Supporting Information

Enantioselective Photocycloaddition of 3-Hydroxyflavones: Total Syntheses and Absolute Configuration Assignments of (+)-Ponapensin and (+)-Elliptifoline

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I. GENERAL INFORMATION

A. Instrumentation and methods

^{1}H NMR spectra were recorded at 300, 400, or 500 MHz at ambient temperature with $CDCl_3$, CD_3OD, DMSO-d_6 or benzene-d_6 (Cambridge Isotope Laboratories, Inc.) as solvents. Data for ^{1}H NMR are reported as follows: chemical shift, integration, multiplicity (br = broad, ovrlp = overlapping, s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet) and coupling constants in Hz. ^{13}C NMR spectra were recorded at 75.0, 100.0, or 125 MHz at ambient temperature with the same solvents unless otherwise stated. Chemical shifts are reported in parts per million relative to the deuterated solvents. All ^{13}C NMR spectra were recorded with complete proton decoupling. Infrared spectra were recorded on a Nicolet Nexus 670 FT-IR spectrophotometer. High-resolution mass spectra were obtained in the Boston University Chemical Instrumentation Center using a Waters Q-TOF API-US mass spectrometer. Melting points were recorded on a Mel-Temp apparatus (Laboratory Devices). Analytical LC-MS was performed on a Waters Acquity UPLC (Ultra Performance Liquid Chromatography (Waters MassLynx Version 4.1) with a Binary solvent manager, SQ mass spectrometer, Water 2996 PDA (PhotoDiode Array) detector, and ELSD (Evaporative Light Scattering Detector). An Acquity UPLC BEH C_{18} 1.7 μm column was used for analytical UPLC-MS. Optical rotations were recorded on an AUTOPOL III digital polarimeter at 589 nm, and specific rotations are given $[\alpha]_D^{20}$ (concentration in grams/100 mL solvent). SFC analysis of enantioenriched compounds was performed on a Berger SFC (Waters) System with a diode array detector using a SFC Chiralcel®OD-H (Chiral Technologies Inc., 100 × 4.6 mm I.D., 5μm) column. CD spectra were measured on an AVIV Circular Dichroism Spectrometer, Model 62DS. Preparative HPLC was performed on a Gilson PLC2020 using a Waters SunFire™ Prep C18 OBD™ 5μm 19X50 mm column.

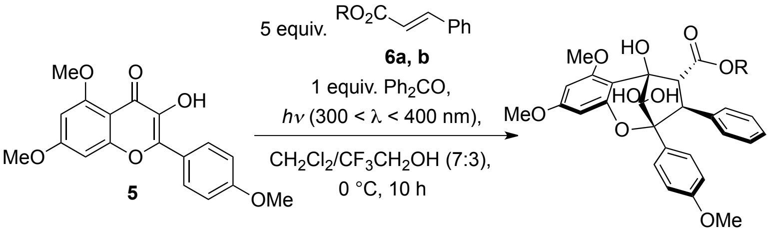
Analytical thin layer chromatography was performed using 0.25 mm silica gel 60-F plates. Flash chromatography was performed using 200-400 mesh silica gel (Scientific Absorbents, Inc.). Yields refer to chromatographically and spectroscopically pure materials, unless otherwise stated. HPLC grade tetrahydrofuran, methylene chloride, diethyl ether, toluene, acetonitrile, and benzene were purchased from Fisher and VWR and were purified and dried by passing through a PURE SOLV® solvent purification system (Innovative Technology, Inc.). Other ACS grade solvents for chromatography were purchased from Clean Harbors.

Fluorescence emission spectra were recorded using a quartz cuvette at room temperature using a fluorimeter (Jobin Yvon Horiba FluoroMax 3). Select photochemistry experiments were performed using a Rayonet RPR-100 photochemical reactor equipped with RPR-3500 irradiation lamps (UVA 315-400 nm). Photochemical reactions were performed in a photobox using a Hanovia 450 W medium pressure mercury lamp housed in a quartz immersion well, cooled with a Thermo Neslab-ULT 80 system circulator. Pyrex test tubes (16 x 100 mm) were mounted on a support approximately 5.0 cm from the immersion well lamp. A uranium filter (hν > 350 nm) was obtained from James Glass (Hanover, MA). All other reactions were carried out in oven-dried glassware under an argon atmosphere unless otherwise noted.

II. EXPERIMENTAL PROCEDURES AND COMPOUND CHARACTERIZATION

A. Preparation of Reduced Aglains in Racemic Form

1. [3+2] Photocycloaddition.



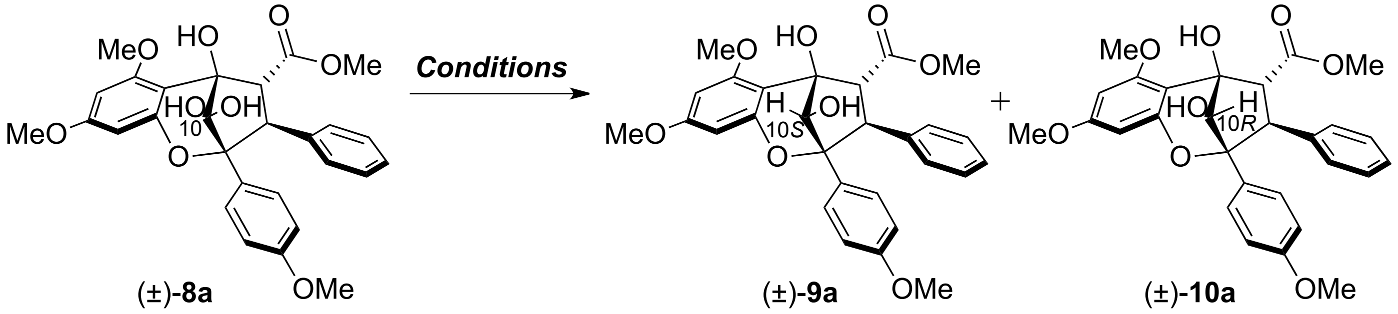
8a, R = Me, 61% yield, 3:1 dr
8b, R = Bn, 60% yield, 3:1 dr

Procedure for [3+2] Photo-cycloaddition of 3-HF 5 and Cinnamic Esters 6a-b (8a-b): A 32 x 240 mm Pyrex test tube was charged with 3-hydroxyflavone **5** (1.0 g, 3.04 mmol, 1.0 equiv.), benzophenone (555 mg, 3.04 mmol, 1.0 equiv.) and dipolarophile **6a-b** (15.2 mmol, 5.0 equiv.) in CH_2Cl_2-TFE (7:3, 75 mL) as solvent. After degassing with argon for 10 min, the mixture was stirred and irradiated (Rayonet, λ > 315 nm) at 0 °C for 12 h. The crude material was concentrated under vacuum and the resulting oil was directly chromatographed on SiO_2. *Note*: decomposition was observed during chromatographic purification on silica gel. Accordingly, the SiO_2 was first washed successively with (80:20:03 hexanes/EtOAc/Et_3N, one length) and (80:20 hexanes/EtOAc, one length) to neutralize surface silanols. Purification *via* flash chromatography using a gradient of hexanes/EtOAc afforded cyclopenta[*bc*]benzopyrans **8a-b** as mixture of isomers (61% yield **8a**, 60% **8b**). This mixture was recrystallized in acetonitrile to afford pure **8a-b** (27% **8a**, 24% **8b**). **8b**: White solid; $\boldsymbol{R_f}$ = 0.44 (1:1 EtOAc/hexanes); **m.p.** 110-114 ºC; **IR** vmax (film): 3484, 3014, 2939, 2840, 1731, 1618, 1590, 1517, 1490, 1456, 1252, 1217, 1148, 1094, 1003, 980, 831, 754 cm^{-1}; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.56 (d, J = 9.0 Hz, 2H), 7.33-7.30 (br dd, J = 6.5, 6.5 Hz, 3H), 7.27-7.22 (overlapping m, 3H), 7.18 (d, J = 6.5 Hz, 2H), 7.05 (dd, J = 6.8, 6.8 Hz, 2H), 7.01 (brt, J = 6.8 Hz, 1H), 6.65 (d, J = 9.0 Hz, 2H), 6.21 (d, J = 2.2 Hz, 1H), 6.03 (d, J = 2.2 Hz, 1H), 5.89 (s, 1H), 5.05 (d, J = 12.8 Hz, 1H), 4.94 (d, J = 12.8 Hz, 1H), 4.24 (d, J = 9.2 Hz, 1H), 3.79 (d, J = 9.2 Hz, 1H), 3.77 (s, 3H), 3.70 (s, 3H), 3.57 (s, 3H), 3.18 (s, 1H); **^{13}C NMR** (125 MHz, CD_3Cl) δ 171.3, 161.5, 158.9, 158.6, 153.8, 140.0, 135.9, 130.2 (2C), 130.0 (2C), 128.7 (2C), 128.2 (2C), 128.1 (2C), 127.7 (2C), 126.7, 112.9 (2C), 103.7, 98.1, 94.7, 93.0, 88.0, 81.4, 66.7, 63.0, 55.8, 55.5, 55.2, 54.7; **HR-MS**: *m/z* Calcd for $[C_{34}H_{32}O_9+Na]^+$ 607.1844, found 607.1825 (-3.1 ppm).

