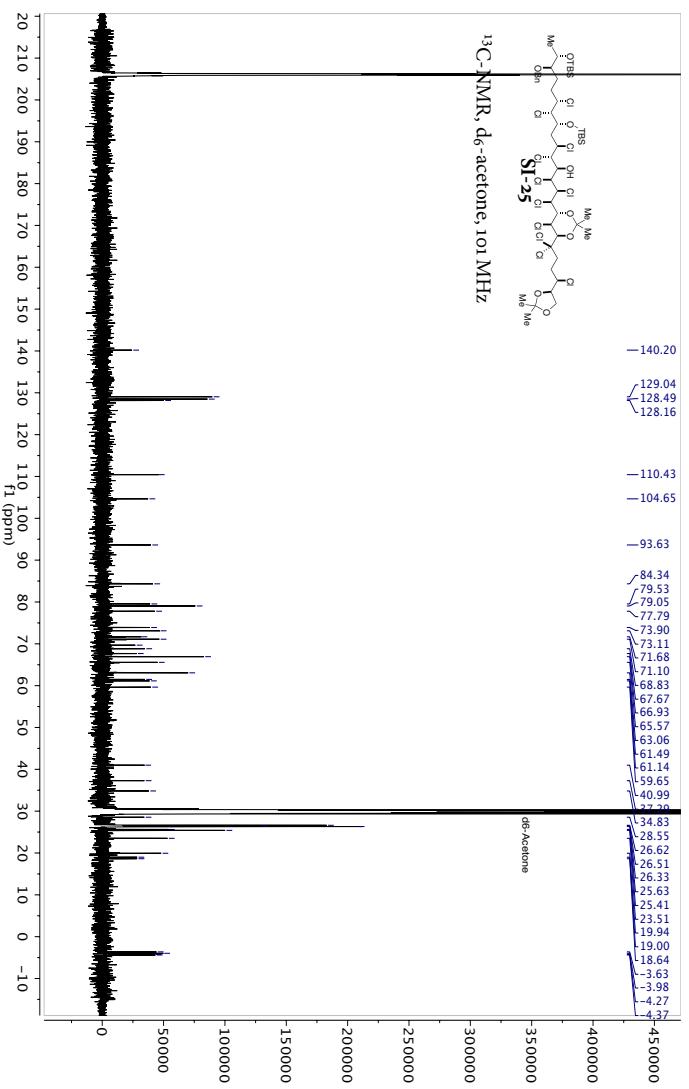
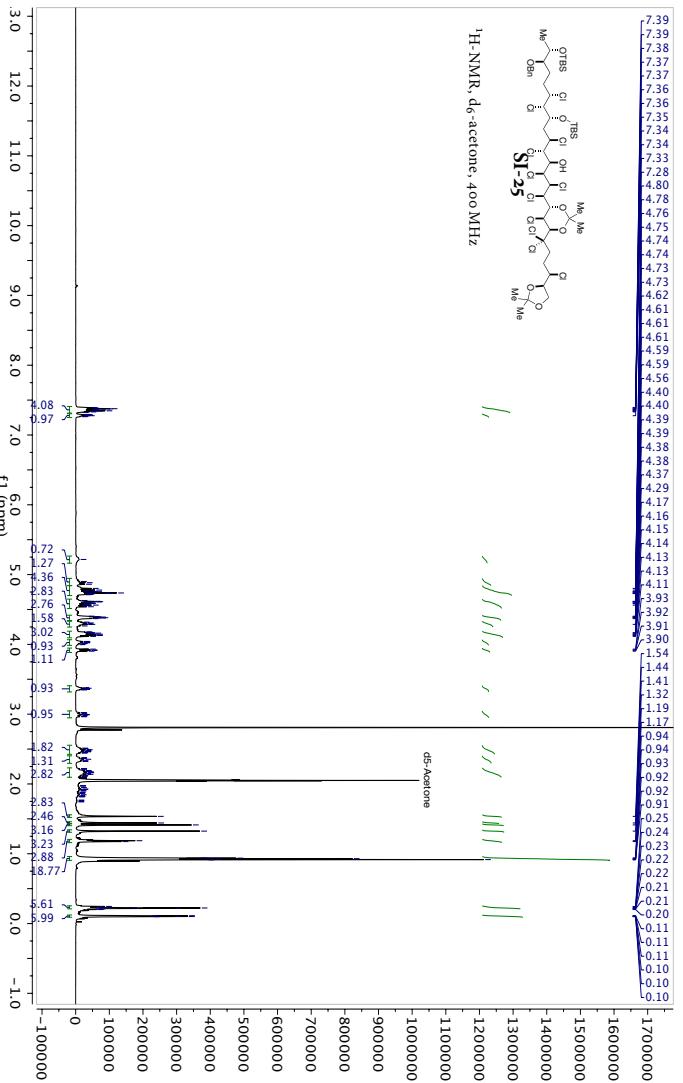


Chapter 3. NMR Spectra

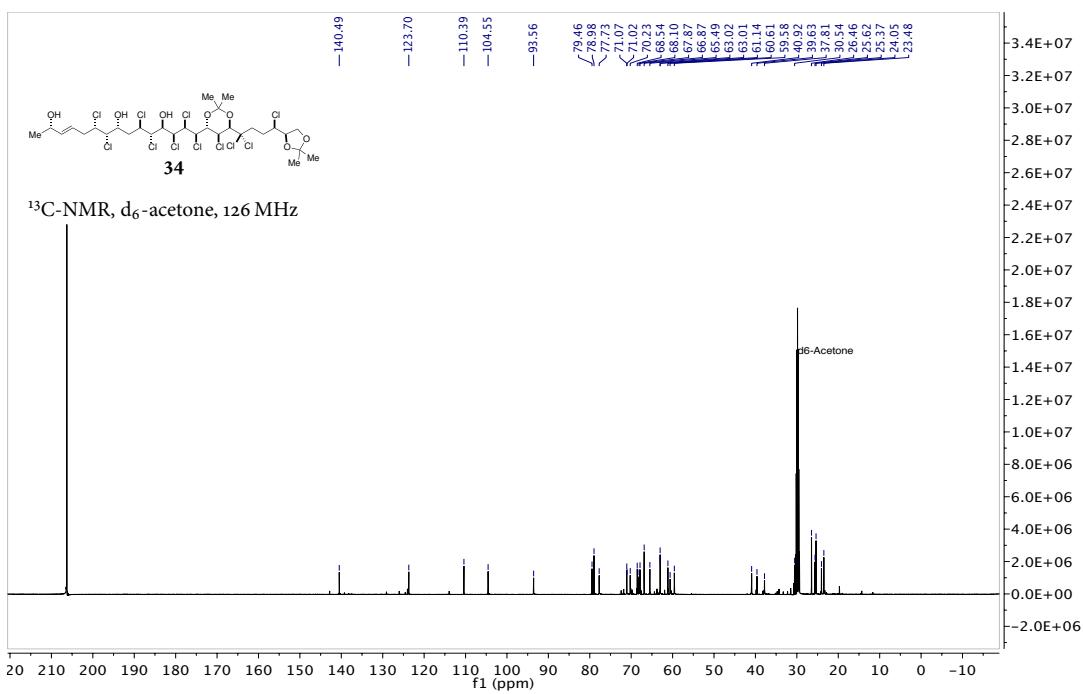
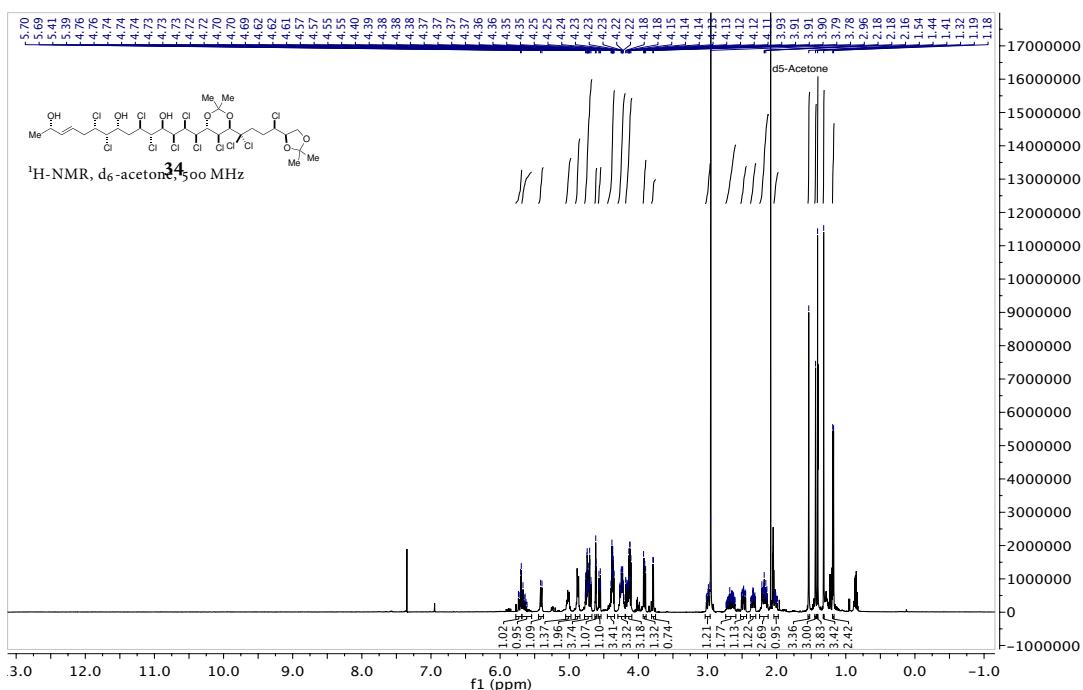


Chapter 3. NMR Spectra

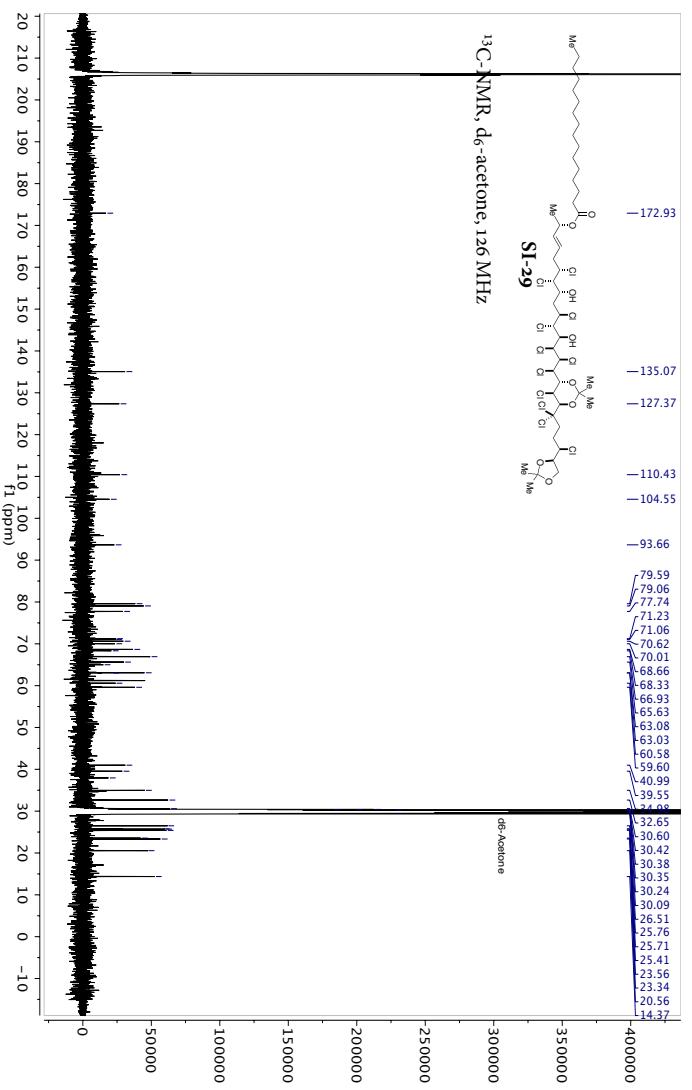
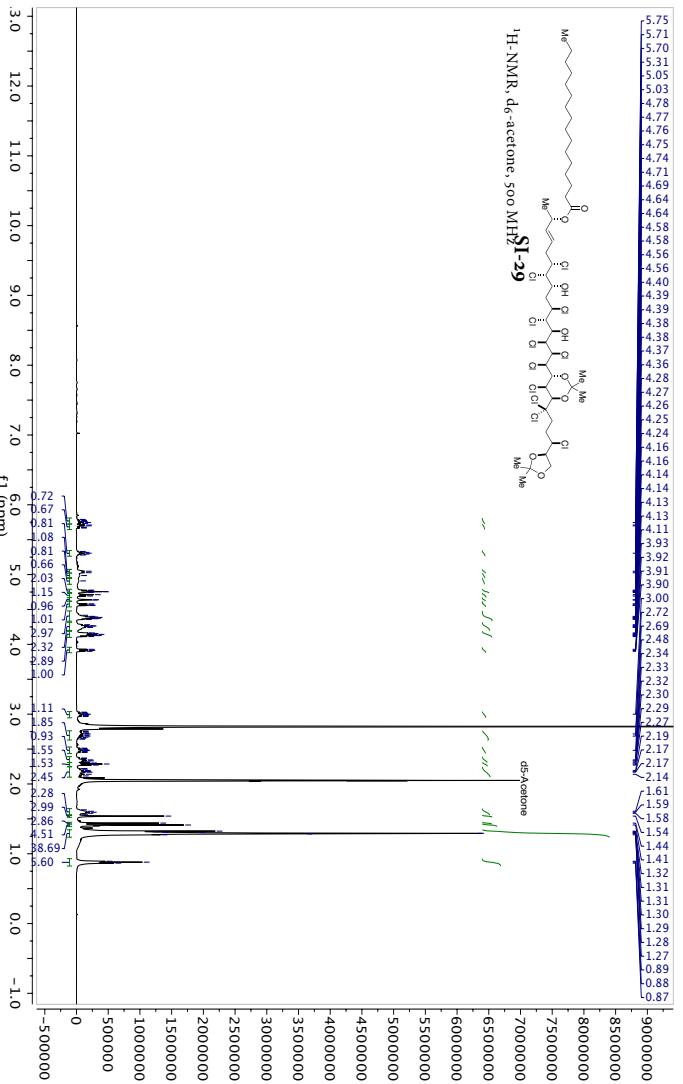