2. Reagent-Controlled Reduction

Screening for diastereoselective reduction at C10: Entry 2 (**Table SI-1**) shows that solubilization in THF was necessary to generate a reaction with sodium borohydride. Counterion size does not affect the diastereoselectivity of BH_4^- reductions as shown in entries 2 and 3 (Na^+ *vs.* Bu_4N^+, respectively). Entry 4 shows that addition of cerium chloride reduces the diasteroselectivity of the $NaBH_4$ reduction. Entries 5 through 8 examine the effect of solvent on the $Me_4NBH(OAc)_3$ reduction. Entry 9 shows that a smaller counterion (Na^+) yields better diastereoselectivity of **9a** than the corresponding $Me_4NBH(OAc)_3$ reduction. Although not shown, temperature marginally affects the diastereoselectivity of these reductions.

Table SI-1. Conditions Evaluated for Reduction of Hydrated Aglain **8a**

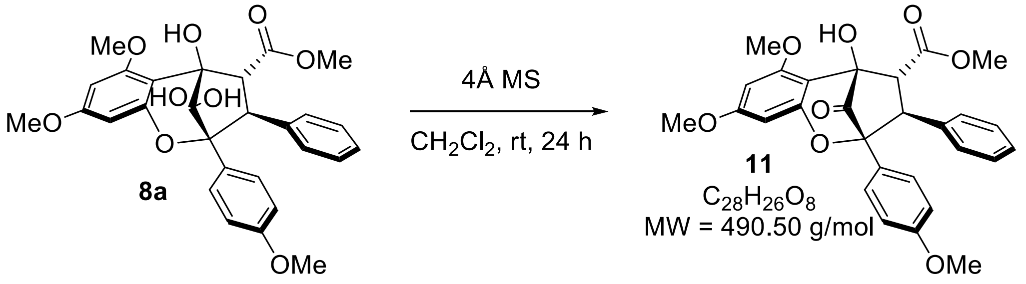


Entry	Reagent	Additive	Equiv	Solvent	T (°C)	Time (h)	9a:10a[a]	Conversion (%)[b]
1	$NaBH_4$	-	75	MeOH	0-rt	24	-	0
2	$NaBH_4$	-	5	THF	0-rt	12	1:5	100 (93)
3	Bu_4NBH_4	-	5	THF	0-rt	24	1:5	100 (98)
4	$NaBH_4$	$CeCl_3$	5, 1.2	THF	0-rt	24	1:2	100 (88)
5	$Me_4NBH(OAc)_3$	AcOH	6, 6	PhH	rt	24	3.1:1	100 (95)
6	$Me_4NBH(OAc)_3$	AcOH	6, 6	PhMe	rt	24	4:1	100 (95)
7	$Me_4NBH(OAc)_3$	AcOH	6, 6	$PhCF_3$	rt	24	5:1	100 (95)
8	$Me_4NBH(OAc)_3$	AcOH	6, 6	CH_2Cl_2	rt	24	4:1	100 (95)
9	$NaBH(OAc)_3$	AcOH	6, 6	$PhCF_3$	rt	24	10:1	100 (95)

[a] Determined by ^{1}H NMR; [b] Based on crude ^{1}H NMR analysis; isolated yields are in parentheses.

General Procedure A (Entries 1 through 4): A dry flask was charged with a stir bar and hydrated aglain **8a** (20 mg, 0.039 mmol, 1 equiv.) under argon, which was then dissolved in the corresponding solvent (2 mL). The resulting solution was then chilled to 0 °C, and the corresponding additive ($CeCl_3 \cdot 7H_2O$, 17 mg, 0.0468 mmol, 1.2 equiv.) and reducing agent (0.195 mmol, 5 equiv.) were sequentially added in one portion. The reaction was warmed gradually to rt and stirred for the designated time. The reaction was quenched with saturated ammonium chloride, and ethyl acetate (1 mL) and water (0.5 mL) were added. The organic phase was then extracted with EtOAc (2 X 10 mL), washed with brine, and dried over sodium sulfate. The filtrate was concentrated in vacuo and purified by column chromatography to give the corresponding products (**9a** eluted at 5:95 EtOAc/CH_2Cl_2, **10a** at 10:90 EtOAc/CH_2Cl_2).

General Procedure B (Entries 5 through 9): A dry flask was charged with a stir bar, reducing agent (0.24 mmol, 6 equiv.), acetic acid (13 µL, 0.24 mmol, 6 equiv.), and solvent (1.5 mL) at rt under argon. The mixture was then sonicated briefly and stirred at rt for 10 min. The hydrated aglain **8a** (20 mg, 0.039 mmol, 1.0 equiv) was then added at rt in one portion under argon. The resulting mixture was then stirred for 24 h and was quenched with saturated ammonium chloride. Entries 5 and 6 were extracted with EtOAc, washed with saturated sodium bicarbonate and brine, and dried over sodium sulfate. Entries 7 through 9 were extracted with CH_2Cl_2, washed with saturated sodium bicarbonate, and dried over sodium sulfate. The filtrate was concentrated in vacuo and ^1H NMR analysis of the crude extract was taken. Column chromatography was used to purify the compounds (**9a** eluted at 5:95 EtOAc/CH_2Cl_2, **10a** at 10:90 EtOAc/CH_2Cl_2).



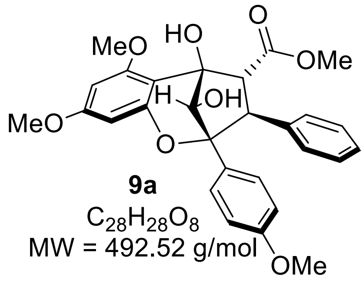
8a

11

$C_{28}H_{26}O_8$

MW = 490.50 g/mol

Procedure for Converting Hydrated-Aglain 8a to ketone form 11: A dry flask was charged with a stir bar, hydrated-aglain **8a** (60 mg, 0.12 mmol, 1.0 equiv.), and 4Å molecular sieves (750 mg) in CH_2Cl_2 (5 mL) under argon. The mixture was stirred for 24 h at room temperature, and formation of the ketone was monitored by ^1H NMR. The sieves were filtered using a plug of Celite, and the filtrate was concentrated *in vacuo* to afford the ketone **11** without any purification (58 mg, 0.12 mmol, 100%). White solid; $\boldsymbol{R_f}$ = 0.42 (3:2 EtOAc/hexanes); **m.p.** 88 ºC; **IR** vmax (film): 3496, 3018, 2952, 2840, 1784, 1734, 1616, 1589, 1517, 1495, 1456, 1437, 1337, 1298, 1253, 1216, 1201, 1161, 1146, 1092, 820, 748 cm^{-1}; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.26 (d, J = 9.2 Hz, 2H), 7.03 (br dd, J = 7.5, 6.5 Hz, 2H), 7.00 (t, J = 7.5 Hz, 1H), 6.85 (d, J = 6.5 Hz, 2H), 6.64 (d, J = 9.2 Hz, 2H), 6.19 (d, J = 2.5 Hz, 1H), 6.13 (d, J = 2.5 Hz, 1H), 5.80 (s, 1H), 4.50 (d, J = 9.0 Hz, 1H), 3.85 (s, 3H), 3.77 (s, 3H), 3.67 (s, 3H), 3.64 (s, 3H), 3.59 (d, J = 9.0 Hz, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 205.5, 170.8, 162.1, 158.9, 158.2, 153.1, 138.3, 129.0 (2C), 128.9 (2C), 128.3 (2C), 127.1, 125.7, 112.9 (2C), 105.0, 94.6, 93.7, 83.9, 81.0, 57.7, 56.3, 55.6, 55.2, 53.5, 52.4; **HR-MS**: *m/z* Calcd for $[C_{28}H_{26}O_8+Na]^+$ 513.1525, found 513.1529 (+0.8 ppm).



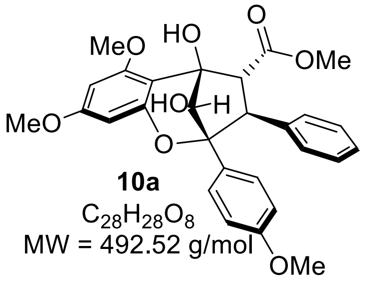
9a

$C_{28}H_{28}O_8$

MW = 492.52 g/mol

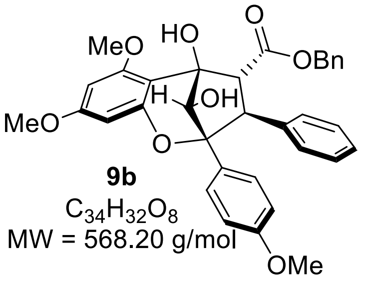
Compound **9a** was prepared and purified according to **general procedure B** from **Table SI-1**, Entry 9 listed above. White solid; $\boldsymbol{R_f}$ = 0.88 (1:9 EtOAc/CH_2Cl_2); **m.p.** 206-209 ºC; **IR** vmax (film): 3427, 2952, 1729, 1617, 1516, 1456, 1250, 1214, 1186, 1148, 1120, 1079, 831, 752 cm^{-1}; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.41 (d, J = 9.0 Hz, 2H), 7.23 (d, J = 6.8, 2H), 7.05 (dd, J = 6.8, 6.8 Hz, 2H), 7.01 (br t, J = 6.8 Hz, 1H), 6.67 (d, J = 9.0 Hz, 2H), 6.09

(d, *J* = 2.4 Hz, 1H), 6.07 (d, *J* = 2.4 Hz, 1H), 5.63 (s, 1H), 4.78 (s, 1H), 4.37 (d, *J* = 9.2 Hz, 1H), 3.85 (s, 3H), 3.79 (d, *J* = 9.2 Hz, 1H), 3.73 (s, 3H), 3.70 (s, 3H), 3.60 (s, 3H), 3.35 (s, 1H); **^{13}C NMR** (125 MHz, CDCl$_3$) δ 172.3, 161.3, 158.8, 157.9, 153.8, 141.6, 130.3 (2C), 130.2 (2C), 129.9, 128.1 (2C), 126.3, 113.0 (2C), 104.7, 94.4, 92.5, 89.1, 80.5, 79.2, 65.2, 56.8, 56.0, 55.4, 55.2, 51.8; **HR-MS**: *m/z* Calcd for $[C_{28}H_{28}O_8+Na]^+$ 515.1682, found 515.1699 (+3.3 ppm).



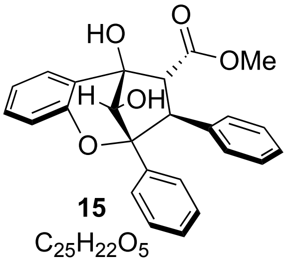
10a
$C_{28}H_{28}O_8$
MW = 492.52 g/mol

Compound **10a** was prepared and purified according to **general procedure** A from **Table SI-1**, Entry 3 listed above. White solid; **R_f** = 0.41 (1:9 EtOAc/CH$_2$Cl$_2$); **m.p.** 200+ ºC, decomposition observed; **IR** νmax (film): 3476, 2952, 1792, 1732, 1617, 1589, 1516, 1438, 1235, 1095, 737 cm^{-1}; **^{1}H NMR** (500 MHz, CDCl$_3$) δ 7.28 (d, *J* = 8.8 Hz, 2H), 7.02 (dd, *J* = 7.5, 7.2 Hz, 2H), 6.96 (br t, *J* = 7.2 Hz, 1H), 6.66 (d, *J* = 8.8 Hz, 2H), 6.23 (d, *J* = 2.2 Hz, 1H), 6.12 (d, *J* = 2.2 Hz, 1H), 5.88 (s, 1H), 4.82 (d, *J* = 6.2 Hz, 1H), 4.10 (d, *J* = 9.0 Hz, 1H), 3.86 (s, 3H), 3.77 (s, 3H), 3.68 (s, 3H), 3.59 (s, 3H), 3.33 (d, *J* = 9.0 Hz, 1H), 2.39 (d, *J* = 6.2 Hz, 1H); **^{13}C NMR** (100 MHz, CDCl$_3$) δ 171.3, 161.2, 159.4, 158.9, 154.0, 139.9, 129.31 (2C), 129.27, 128.7 (2C), 128.2 (2C), 126.6, 113.3 (2C), 102.4, 94.4, 93.0, 87.4, 80.2, 73.7, 62.0, 56.0, 55.5, 55.2, 54.7, 51.9; **HR-MS**: *m/z* Calcd for $[C_{28}H_{28}O_8+H]^+$ 493.1862, found 493.1861 (-0.2 ppm).



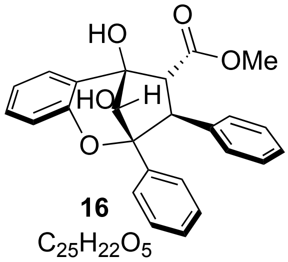
9b
$C_{34}H_{32}O_8$
MW = 568.20 g/mol

Compound **9b** was prepared and purified according to **general procedure B** listed above (NaBH(OAc)$_3$, dr 10:1, 92% **9b**). White solid; **R_f** = 0.70 (1:1 EtOAc/hexanes); **m.p.** 90-96 ºC; **IR** νmax (film): 3517, 3478, 3015, 1736, 1616, 1588, 1519, 1464, 1341, 1257, 1217, 1202, 1179, 1129, 1094, 1036, 980, 948, 824, 750 cm^{-1}; **^{1}H NMR** (500 MHz, CDCl$_3$) δ 7.42 (d, *J* = 8.5 Hz, 2H), 7.35-7.29 (overlapping m, 1H), 7.33 (d, *J* = 7.0 Hz, 2H), 7.26-7.23 (ovrlp m, 4H), 7.06 (dd, *J* = 7.0, 7.0 Hz, 2H), 7.02 (t, *J* = 7.0 Hz, 1H), 6.67 (d, *J* = 8.5 Hz, 2H), 6.10 (d, *J* = 2.0 Hz, 1H), 6.01 (d, *J* =2.0 Hz, 1H), 5.72 (s, 1H), 5.07 (d, *J* = 12.8 Hz, 1H), 4.96 (d, *J* = 12.8 Hz, 1H), 4.79 (s, 1H), 4.42 (d, *J* = 9.0 Hz, 1H), 3.89 (d, *J* = 9.0 Hz, 1H), 3.74 (s, 3H), 3.70 (s, 3H), 3.58 (s, 3H), 3.42 (s, 1H); **^{13}C NMR** (125 MHz, CDCl$_3$) δ 171.8, 161.4, 158.9, 158.0, 153.9, 141.6, 136.0, 130.3 (4C), 129.9, 128.7 (2C), 128.12, 128.10, 127.7 (2C), 126.3, 113.0 (2C), 104.7, 94.5, 92.6, 89.2, 80.6, 79.3, 66.5, 65.4, 56.9, 55.8, 55.5, 55.2; **HR-MS**: *m/z* Calcd for $[C_{34}H_{32}O_8+Na]^+$ 591.1995, found 591.1981 (– 2.4 ppm).