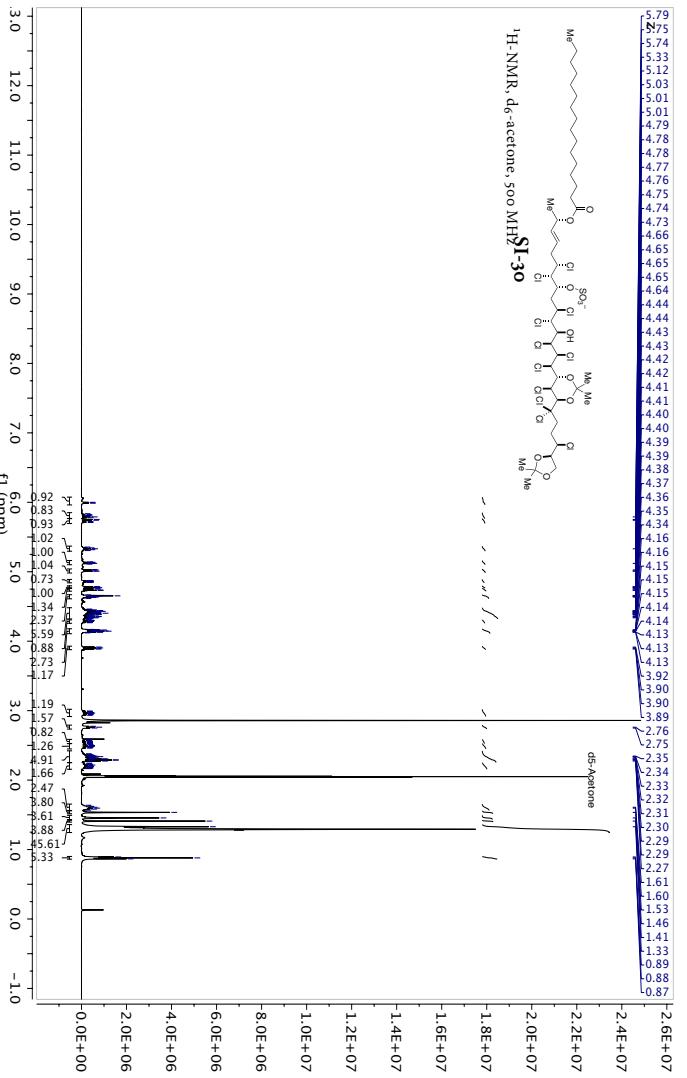


Chapter 3. NMR Spectra



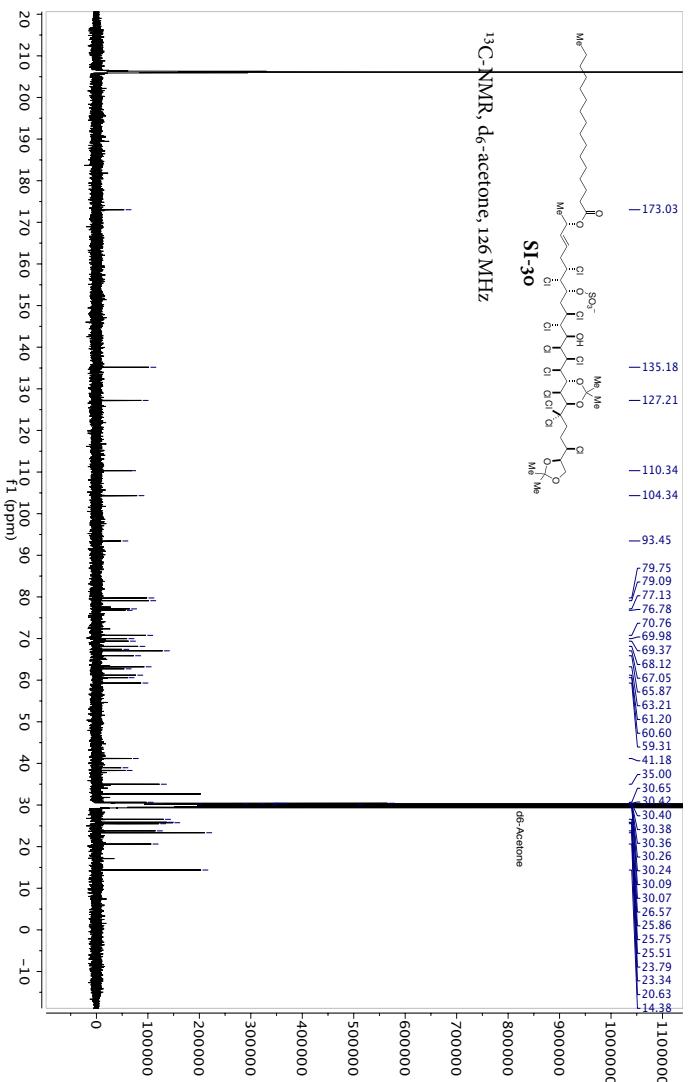
Chapter 3. NMR Spectra



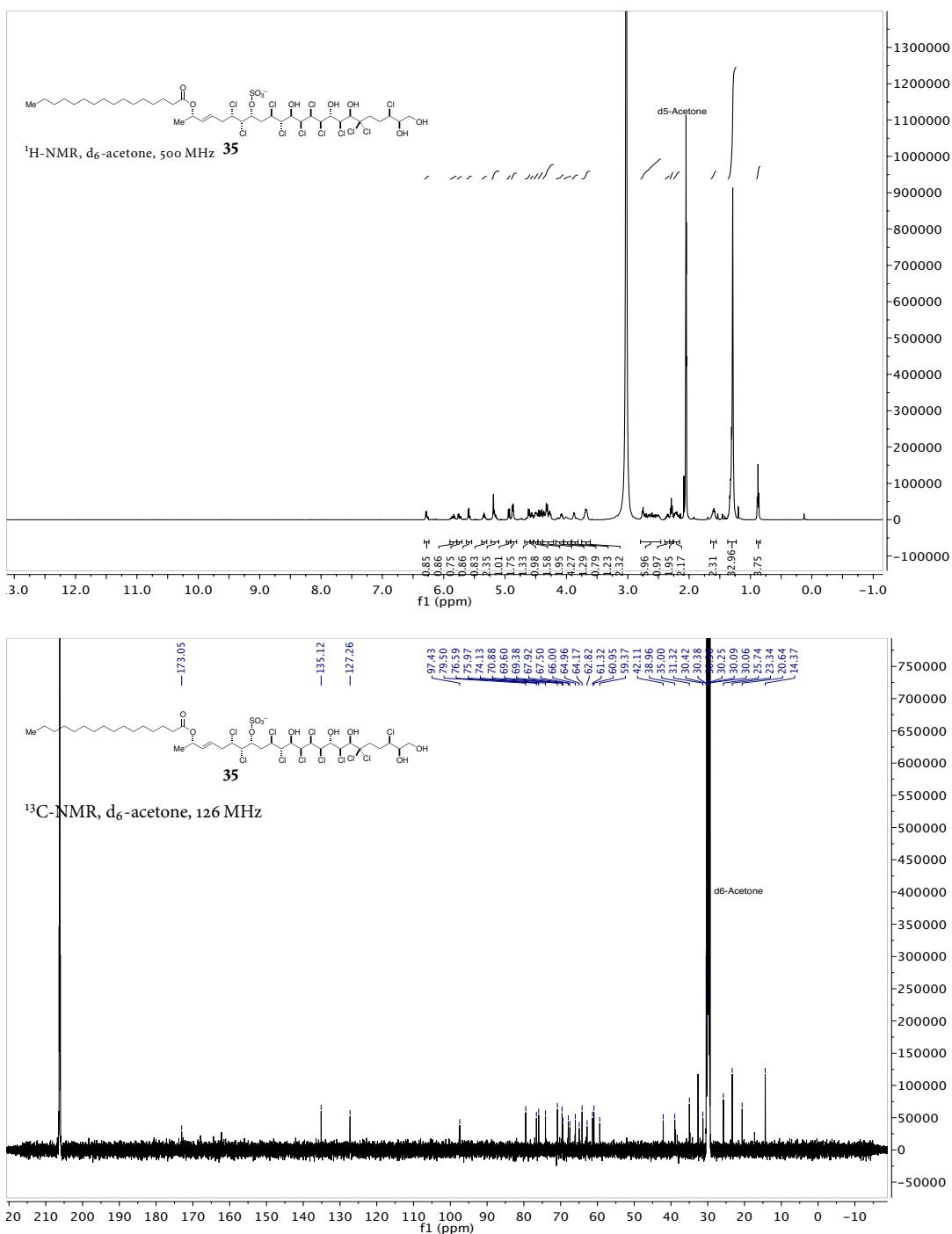


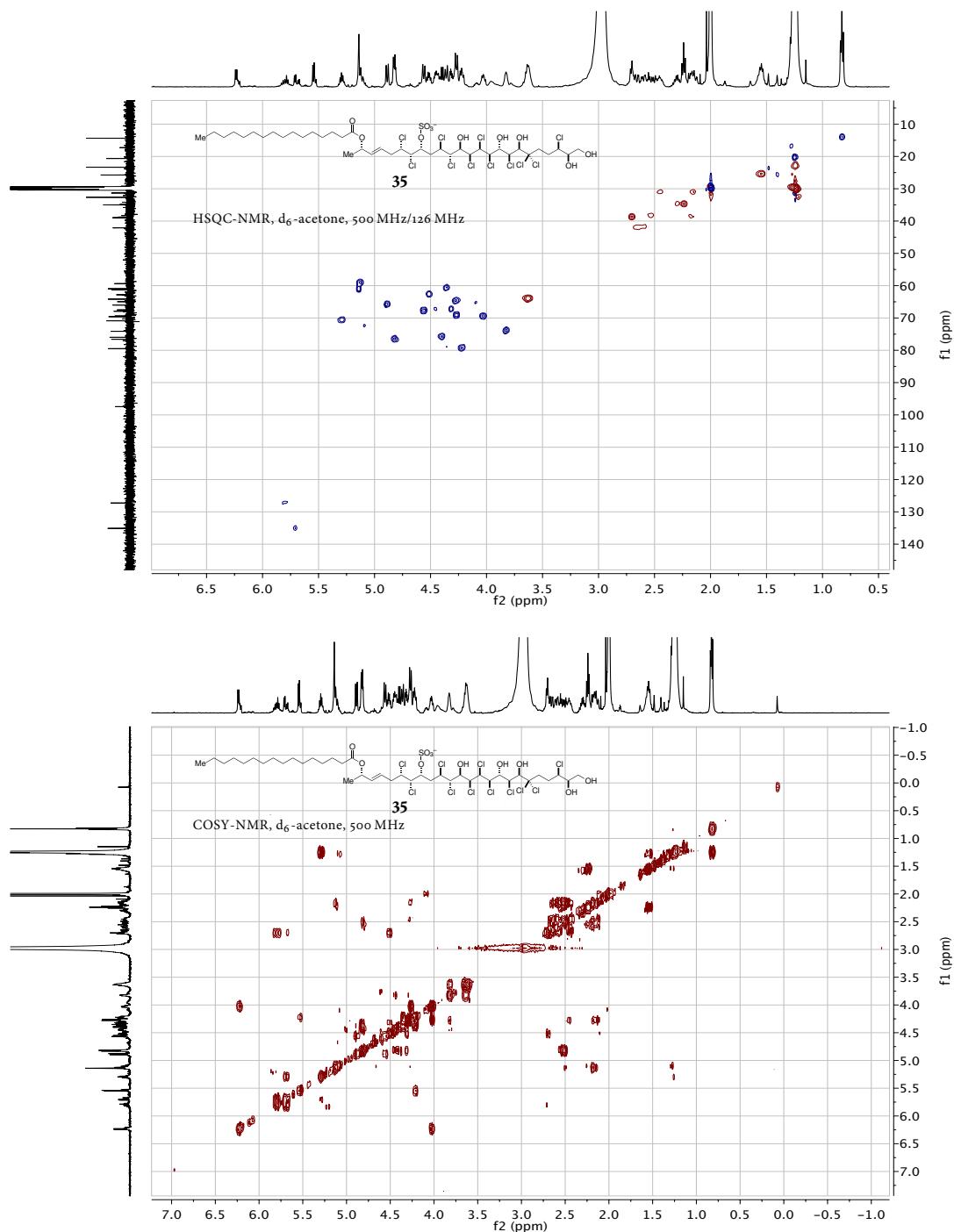
¹H-NMR, d₆-acetone, 500 MHz **SI-30**

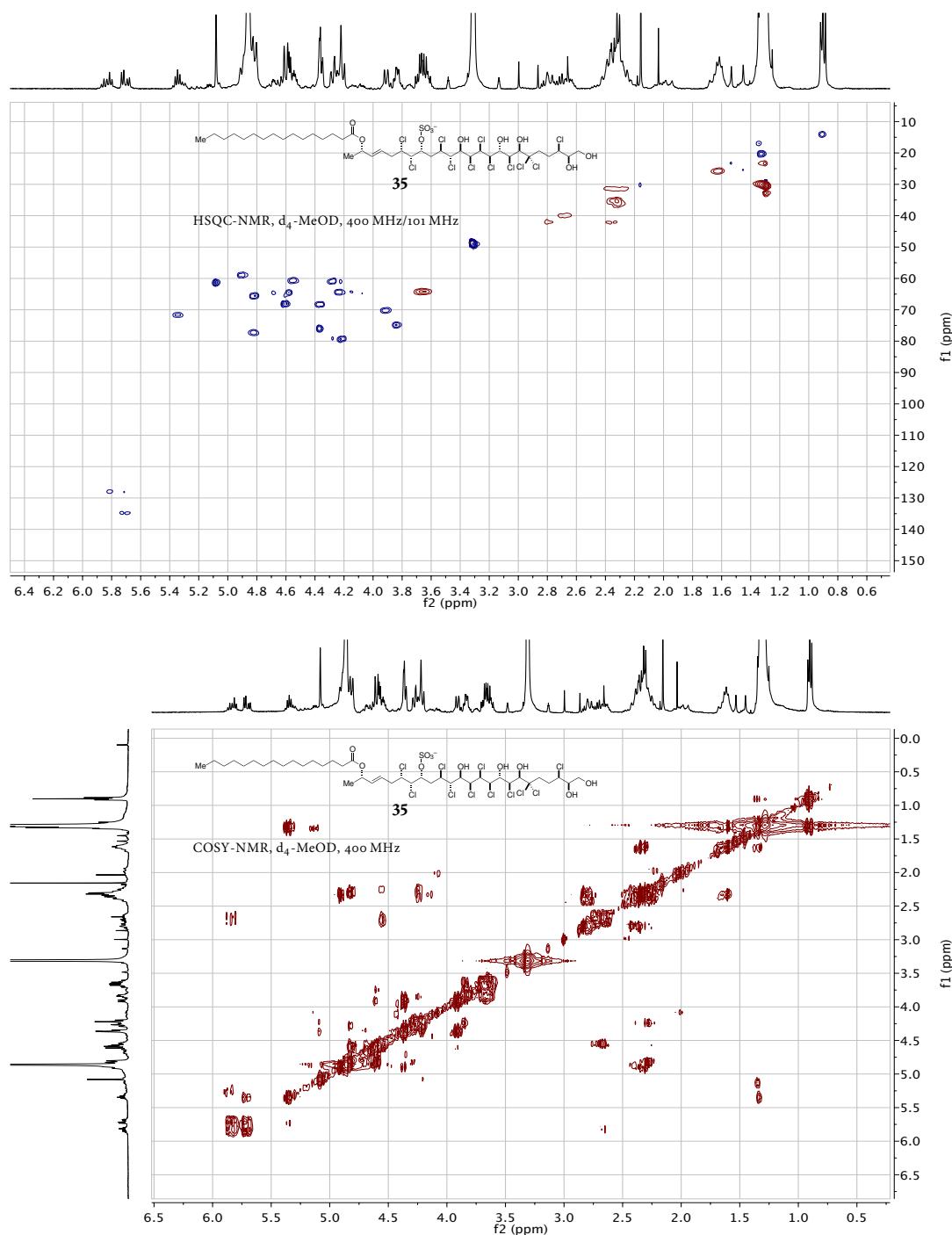