15
$C_{25}H_{22}O_5$
MW = 402.44 g/mol

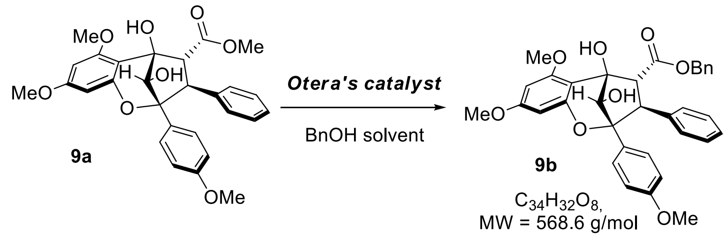
Compound **15** was prepared and purified according to **general procedure B** listed above (NaBH(OAc)$_3$, dr 8:1, 90%). White solid; **R_f** = 0.49 (1:1 EtOAc/hexanes); **m.p.** 220+ °C decomposition observed; **IR** νmax (film): 3458, 3034, 1701, 1608, 1586, 1499, 1482, 1456, 1435, 1277, 1236, 1181, 1153, 1080, 1061, 1034, 1014, 993, 961 cm^{-1}; **^{1}H NMR** (400 MHz, $(CD_3)_2SO$) δ 7.45 (dd, *J* = 7.4, 1.4 Hz, 2H), 7.31 (br d, *J* = 7.4 Hz, 1H), 7.24 (d, *J* = 7.4 Hz, 2H), 7.17-6.95 (ovrlp m, 8H), 6.88 (dd, *J* = 7.4 Hz, 1H), 6.72 (d, *J* = 7.4 Hz, 1H), 6.46 (d, *J* = 4.2 Hz, 1H), 5.99 (s, 1H), 4.51 (d, *J* =4.2 Hz, 1H), 4.27 (d, *J* = 8.6 Hz, 1H), 3.71 (d, *J* = 8.6 Hz, 1H), 3.44 (s, 3H); **^{13}C NMR** (100 MHz, $(CD_3)_2SO$) δ 171.7, 151.4, 142.0, 138.4, 129.9 (2C), 128.94 (2C), 128.87, 127.7 (2C), 127.3, 127.0 (3C), 126.0, 124.7, 120.0, 114.9, 89.0, 79.3, 77.0, 64.0, 56.6, 51.4; **HR-MS**: *m/z* Calcd for $[C_{25}H_{22}O_5{-}H_2O]^+$ 385.1440, found 385.1456 (+ 4.2 ppm).



16
$C_{25}H_{22}O_5$
MW = 402.44 g/mol

Compound **16** was prepared and purified according to **general procedure A** listed above (Bu_4NBH_4, dr 7:1, 73%). White solid; ***R$_f$*** = 0.27 (1:1 EtOAc/hexanes); **m.p.** 77 °C; **IR** νmax (film): 3452, 3060, 3033, 2940, 1736, 1608, 1584, 1483, 1452, 1210, 905 cm^{-1}; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.38 (ovrlp d, *J* = 7.2 Hz, 3H), 7.28 (ddd, *J* = 8.0, 8.0, 1.2 Hz, 1H), 7.17-6.95 (ovrlp m, 10H), 4.93 (d, *J* = 8.2 Hz, 1H), 4.19 (d, *J* = 9.0 Hz, 1H), 3.65 (s, 1H), 3.57 (s, 3H), 3.47 (d, *J* = 9.0 Hz, 1H), 2.38 (d, *J* = 8.2 Hz, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 170.7, 151.7, 139.6, 136.7, 130.1, 129.2 (2C), 128.2 (2C), 127.91 (2C), 127.85, 127.3 (2C), 126.8, 126.0, 123.7, 121.5, 116.3, 88.2, 78.2, 73.9, 60.0, 54.5, 52.5; **HR-MS**: *m/z* Calcd for $[C_{25}H_{22}O_5{+}Na]^+$ 425.1365, found 425.1355 (− 2.3522 ppm).

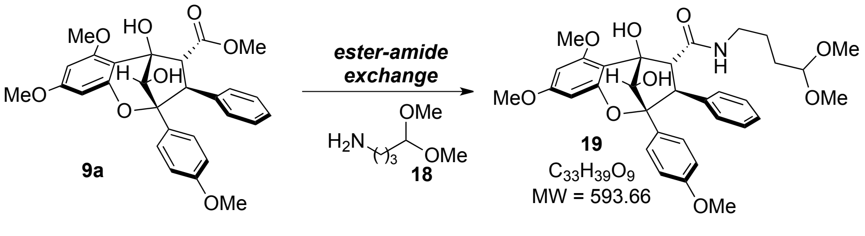
3. Transesterification and Ester-Amide Exchange Protocols



9a

9b
$C_{34}H_{32}O_8$,
MW = 568.6 g/mol

Protocol for transesterification of (±)-9a to (±)-9b: To a solution of aglain methyl ester **(±)-9a** (25 mg, 0.05 mmol, 1 equiv.) in toluene (1.0 mL), benzyl alcohol (520 μL, 5.0 mmol, 100 equiv.) and Otera's catalyst ($C_{36}H_{72}N_4O_2S_4Sn_4$, 12 mg, 0.01 mmol, 0.2 equiv.) were added under argon at room temperature. The resulting slurry was then heated at 110 °C under house vacuum for 24 h. The resulting yellow solution was distilled under high vacuum to remove excess benzyl alcohol and afford the crude product as an oil. The crude material was purified by flash chromatography using a gradient EtOAc/hexanes 20:80 to 60:40 affording the corresponding pure aglain **9b** as a white solid (18 mg, 0.032 mmol, 64%) along with recovered starting aglain **9a** (7 mg, 0.014 mmol, 28%). ***R$_f$*** = 0.70 (1:1 EtOAc/hexanes); Other spectroscopic data of compound **9b** are listed above.