¹³C-NMR, d₆-acetone, 126 MHz



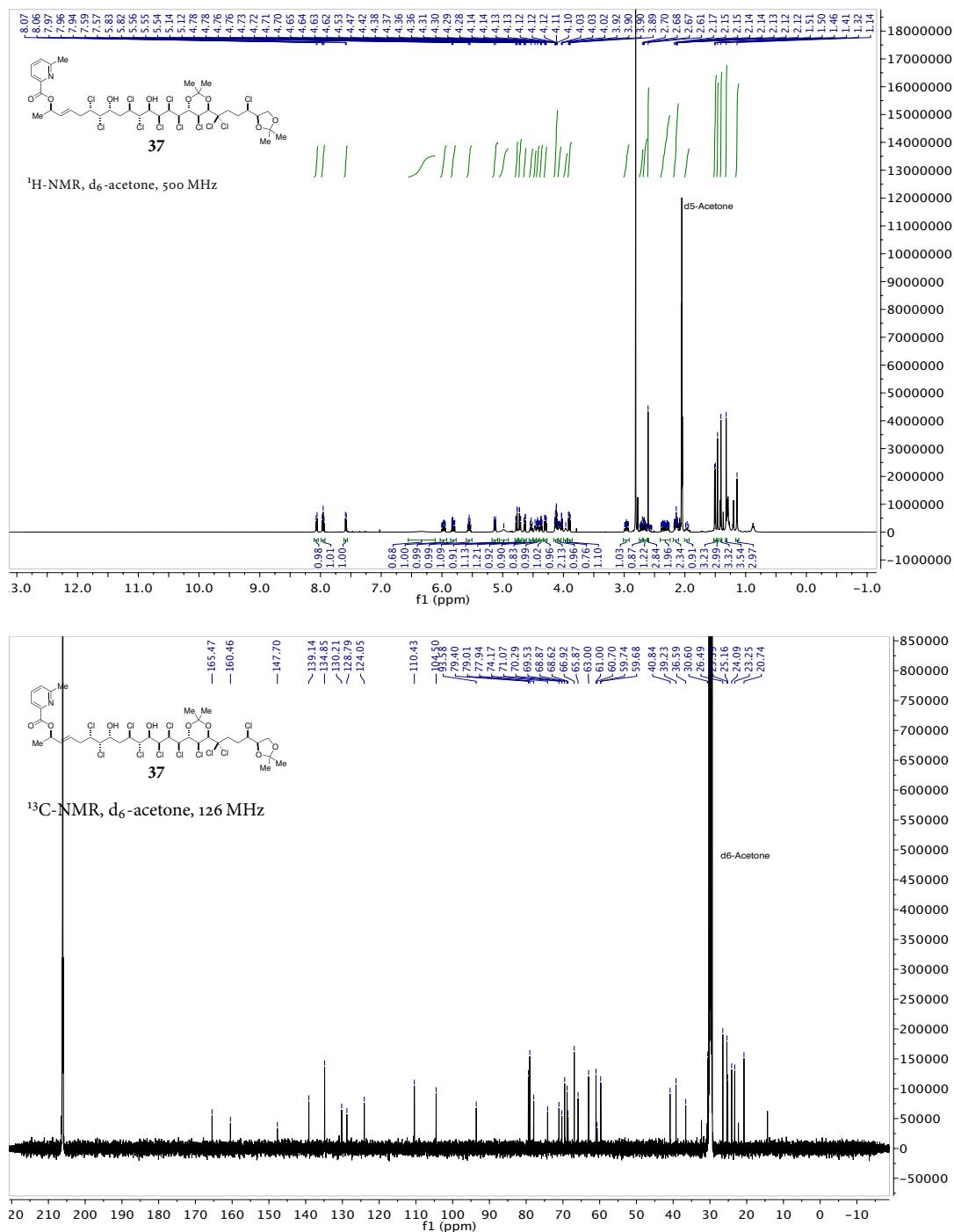
Chapter 3. NMR Spectra



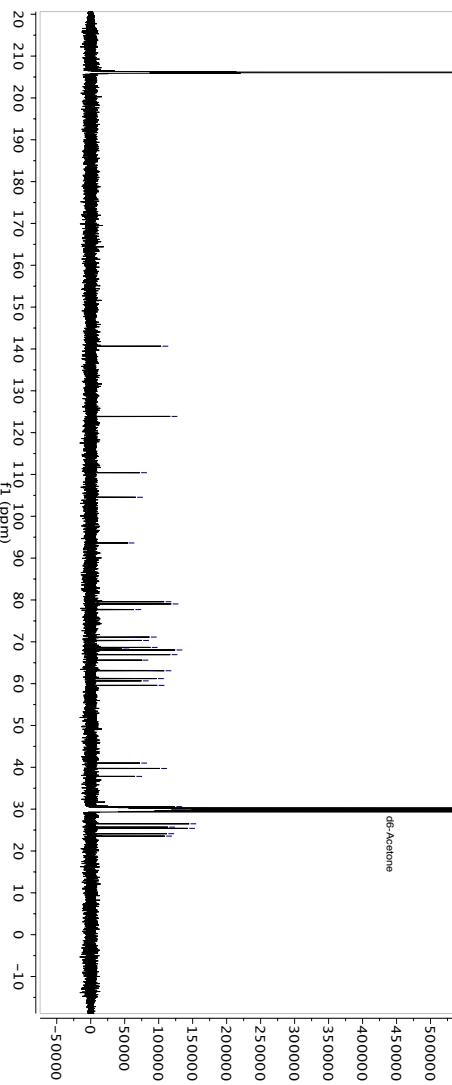
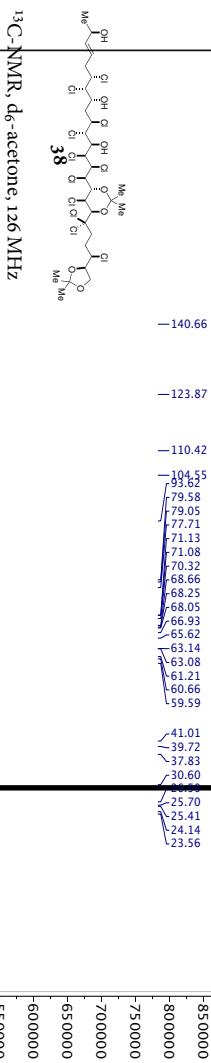
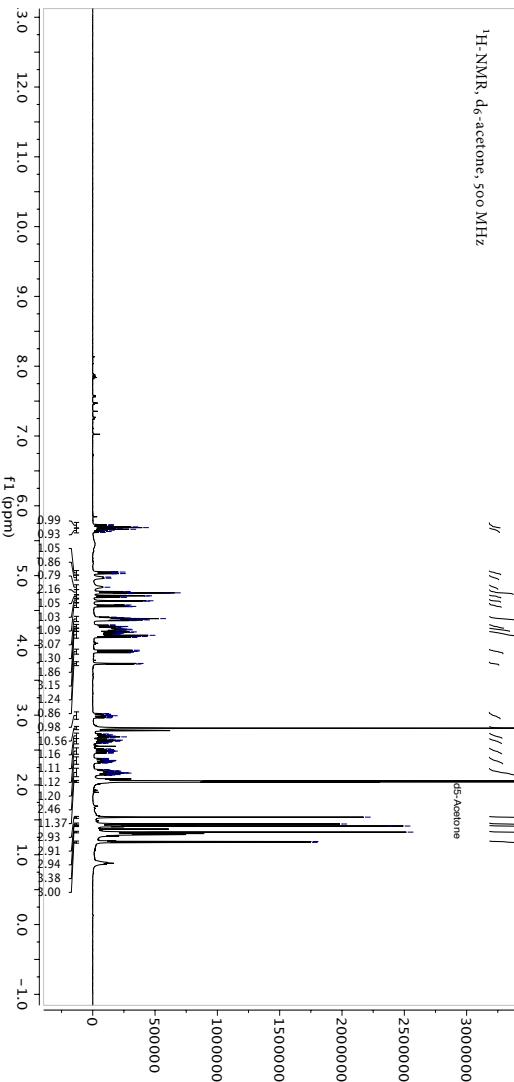
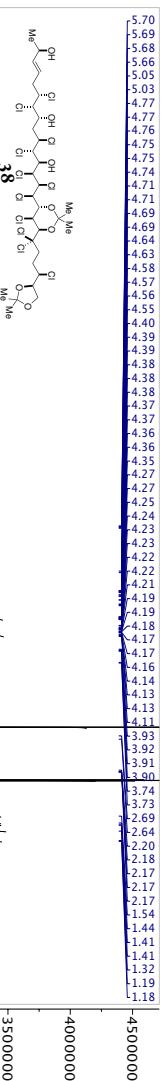


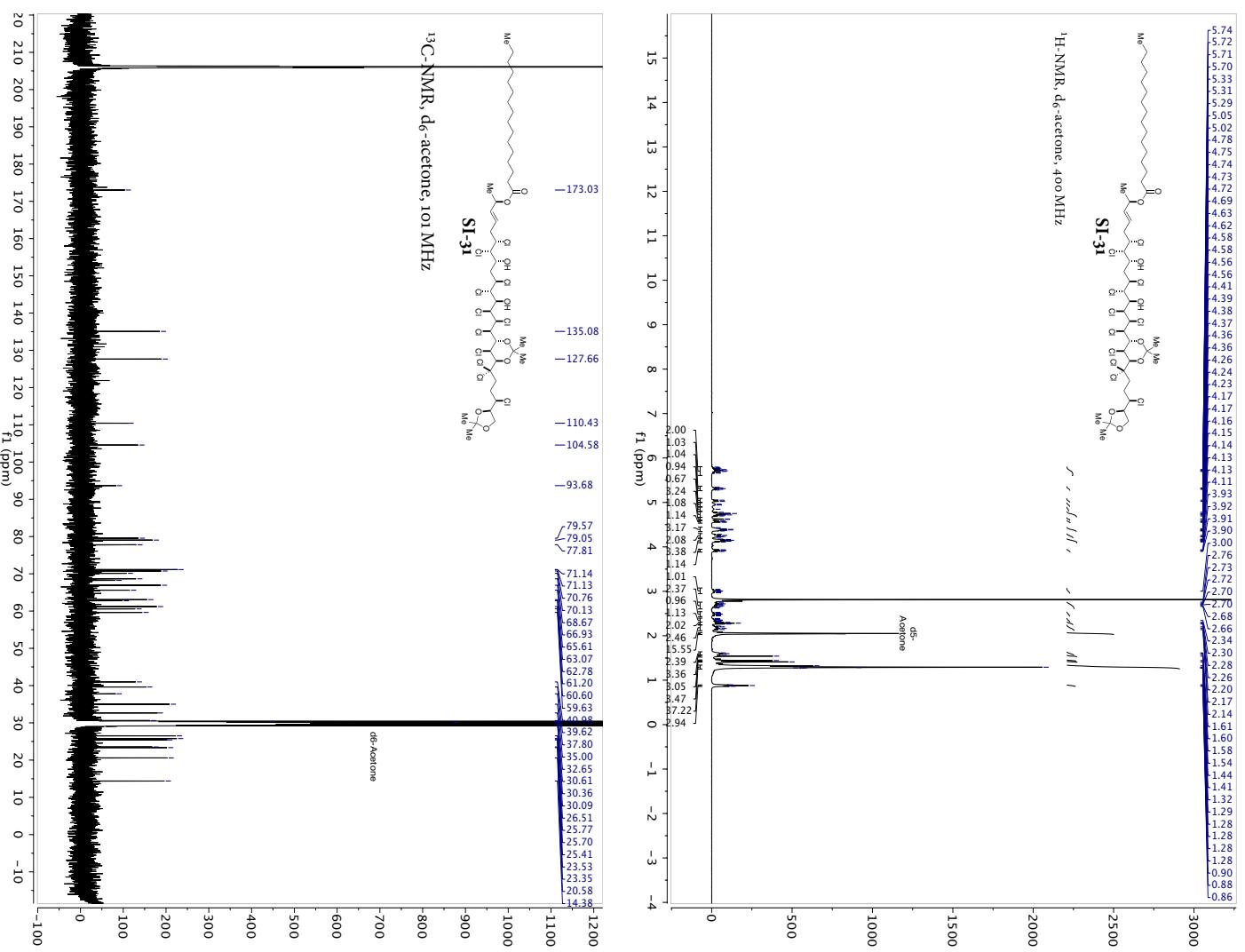


Chapter 3. NMR Spectra

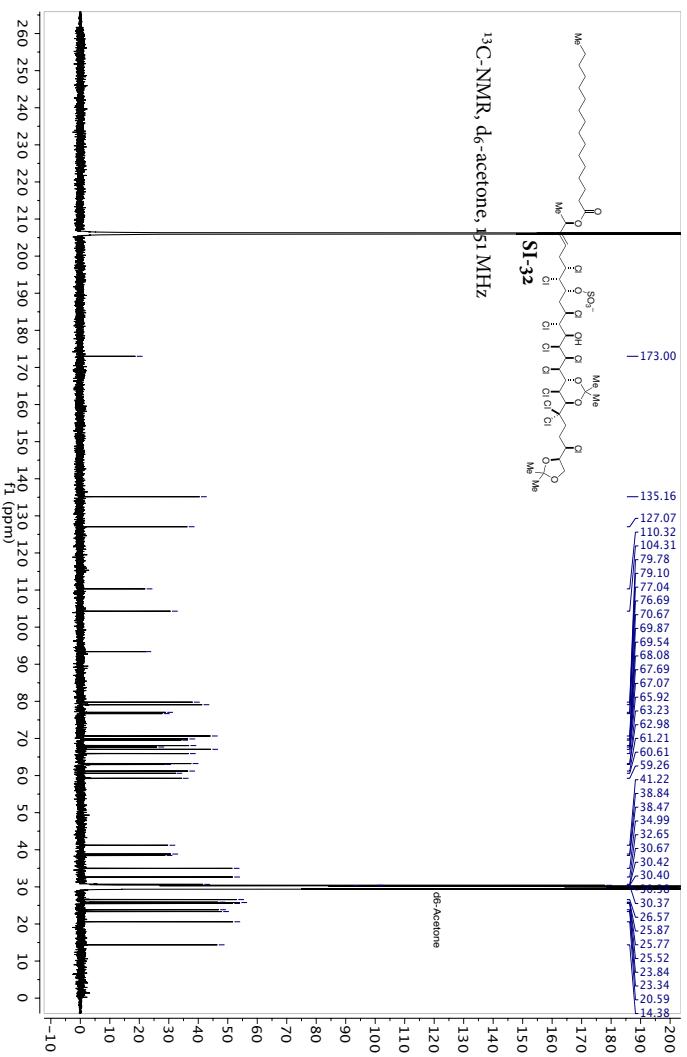
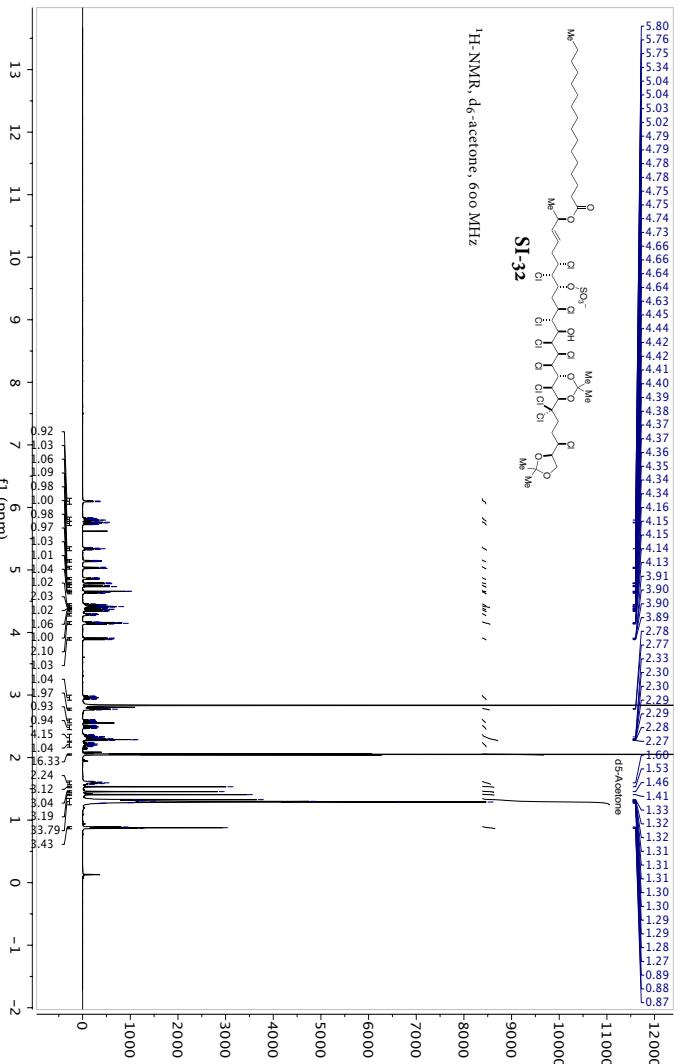