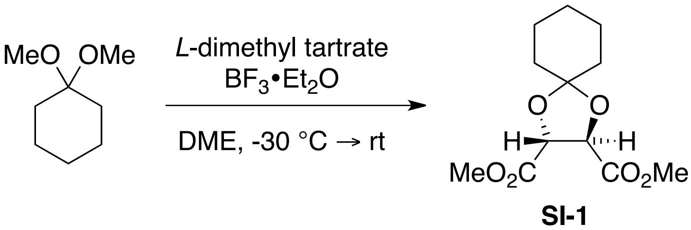
9a

18

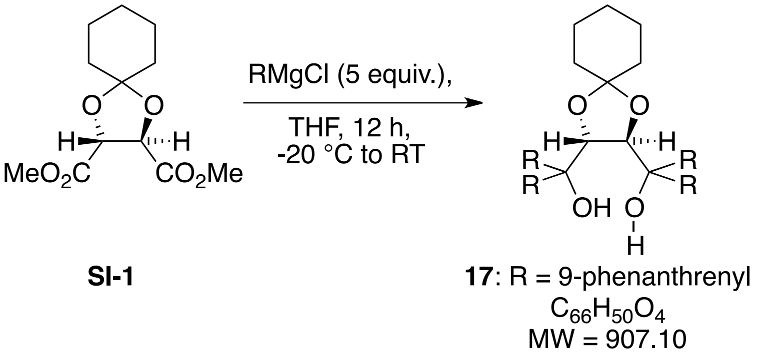
19
$C_{33}H_{39}O_9$
MW = 593.66

Ester-amide exchange protocol to access amido acetal (±)-19. To a solution of amine **18** (637 mg, 4.78 mmol, 20 equiv.) in toluene (1.0 mL) under argon and at rt was added dropwise a solution of trimethylaluminum [2M] (2.4 mL, 4.79 mmol, 20 equiv.). The resulting solution was heated at 40 °C for 1 h to preform the corresponding dimethylaluminum amide. Then a solution of aglain methyl ester (±)-**9a** (110 mg, 0.223 mmol, 1 equiv.) in toluene (6.5 mL) was added *via* cannula, and the reaction mixture was heated at 70 °C for 12 h. The reaction mixture was quenched at 0 °C with saturated ammonium chloride (4 mL), stirred for 1 h, then extracted with EtOAc (3 X 10 mL). The combined organic layers were washed with brine, dried over Na_2SO_4, and filtered. The solvent was removed *in vacuo* to afford a crude white yellow solid. Purification *via* flash chromatography using a gradient of EtOAc/hexanes 1:4 to 4:1 afforded accordingly the corresponding pure amide (±)-**19** (97 mg, 0.163 mmol, 73%). White solid; $\boldsymbol{R_f}$ = 0.22 (EtOAc/hexanes 4:1); **m.p.** 98 ºC; **IR** νmax (film): 3405, 2941, 2837, 1661, 1617, 1589, 1517, 1467, 1439, 1252, 1214, 1201, 1183, 1148, 1129, 1075, 830, 752 cm^{-1}; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.40 (d, *J* = 9.0 Hz, 2H), 7.22 (d, *J* = 7.2 Hz, 2H), 7.03 (br dd, *J* = 7.2, 7.2 Hz, 2H), 6.97 (br t, *J* = 7.2 Hz, 1H), 6.67 (d, *J* = 9.0 Hz, 2H), 6.08 (d, *J* = 2.2 Hz, 1H), 6.06 (d, *J* = 2.2 Hz, 1H), 5.90 (s, 1H), 5.74 (br dd, *J* = 5.5, 5.5 Hz), 4.75 (s, 1H), 4.48 (br d, *J* = 9.0 Hz, 1H), 4.30 (dd, *J* = 5.5, 5.5 Hz, 1H), 3.84 (s, 3H), 3.72 (s, 3H), 3.70 (s, 3H), 3.53 (d, *J* = 9.0 Hz, 1H), 3.18 (ddd, *J* = 13.5, 7.5, 5.5 Hz, 1H) 3.12 (ddd, *J* = 13.5, 6.5, 5.5 Hz, 1H), 1.56-1.51 (ovrlp m, 2H), 1.51-1.45 (ovrlp m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 169.8, 161.2, 158.8, 157.8, 154.0, 142.0, 130.3 (2C), 130.2 (2C), 130.1, 128.0 (2C), 126.1, 113.0 (2C), 104.4, 104.3, 94.7, 92.5, 89.2, 81.0, 79.6, 66.2, 56.1, 55.9, 55.4, 55.2, 53.15, 53.07, 39.5, 30.1, 24.8; **HR-MS**: *m/z* Calcd for $[C_{33}H_{39}O_9+H]^+$ 594.2703, found 594.2704 (+0.17 ppm).

B. General Protocols to Access TADDOL Additives



Preparation of dimethyl 2,3-*O*-cyclohexylidene-*L*-tartrate SI-1: To a solution of *L*-dimethyl tartrate (9.82 g, 55.1 mmol, 1.5 equiv.) in 1,2-dimethoxyethane (DME) (150 mL) at -30 °C under inert atmosphere was added successively 1,1-dimethoxycyclohexane (5.3 g, 36.75 mmol, 1.0 equiv.) and $BF_3 \cdot Et_2O$ (5.45 mL, 44.1 mmol, 1.2 equiv.) dropwise. The resulting mixture was then stirred for 3 h having the temperature raised from -30 °C to RT. The reaction was then cooled to 0 °C and carefully quenched with sat. aqueous $NaHCO_3$ solution. The organic layer was then separated and the aqueous phase was extracted with EtOAc (3 X 400 mL). The combined organic phases were washed with water (2 X 400 mL) and brine (1 X 400 mL). The combined organic extracts were dried over Na_2SO_4, filtered, and concentrated *in vacuo* to afford a crude oil, which was further purified by flash chromatography (gradient of EtOAc/hexanes 2:98 to 15:85) affording pure **SI-1** as a colorless oil (8.07 g, 31.23 mmol, 85%) which was spectroscopically identical to a previously reported compound.[S1] R_f = 0.12 (EtOAc/hexanes 10:90); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 4.73 (s, 2H), 3.74 (s, 6H), 1.60 (m, 8H), 1.33 (m, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ (ppm): 170.2 (2C), 114.5, 76.6 (2C), 52.6 (2C), 35.7 (2C), 24.7, 23.6 (2C); $[\alpha]_D^{20} = -26.9^\circ$ (c = 2.00, $CHCl_3$); literature report [S2] $[\alpha]_D^{20} = -19.8^\circ$ (c = 2.00, $CHCl_3$).



Grignard addition to produce (*R*, *R*)-*2,2-cyclohexyl-α, α, α', α'*-tetrakis(phenanthren-9-yl)-1,3-dioxolane-4,5-dimethanol 17.[S2] A solution of **SI-1** (1.00 g, 3.87 mmol, 1.0 equiv.) in THF (10 mL) was added dropwise to a solution of (phenanthren-9-yl)magnesium bromide (19.4 mmol, 5 equiv., (prepared from 4.98 g of 9-bromophenanthrene and 0.46 g of Mg powder and catalytic amount of iodine in THF (70 mL) at rt) at -20 °C under inert atmosphere. The reaction mixture was then stirred at rt for 12 h. The reaction was quenched at 0 °C by careful addition of ice and a saturated aqueous NH_4Cl solution. The organic layer was separated and the aqueous layer was extracted with ether (3 X 50 mL). The combined organic extracts were dried over Na_2SO_4 and the solvent was removed *in vacuo* to afford a yellow oil. The TADDOL was purified *via* flash chromatography using EtOAc/hexanes (20:80). The white solid was then recrystallized from

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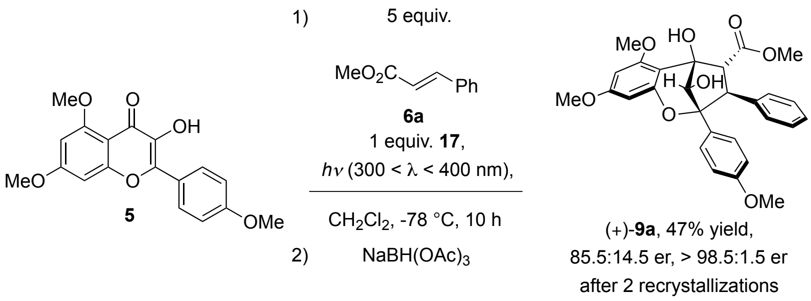
[S1] Cuenca, A.; Medio-Simon, M.; Aguilar, G. A.; Weibel, D.; Beck, A. K.; Seebach, D. *Helv. Chim.Acta*. **2000**, *83*, 3153-3162

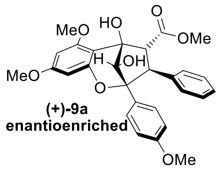
[S2] Gerard, B.; Jones II, G.; Porco Jr., J. A. *J. Am. Chem. Soc.* **2004**, *126*, 13620–13621

CH_2Cl_2/MeOH (10:90), affording pure TADDOL **17** as a white powder (2.036 g, 58%). ***R$_f$*** = 0.35 (CH_2Cl_2/hexanes 1:1); $[\alpha]_D^{20}$ = + 268° (*c* = 2.0, $CHCl_3$); literature report [S2] $[\alpha]_D^{20}$ = + 79° (*c* = 2.0, $CHCl_3$); **HR-MS**: *m/z* Calcd for $[C_{66}H_{50}O_4+Na]^+$ 929.3609, Found 929.3607 (+0.0 ppm). Other spectroscopic data for compound **17** are identical to literature reports.

C. Compound Characterization Toward (+)-Ponapensin (3) and (+)-Elliptifoline (4)

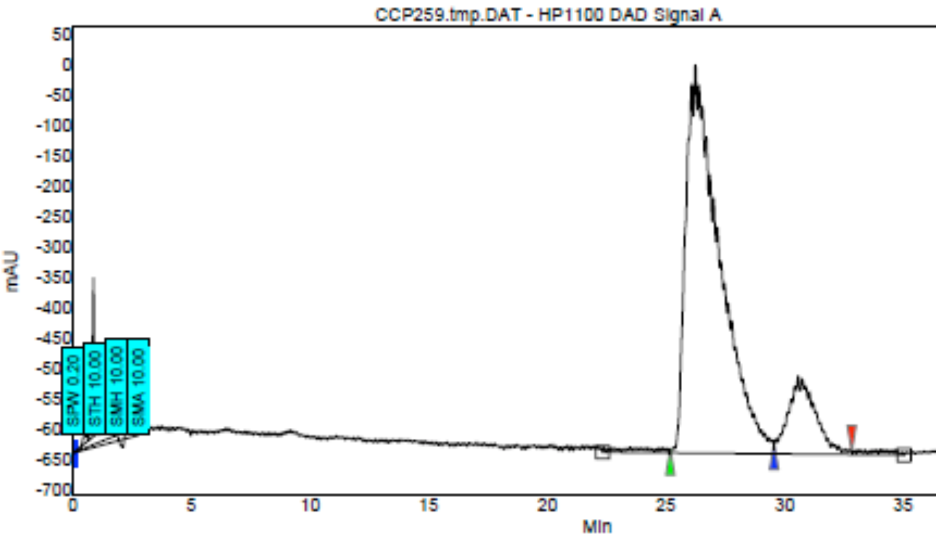


Procedure for enantioselective photocycloaddition: A 16 x 100 mm Pyrex test tube was flame dried under vacuum and then charged with anhydrous 3-hydroxyflavone **5** (dried overnight in vacuum oven) (100 mg, 1.0 equiv., 0.305 mmol, 1.0 equiv.), methyl cinnamate **6a** (247 mg, 5.0 equiv., 1.52 mmol), and TADDOL **17** (276 mg, 0.305 mmol, 1.0 equiv.) in anhydrous CH_2Cl_2 (0.05 M; 6 mL). After degassing with argon for 10 min, the mixture was stirred and irradiated at -78 ^{o}C in the Rayonet RPR-3100 (300 < λ < 400 nm) for 10 h. The solution was concentrated *in vacuo* to afford a brown-yellow oil. Silica gel was washed successively with 80:20:03 hexanes/EtOAc/NEt_3 (one column length) and 80:20 hexanes/EtOAc (one column length) to neutralize acidity. Purification *via* flash chromatography using a gradient of hexanes/EtOAc (80:20 to 30:70) afforded cyclopenta[*bc*]benzopyran **8a**, a light yellow foam, as a mixture of isomers (107 mg, 0.210 mmol, 69%). This mixture of isomers was used without further purification and transformed into the desired reduced 10*S*-aglain **9a** using sodium triacethoxyborohydride (see **general procedure B** for diastereoselective reduction of hydrated aglains). The four diastereomers were separated *via* flash chromatography using a gradient of hexanes/EtOAc (90:10 to 50:50) to afford the desired reduced 10*S* aglain **9a** (49 mg, 0.099 mmol, 47%) which was spectroscopically identical to the racemic compound (±)-**9a** (see above). Enantiopure crystals of **9a** were obtained by slow evaporation from isopropanol (>96:04 er), then another recrystallization by slow evaporation from acetonitrile (>98.6:1.4 er). $[\alpha]_D^{20} = + 136.5^{o}$ (c = 1.0, $CHCl_3$).

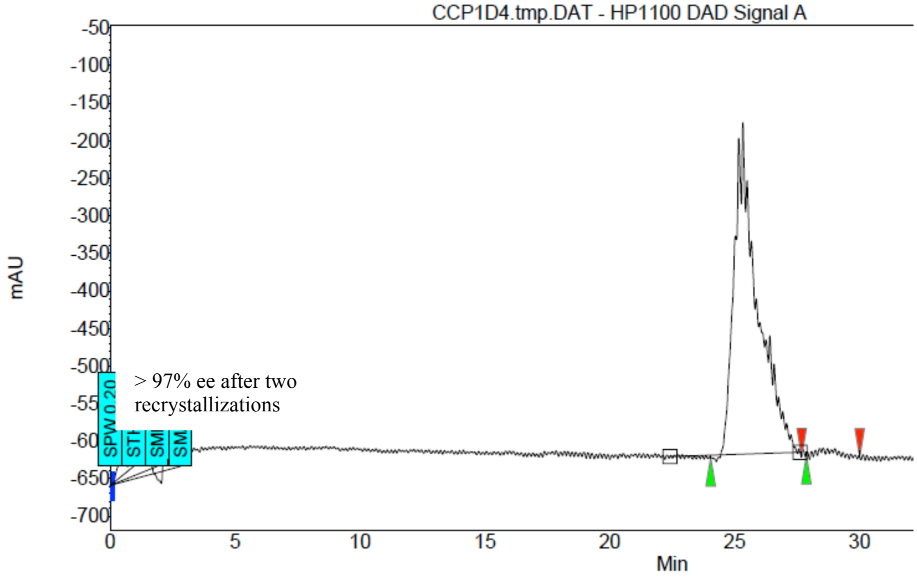


(+)-9a
enantioenriched

Analysis of Aglain 9a: SFC Chiralcel®OD-H column (temperature 35 °C) was used with isocratic elution of MeOH (NEt$_2$ 0.1% / Vol) : CO$_2$ (08:92) with a flow rate of 1.5 mL/min at 100 bar (CO$_2$ pressure) for 45 minutes.

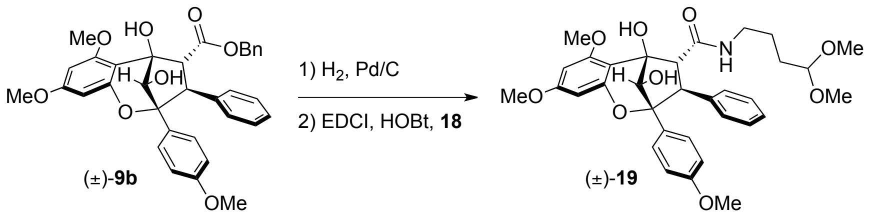


Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	25.17	26.23	29.55	0.00	86.19	639.8	1049.5	86.187
2	UNKNOWN	29.55	30.57	32.82	0.00	13.81	128.9	168.2	13.813
Total						100.00	768.7	1217.7	100.000



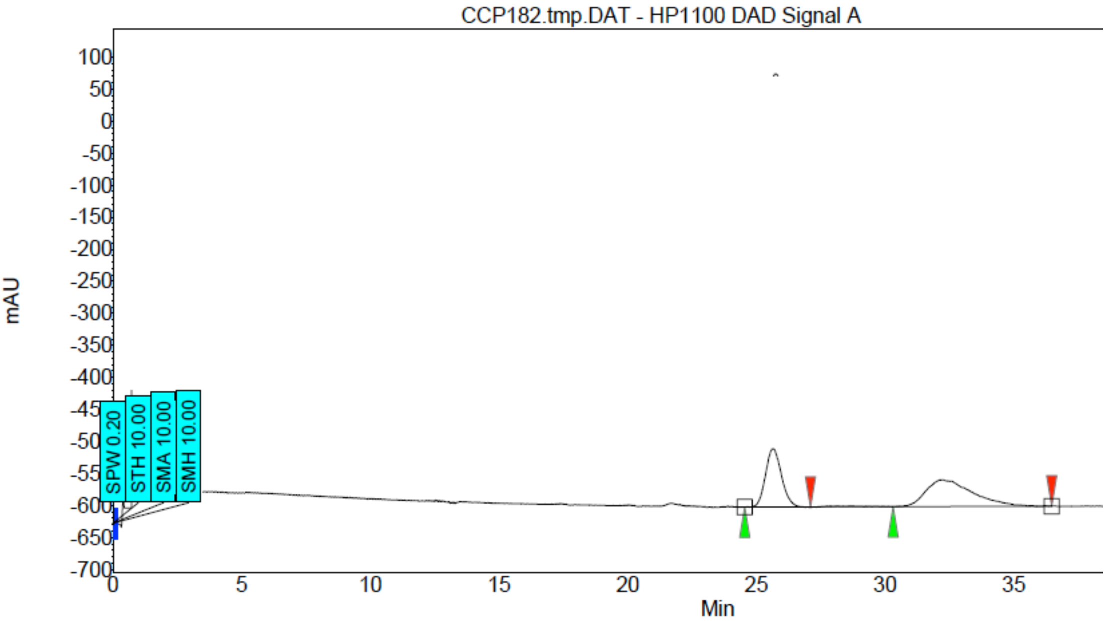
> 97% ee after two recrystallizations

Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	24.04	25.33	27.68	0.00	98.61	441.4	469.3	98.614
2	UNKNOWN	27.87	29.59	30.00	0.00	1.39	11.6	6.6	1.386
Total						100.00	453.0	475.9	100.000