Chapter 3. NMR Spectra

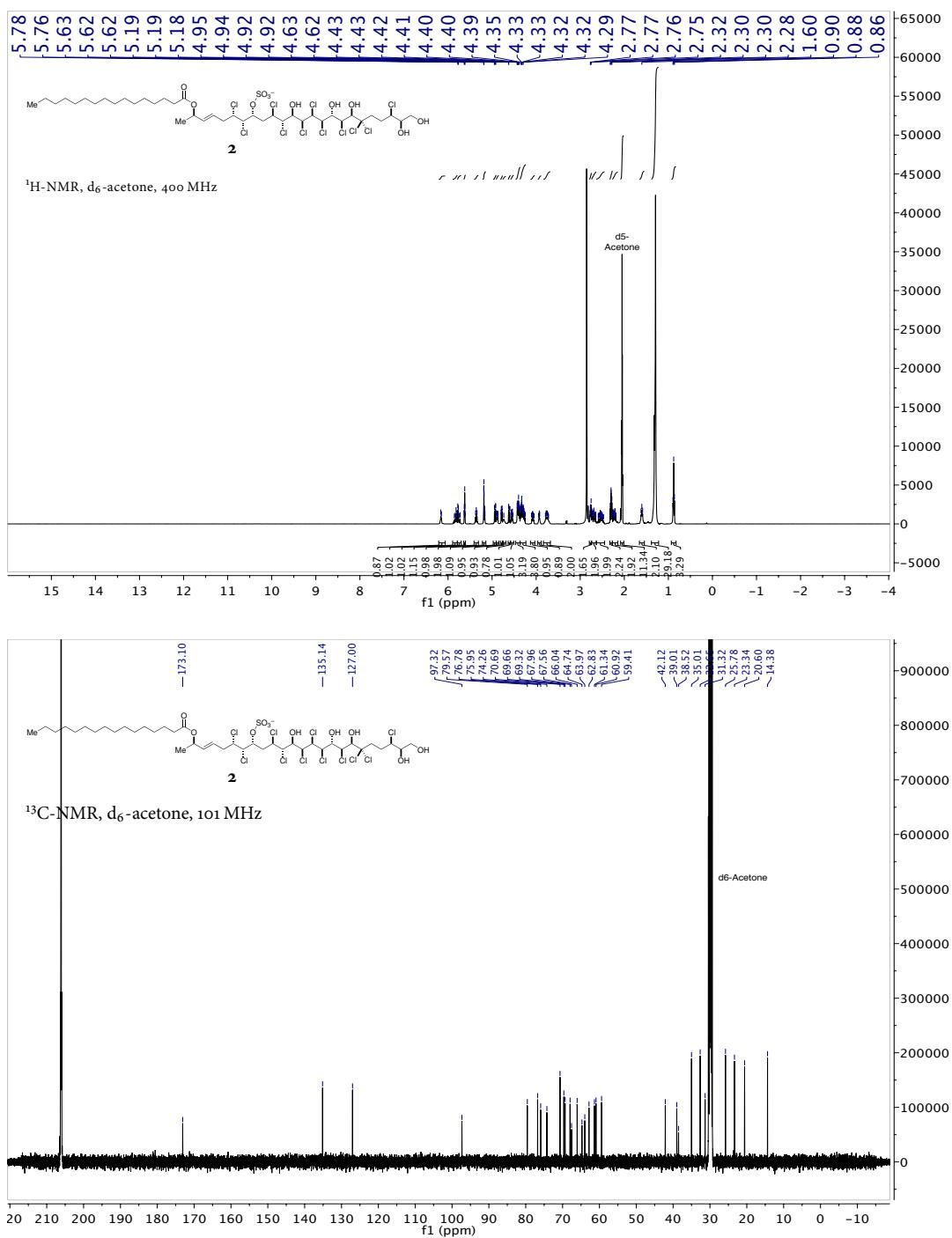


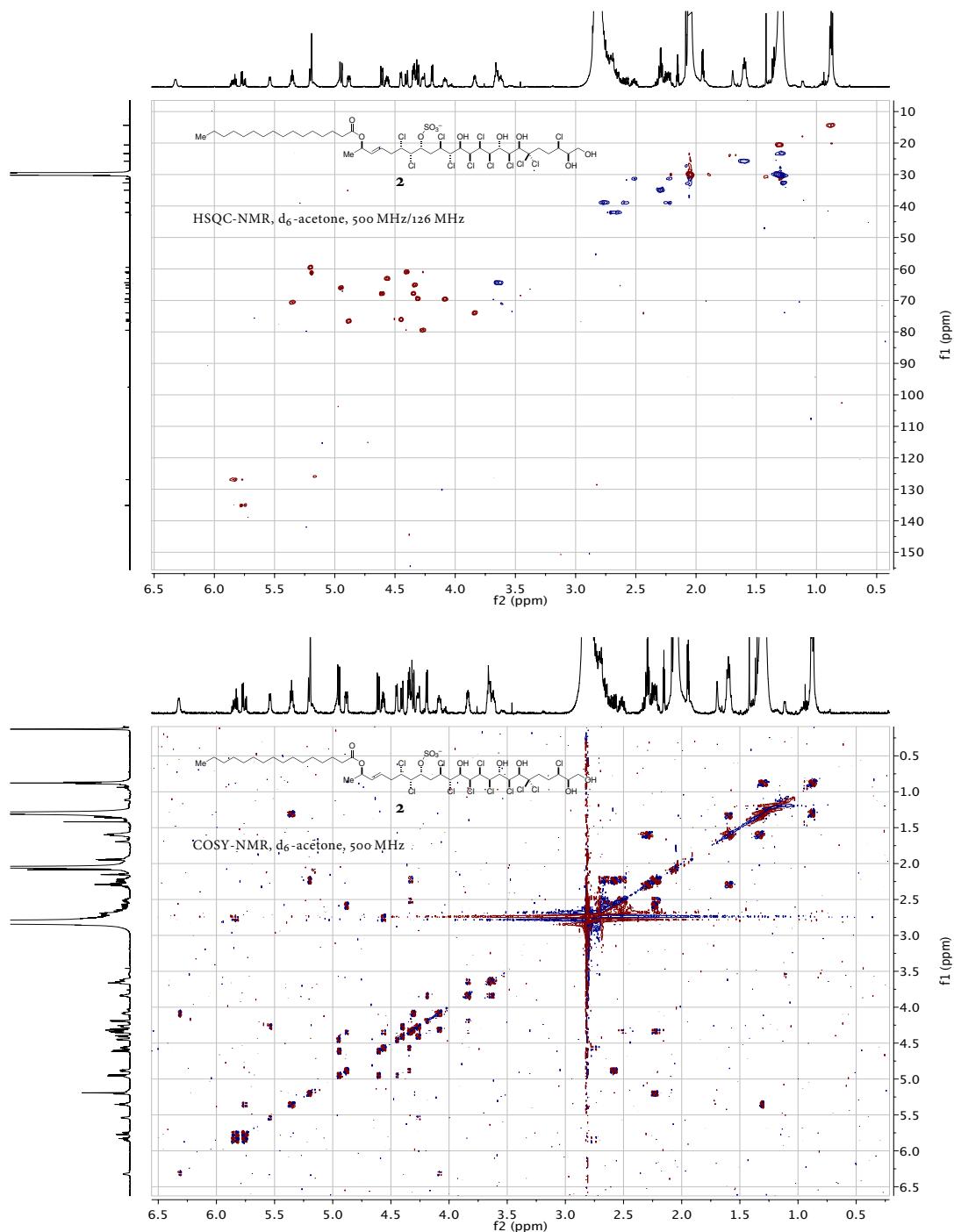


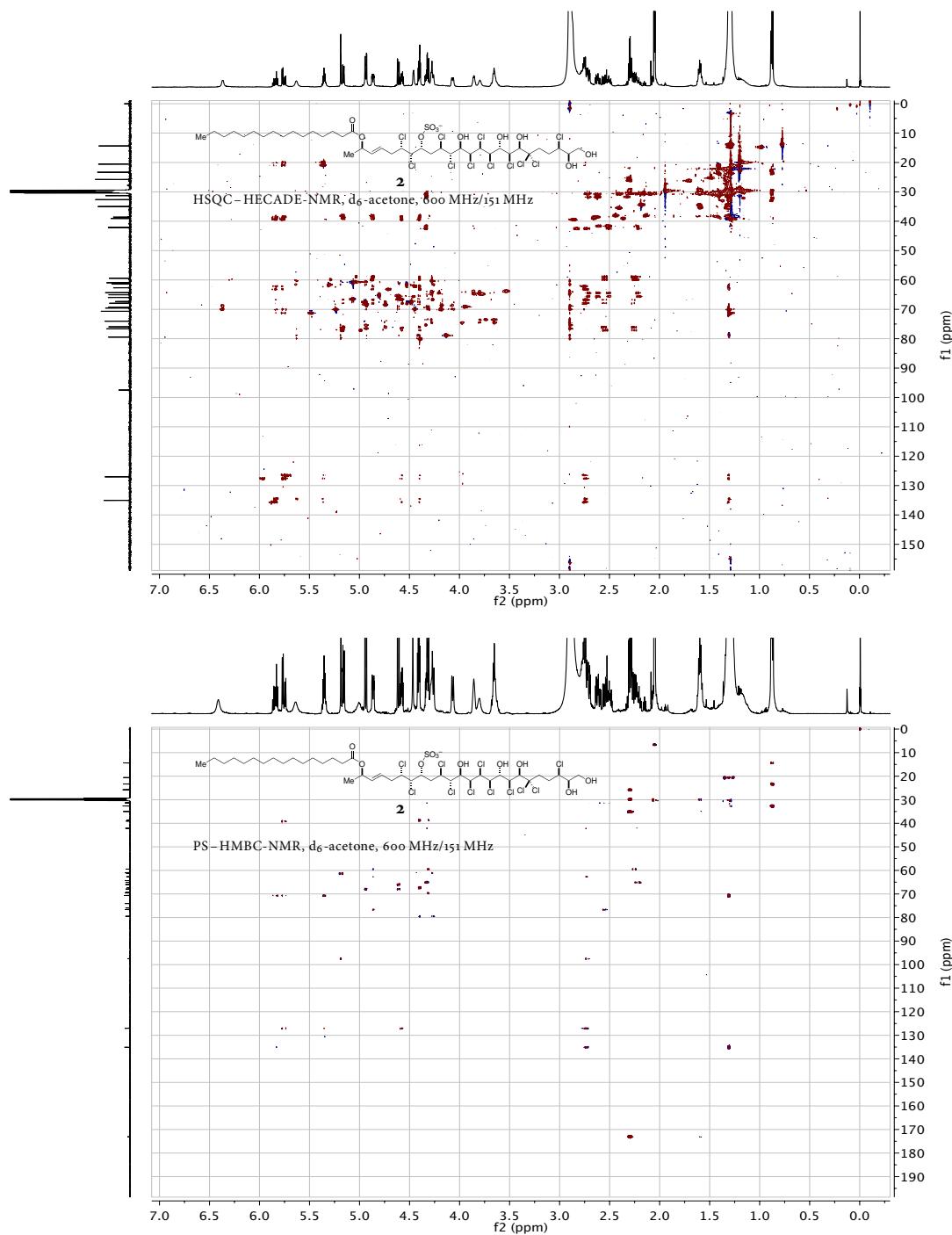
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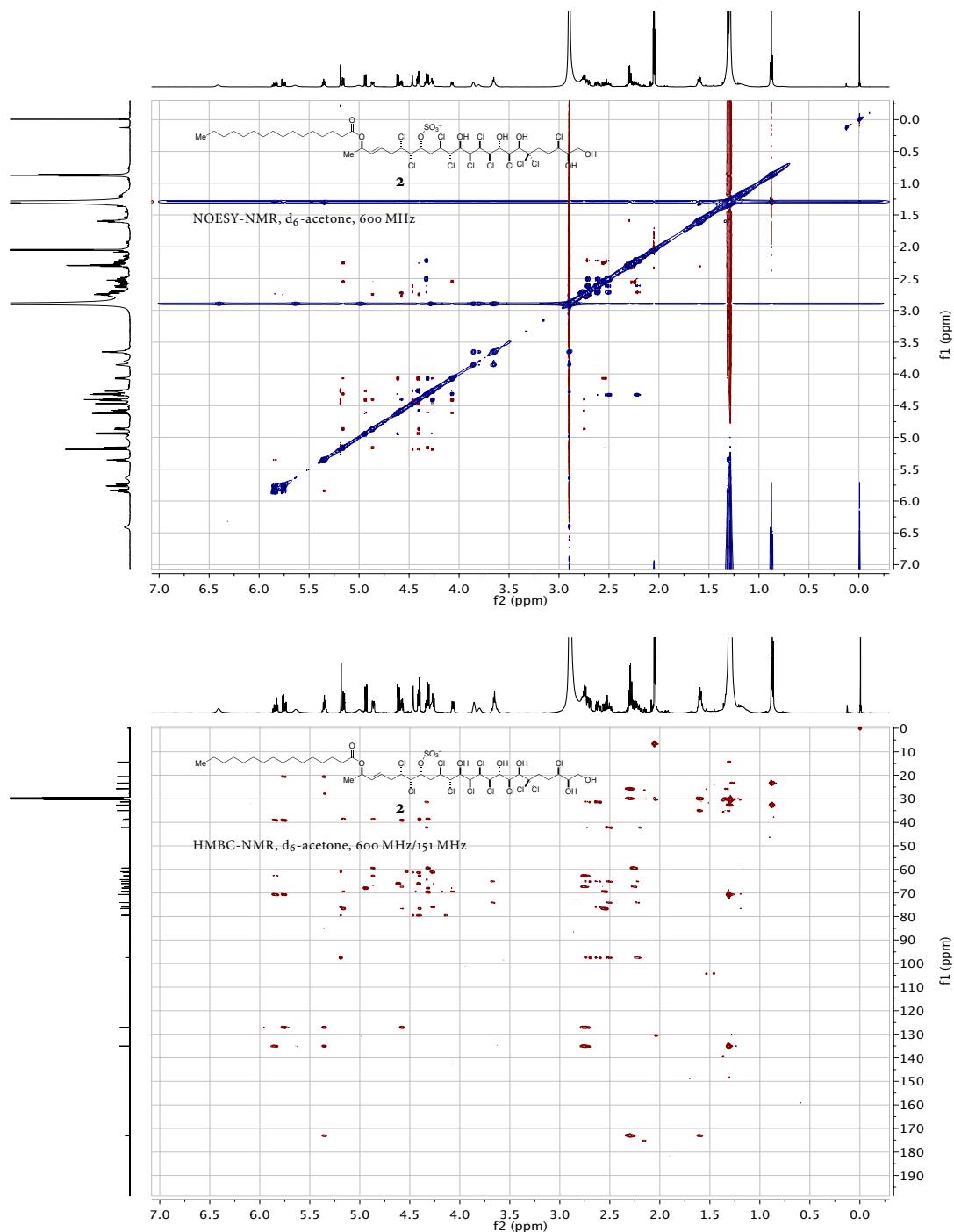


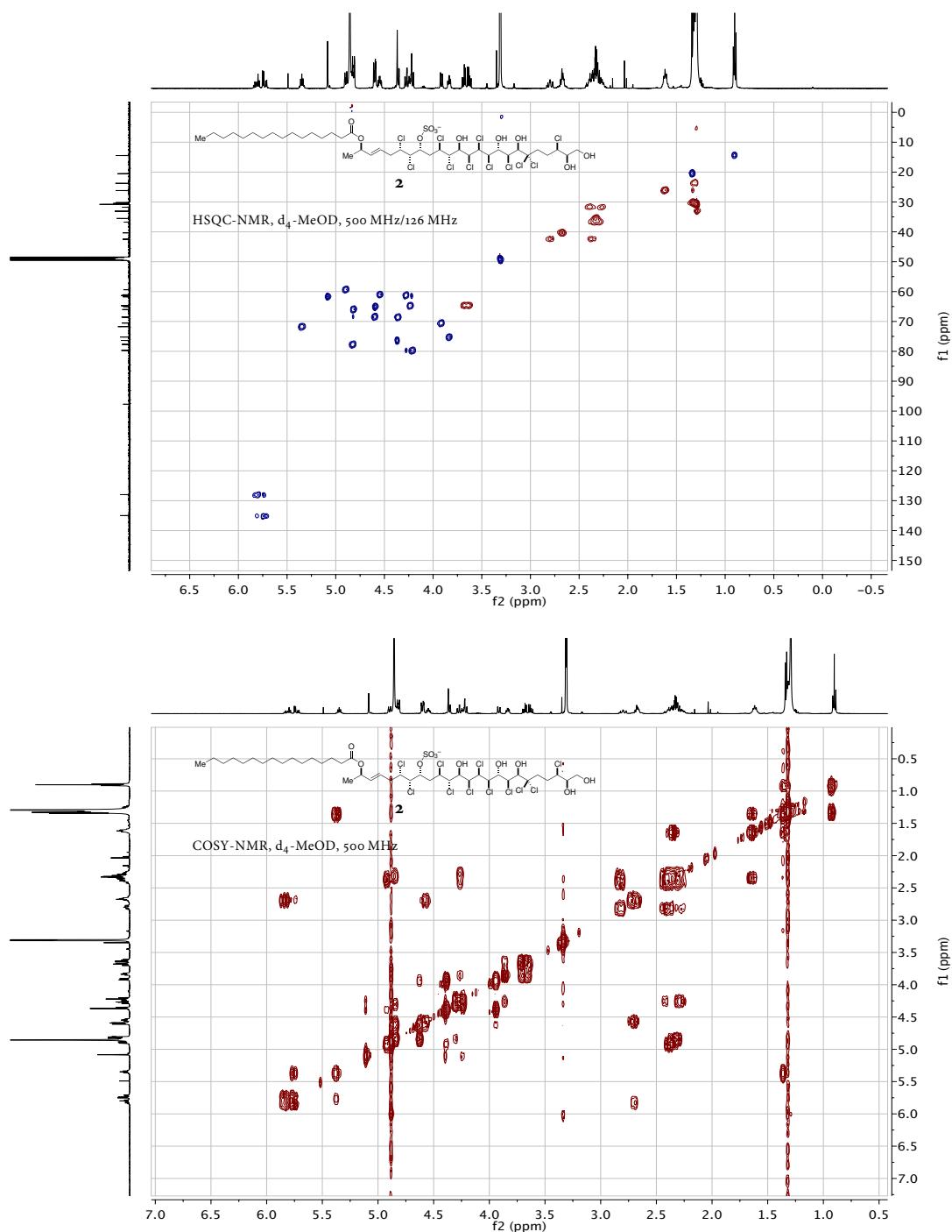
Chapter 3. NMR Spectra



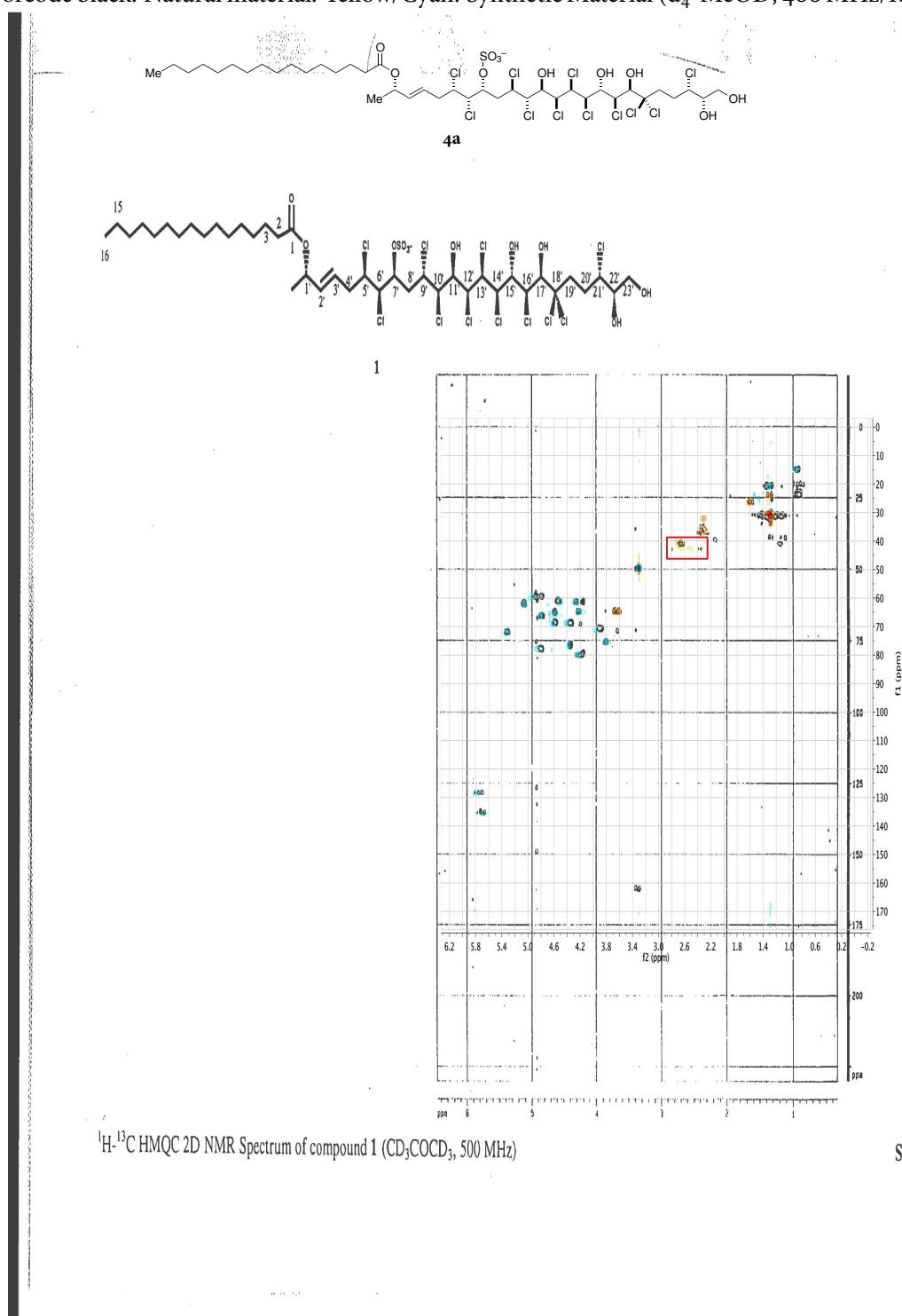




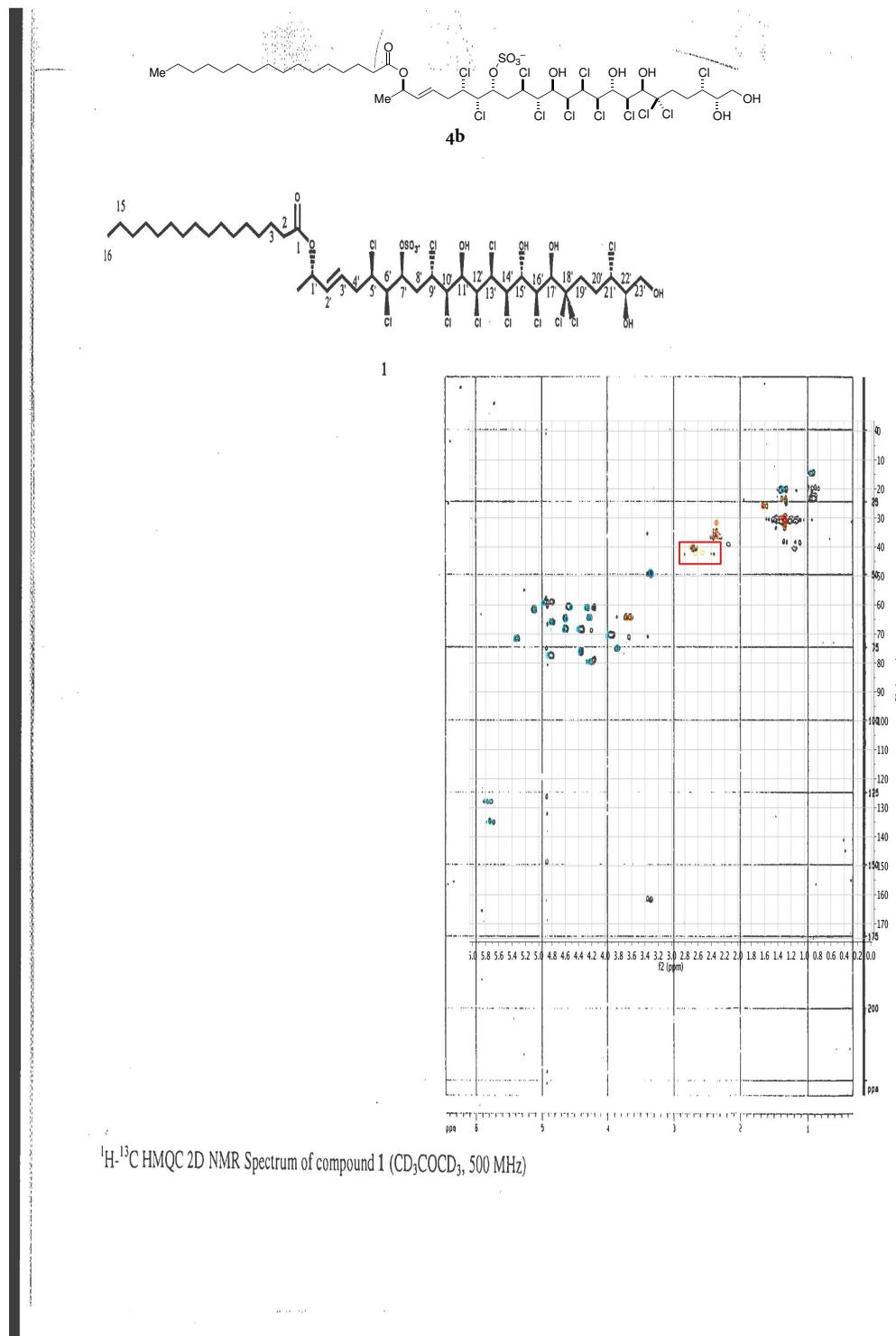




Overlay of epi-C₁/C₂₁/C₂₃ Mytilipin B **4a** (HSQC) with HMQC of natural Mytilipin B (Colorcode black: Natural material. Yellow/Cyan: Synthetic Material (d_4 -MeOD, 400 MHz/101 MHz).

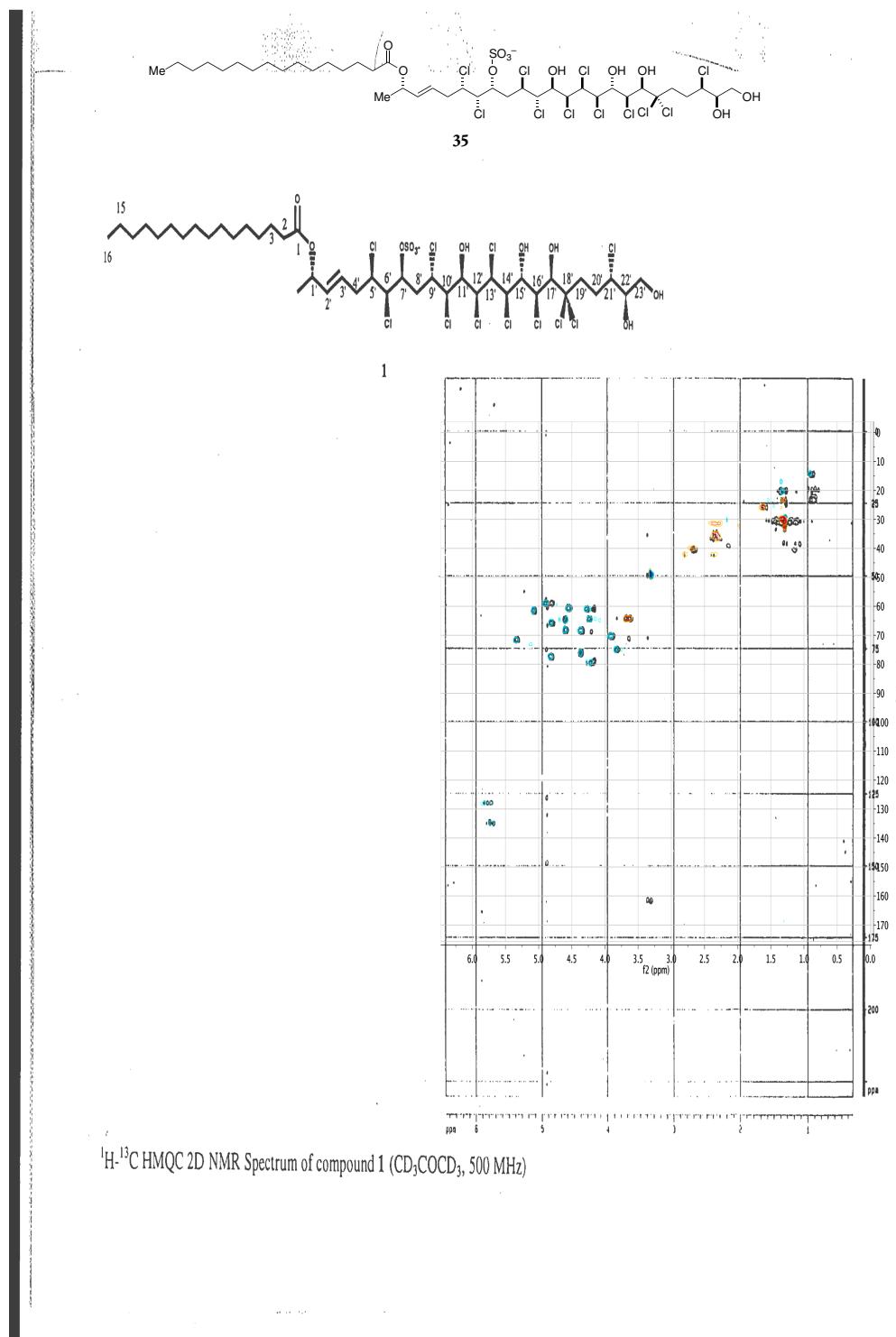


Overlay of epi-C₂₁/C₂₂ Mytilipin B **4b** (HSQC) with HMQC of natural Mytilipin B (Colorcode black: Natural material. Yellow/Cyan: Synthetic Material (d_4 -MeOD, 500 MHz/126 MHz).