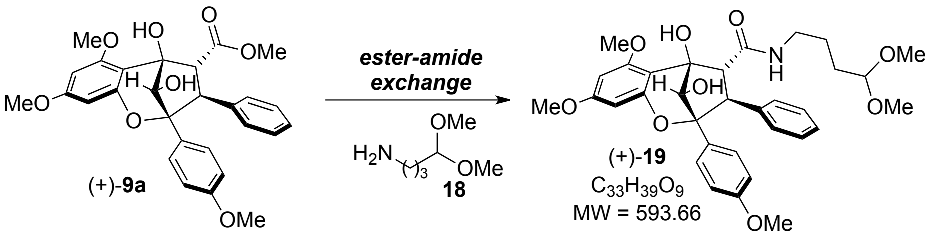


Procedure for the amidation of 9b to produce (±)-19 (2 steps): A dry flask was charged with **9b** (70 mg, 0.124 mmol, 1.0 equiv.) and a stir bar. **9b** was then dissolved in a $CHCl_3$/EtOH (1:3, 12 mL). 10% Pd on carbon (14 mg, 0.013 mmol, 0.1 equiv.) was then added, and the mixture was stirred. The reaction vessel was then purged with H_2 gas using a balloon filled with H_2 and a vacuum manifold. The reaction was stirred under H_2 for 1 h, and then purged/charged with argon. The Pd/C was filtered using a Celite plug, and the filtrate was concentrated *in vacuo* to produce the crude carboxylic acid (58 mg, 100%) which was used in the next reaction without further purification. A flask was charged with the carboxylic acid (58 mg, 1.0 equiv., 0.124 mmol), EDCI (35 mg, 0.182 mmol, 1.5 equiv.), HOBt•H_2O (22 mg, 0.146 mmol, 1.2 equiv.), and a stir bar. The contents were then dissolved in CH_2Cl_2 (3.5 mL). A solution of amine **18** (49 mg, 0.365 mmol, 3.0 equiv.) in CH_2Cl_2 (1 mL) was added to the reaction vessel at 0 ºC under argon. The reaction was then brought to rt and stirred for 16 h. Water (10 mL) and CH_2Cl_2 (10 mL) were added and the organic layer was extracted with CH_2Cl_2 (3 X 10 mL). Brine was used to aid separation of the layers. The combined organic extracts were dried over sodium sulfate and purified *via* flash chromatography (product eluted with 8:2 EtOAc/hexanes, 51 mg, 71% yield). White solid; ***R$_f$*** = 0.22 (4:1 EtOAc/hexanes); **m.p.** 98 ºC; **IR** νmax (film): 3405, 2941, 2837, 1661, 1617, 1589, 1517, 1467, 1439, 1252, 1214, 1201, 1183, 1148, 1129, 1075, 830, 752 cm^{-1}; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.40 (d, *J* = 9.0 Hz, 2H), 7.22 (d, *J* = 7.2 Hz, 2H), 7.03 (br dd, *J* = 7.2, 7.2 Hz, 2H), 6.97 (br t, *J* = 7.2 Hz, 1H), 6.67 (d, *J* = 9.0 Hz, 2H), 6.08 (d, *J* = 2.2 Hz, 1H), 6.06 (d, *J* = 2.2 Hz, 1H), 5.90 (s, 1H), 5.74 (br dd, *J* = 5.5, 5.5 Hz), 4.75 (s, 1H), 4.48 (br d, *J* = 9.0 Hz, 1H), 4.30 (dd, *J* = 5.5, 5.5 Hz, 1H), 3.84 (s, 3H), 3.72 (s, 3H), 3.70 (s, 3H), 3.53 (d, *J* = 9.0 Hz, 1H), 3.18 (ddd, *J* = 13.5, 7.5, 5.5 Hz, 1H) 3.12 (ddd, *J* = 13.5, 6.5, 5.5 Hz, 1H), 1.56-1.51 (ovrlp m, 2H), 1.51-1.45 (ovrlp m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 169.8, 161.2, 158.8, 157.8, 154.0, 142.0, 130.3 (2C), 130.2 (2C), 130.1, 128.0 (2C), 126.1, 113.0 (2C), 104.4, 104.3, 94.7, 92.5, 89.2, 81.0, 79.6, 66.2, 56.1, 55.9, 55.4, 55.2, 53.15, 53.07, 39.5, 30.1, 24.8; **HR-MS**: *m/z* Calcd for $[C_{33}H_{39}O_9+H]^+$ 594.2703, found 594.2704 (+0.17 ppm).

Analysis of (±)-19: SFC Chiralcel®OD-H column (temperature 35 °C) was used with an elution of MeOH (NEt_2 0.1% / Vol) : CO_2 with a flow of 2.5 mL/min at 100 bar (CO_2 pressure): isocratic 05:95 (3 min) then ramped from 05:95 to 20:80 over 43 min (rate: 0.35). T_1 = 25.7 min, T_2 = 32.4 min.



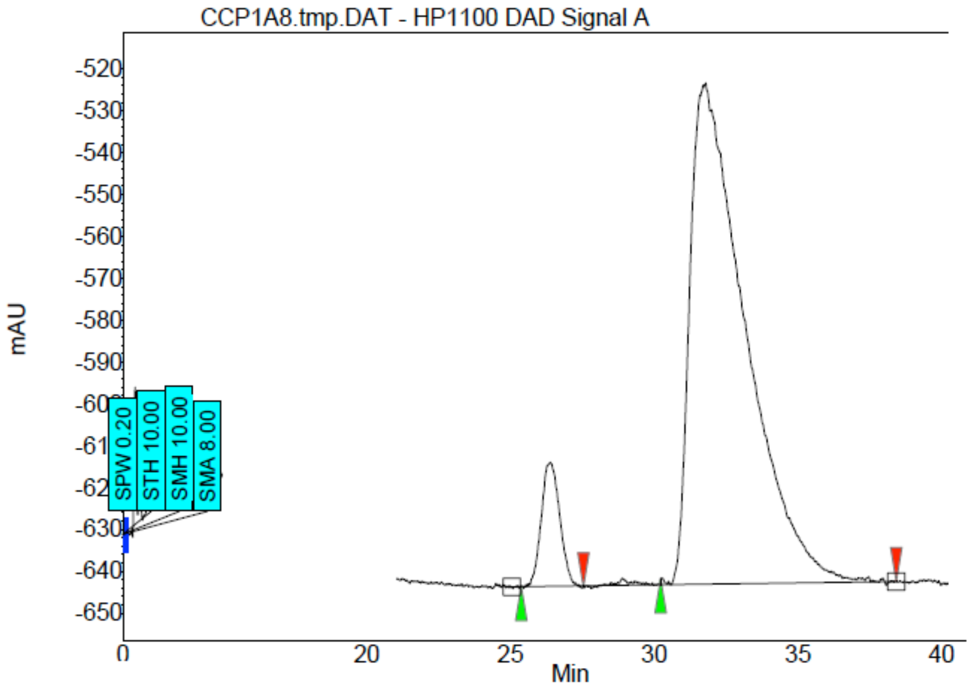
Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	24.65	25.72	27.21	0.00	42.57	90.6	64.9	42.567
2	UNKNOWN	30.42	32.37	36.58	0.00	57.43	41.7	87.5	57.433
Total						100.00	132.3	152.4	100.000