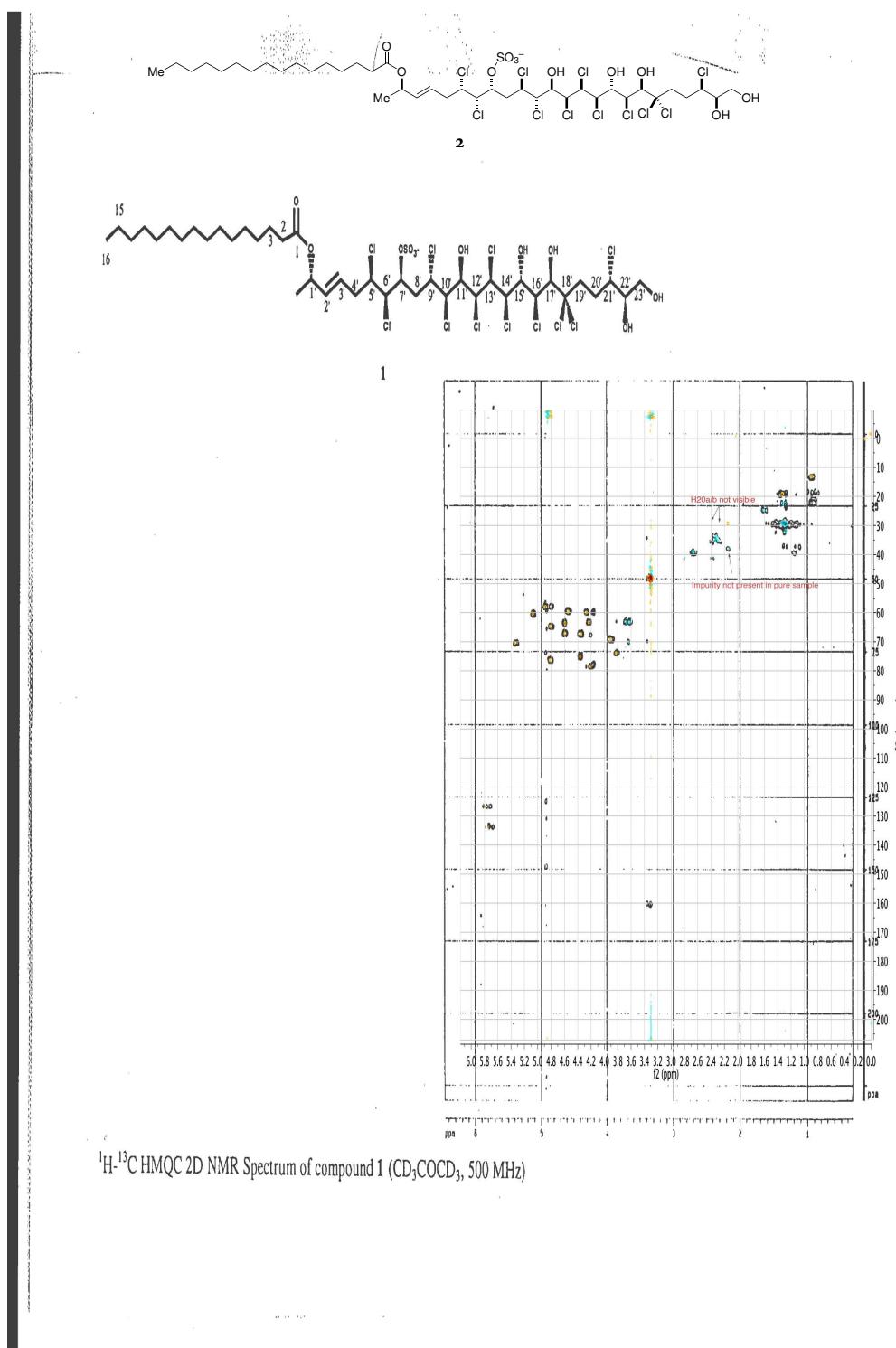
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Overlay of epi-C1 Mytilipin B **35** (HSQC) with HMQC of natural Mytilipin B (Colorcode black:
Natural material. Yellow/Cyan: Synthetic Material (d_4 -MeOD, 500 MHz/126 MHz).

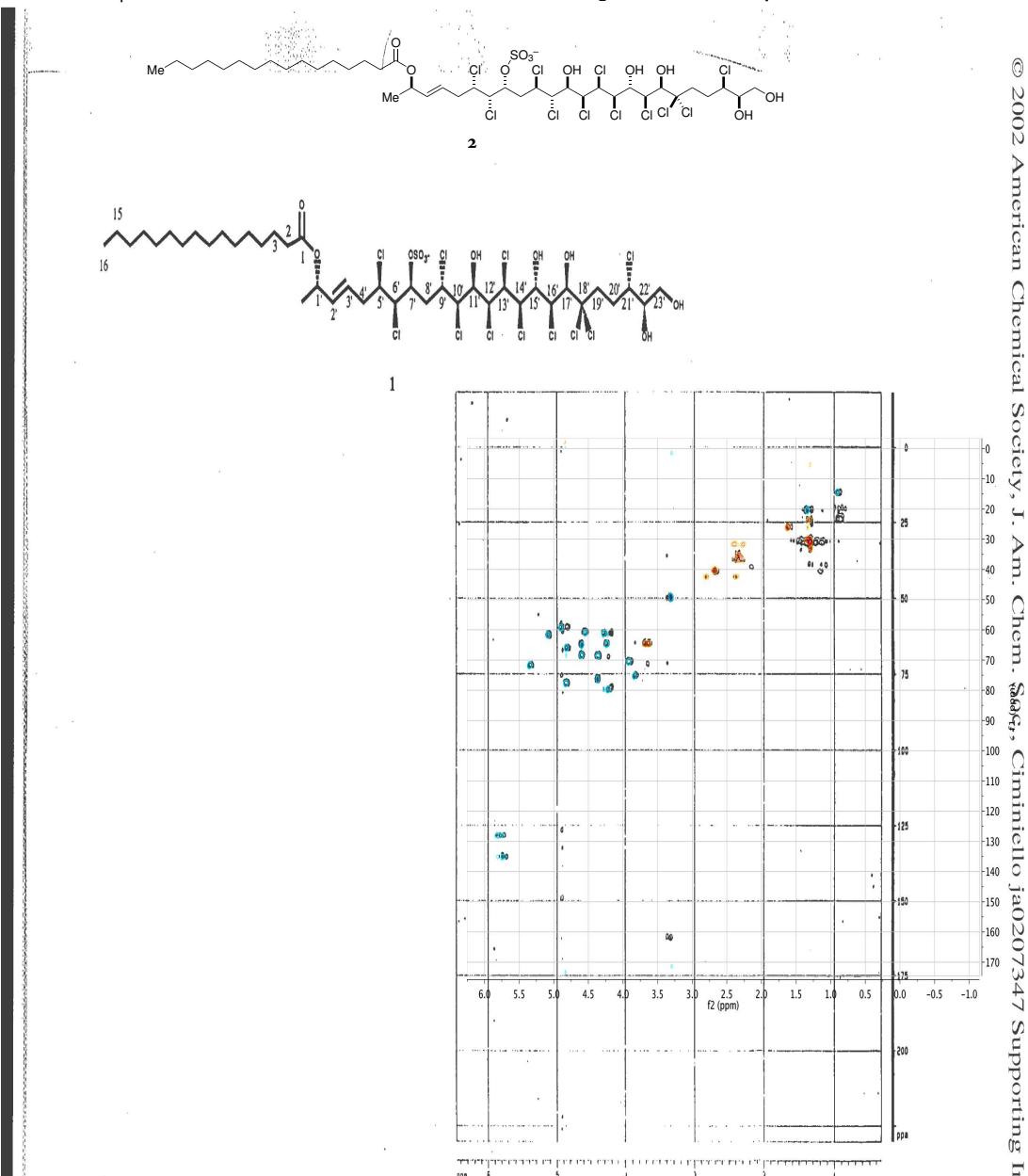


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Overlay of slightly impure Mytilipin B **2** (HSQC) at low concentrations with HMQC of natural Mytilipin B (Colorcode black: Natural material. Yellow/Cyan: Synthetic Material (d_4 -MeOD, 500 MHz/126 MHz). The highlighted impurity is likely a decomposition product and H₂oa/b are not visible at low concentrations.



Overlay of pure Mytilipin B **2** (HSQC) at higher concentrations with HMQC of natural Mytilipin B (Colorcode black: Natural material. Yellow/Cyan: Synthetic Material (d_4 -MeOD, 500 MHz/126 MHz). Also note the previous overlay at a lower concentration.

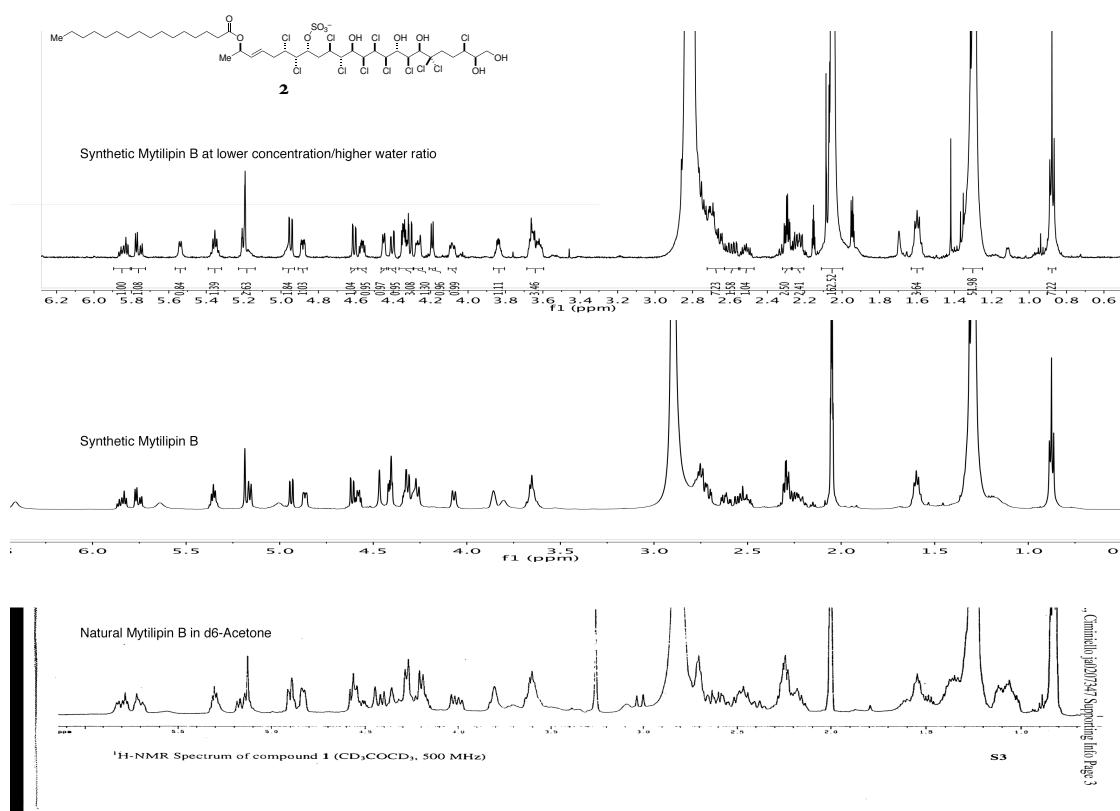


^1H - ^{13}C HMQC 2D NMR Spectrum of compound 1 (CD_3COCD_3 , 500 MHz)

S5

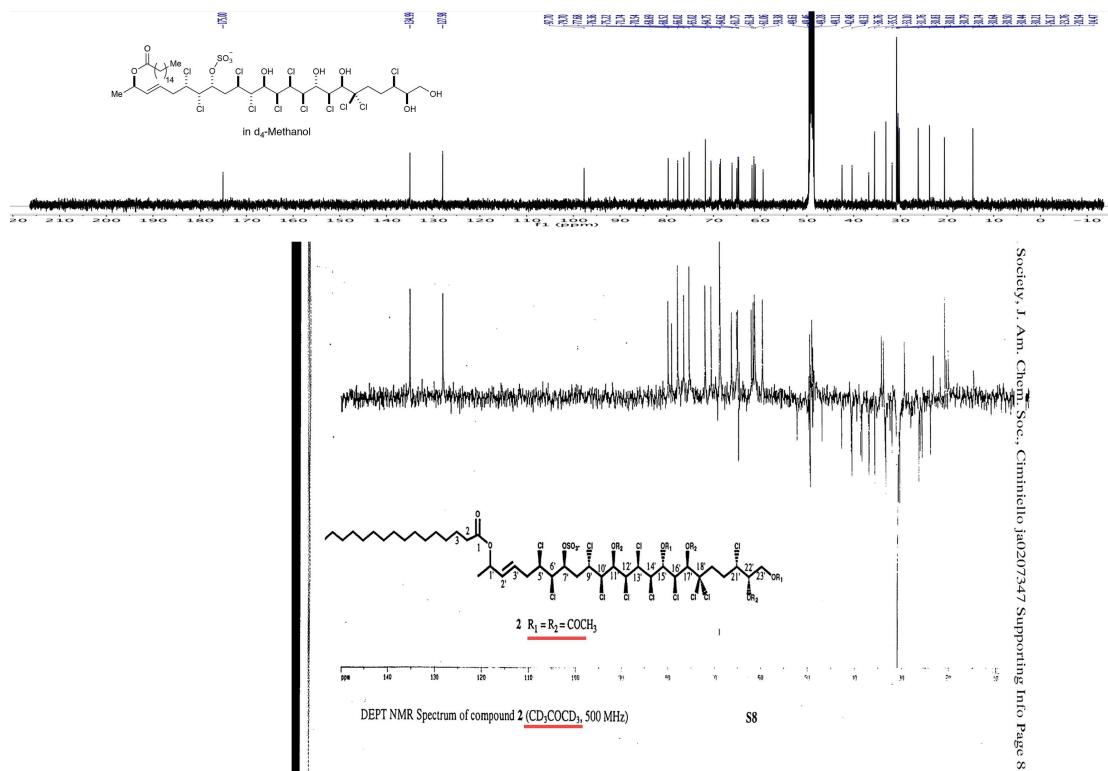
Chapter 3. NMR Spectra

¹H-NMR overlay of synthetic Mytilipin B **2** (top) with natural Mytilipin B (bottom, d₆-Acetone, 500 MHz/126 MHz).



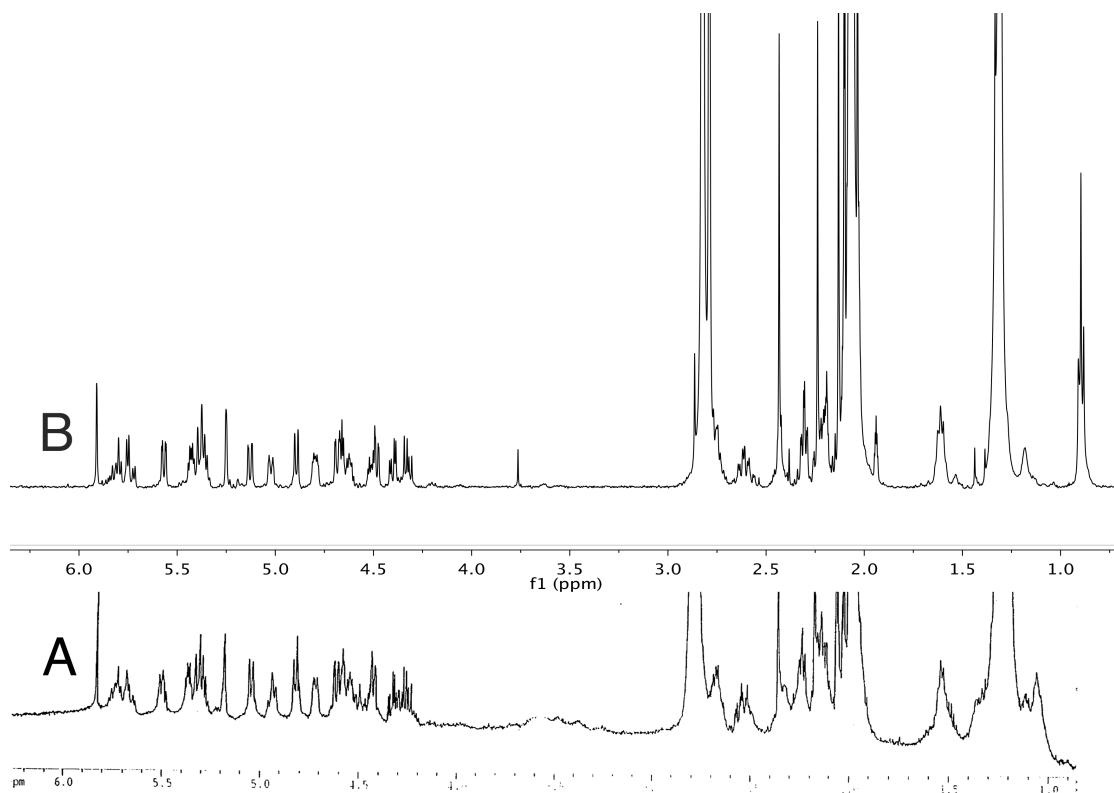
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^{13}C -NMR overlay of synthetic Mytilipin B **2** (top, $\text{d}_4\text{-MeOD}$, 151 MHz) with DEPT-spectrum assigned by the isolation team as peracetylated natural Mytilipin B in $\text{d}_6\text{-acetone}$ (bottom) .

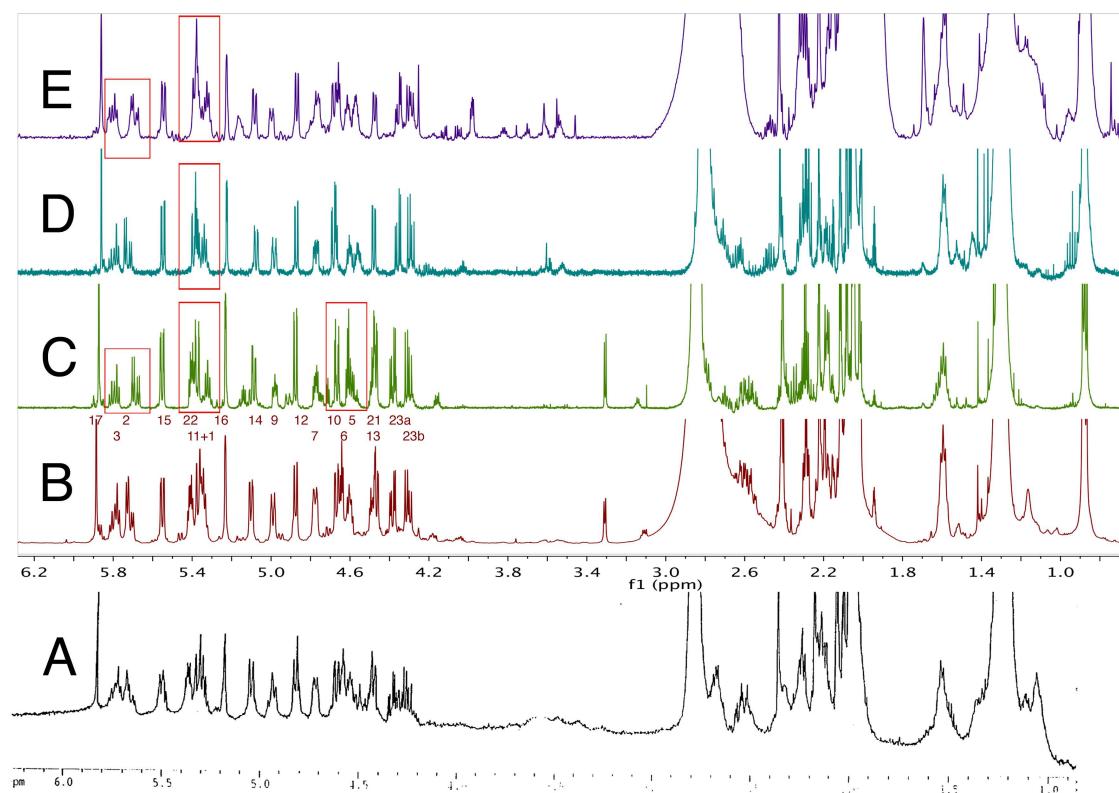


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¹H-NMR overlay of the isolation team's spectrum of peracetylated natural Mytilipin B (A) with synthetic peracetylated compounds **39** (derived from synthetic Mytilipin B (**2**) (B) (both d_6 -Acetone, 500 MHz).

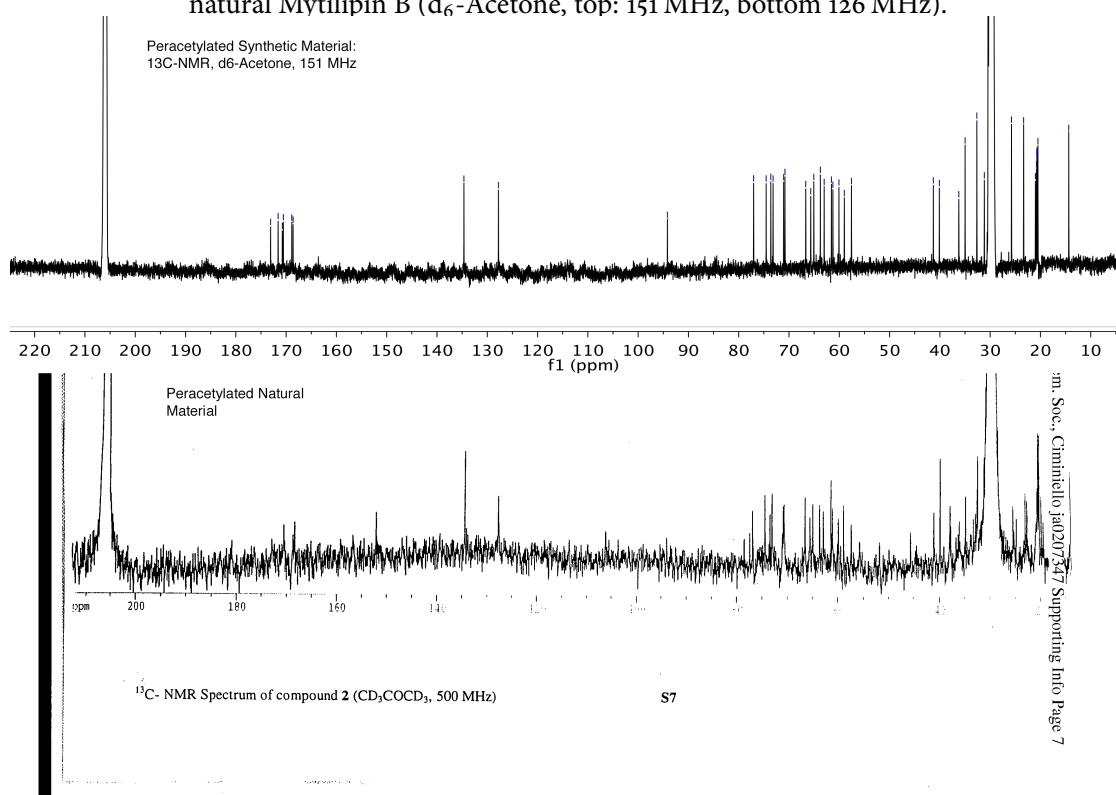


¹H-NMR overlay of the spectrum of peracetylated natural Mytilipin B (A) with synthetic peracetylated compounds **39** (correct structure, derived from synthetic Mytilipin B (**2**) (B), **36** (C), **31** (D) and **27** (E) (top 4: d₆-Acetone, 600 MHz, bottom: d₆-Acetone, 500 MHz).



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^{13}C -NMR overlay of peracetylated synthetic Mytilipin B **39** with ^{13}C -spectrum of peracetylated natural Mytilipin B (d_6 -Acetone, top: 151 MHz, bottom 126 MHz).



Bibliography

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- (2) Geisser, R. W. Dissertation Roger Geisser, Diss ETH Nr. 19364, 2010., Ph.D. Thesis.
- (3) Koźmiński, W.; Nanz, D. *Journal of Magnetic Resonance* **1997**, *124*, 383–392.
- (4) Ding, K. *Magnetic Resonance in Chemistry* **2000**, *38*, 321–323.