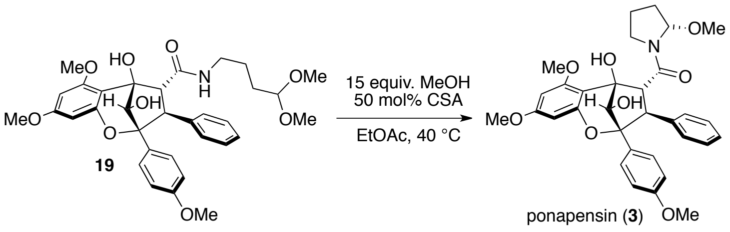
Ester-amide exchange protocol to access aglain-amide (+)-19. To a solution of amine **18** (637 mg, 4.78 mmol, 20 equiv.) in toluene (1.0 mL) under argon and at room temperature was added dropwise a solution of trimethylaluminum [2M] (2.4 mL, 4.79 mmol, 20 equiv.). The resulting solution was heated at 40 °C for 1 h to preform the corresponding aluminate. Then a solution of aglain methyl ester (+)-**9a** (110 mg, 0.223 mmol, 1 equiv.) in toluene (6.5 mL) was added *via* cannula, and the reaction mixture was heated at 70 °C for 12 h. The reaction mixture was quenched at room temperature with a solution of NH_4Cl sat. (4 mL), stirred for 30 min, extracted with EtOAc (3 X 10 mL), and the combined organic layers washed with brine. The organic layer was dried over Na_2SO_4, the solvent was removed *in vacuo* to afford a crude white yellow solid. Purification *via* flash chromatography using a gradient of EtOAc/hexanes 1:4 to 4:1 afforded pure amide (+)-**19** (85 mg, 0.143 mmol, 64%) along with recovered starting material (+)-**9a** (5 mg, 0.010 mmol, 5%). White solid; $\boldsymbol{R_f}$ = 0.22 (EtOAc/hexanes 4:1);

$[\alpha]_D^{20}$ = + 94.8° (c = 1.0, $CHCl_3$); Other spectroscopic data of compound (+)-**19** are identical to its racemate (see above).

Analysis of enantioenriched (+)-19: SFC Chiralcel®OD-H column (temperature 35 °C) was used with an elution of MeOH (NEt_2 0.1% / Vol) : CO_2 with a flow rate of 2.5 mL/min at 100 bar (CO_2 pressure): isocratic 05:95 (3 min) then ramped from 05:95 to 20:80 over 43 min (rate: 0.35). T_1 = 25.7 min, T_2 = 31.1 min.



Index	Name	Start	Time	End	RT Offset	Quantity	Height	Area	Area
		[Min]	[Min]	[Min]	[Min]	[% Area]	[µV]	[µV.Min]	[%]
1	UNKNOWN	24.65	25.66	26.81	0.00	3.92	29.6	10.9	3.923
2	UNKNOWN	29.50	31.07	37.70	0.00	96.08	119.7	266.3	96.077
Total						100.00	149.3	277.2	100.000



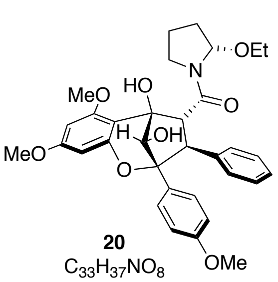
Procedure to prepare (+)-ponapensin (3): A dry flask was charged with aglain amide (+)-**19** (53 mg, 0.090 mmol, 1.0 equiv.) and a stir bar under argon. (+)-**19** was dissolved in EtOAc (9.0 mL) and chilled to 0 °C. Under argon, CSA (10.4 mg, 0.045 mmol, 0.5 equiv.) and MeOH (54 µL, 1.34 mmol, 15 equiv) were added, and the reaction was warmed up to rt, then heated at 40 °C for 2 h. Triethylamine (7 µL, 0.045 mmol, 0.5 equiv.) was added and stirred for 30 min.

Water (2 mL) was added to the reaction, and the organic layer was separated and dried over sodium sulfate. The organic extract was concentrated and purified using preparative TLC (49:1 $CHCl_3$/MeOH) using a TLC plate that was neutralized with MeOH/triethylamine (99:1). Compound **3** was isolated (34 mg, 0.062 mmol, 68%) as a white solid. The reaction of (±)-**19** to (±)-**3** was reacted and purified in the exact same fashion and was crystallized *via* slow evaporation in benzene (600 μL) and hexanes (100 μL). White solid; ***R*** R_f = 0.46 (1:4 hexanes/EtOAc); $[\alpha]_D^{20}$ = + 170° (*c* = 0.2, $CHCl_3$); **m.p.** 235-240 ºC, decomposition observed; **IR** νmax (film): 3476, 3011, 2935, 2840, 1619, 1591, 1517, 1436, 1251, 1215, 1148, 1128, 1081, 750 cm^{-1}; ^{1}**H NMR** (500 MHz, CD_3OD) δ 7.40 (d, *J* = 9.0 Hz, 2H), 7.18 (br d, *J* = 7.0 Hz), 7.00-6.91 (m, 3H), 6.61 (d, *J* = 9.0 Hz, 2H), 6.12 (d, *J* = 2.2 Hz, 1H), 6.03 (d, *J* = 2.2 Hz, 1H), 5.80 (br d, *J* = 3.5 Hz, 1H), 4.62 (br s, 1H), 4.40 (br d, *J* = 9.5 Hz, 1H), 4.36 (d, *J* = 9.5 Hz, 1H), 3.78 (s, 3H), 3.73 (s, 3H), 3.67 (s, 3H), 3.34 (m, 2H), 2.80 (s, 3H), 2.04-2.00 (m, 1H), 1.94-1.88 (ovrlp m, 3H); ^{13}**C NMR** (100 MHz, $CDCl_3$) δ 172.4, 162.7, 160.0, 159.8, 155.0, 143.1, 132.0, 131.7 (2C), 131.4 (2C), 128.6 (2C), 127.0, 113.4 (2C), 107.2, 95.2, 92.8, 90.0, 89.6, 83.1, 80.9, 63.6, 58.5, 56.5, 55.8, 55.4, 54.3, 46.3, 32.7, 21.7; **HR-MS**: *m/z* Calcd for $[C_{32}H_{35}NO_8+Na]^+$ 584.2260, found 584.2252 (-1.4 ppm).

Table SI-2. Comparison of ^{1}H and ^{13}C spectra for natural and synthetic ponapensin (**3**)

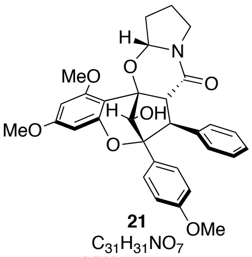
^{1}H Literature [S3]		^{1}H Observed		^{13}C Literature [S3]	^{13}C Observed
Chemical Shift (ppm)	Appearance	Chemical Shift (ppm)	Appearance	Chemical Shift (ppm)	Chemical Shift (ppm)
7.40	d, *J* = 8.9 Hz, 2H	7.40	d, *J* = 9.0 Hz, 2H	172.4	172.4
7.18	d, *J* = 6.8 Hz, 2H	7.18	br d, *J* = 7.0 Hz, 2H	162.7	162.7
6.96	m, 3H	6.96	m, 3H	160.0	160.0
6.61	d, J = 8.9 Hz, 2H	6.61	d, J = 9.0 Hz, 2H	159.8	159.8
6.12	d, *J* =2.2 Hz, 1H	6.12	d, *J* =2.2 Hz, 1H	155.0	155.0
6.03	d, J =2.2 Hz, 1H	6.03	d, J =2.2 Hz, 1H	143.1	143.1
5.80	br d, *J* = 3.3 Hz, 1H	5.80	br d, *J* = 3.5 Hz, 1H	132.0	132.0
4.62	s, 1H	4.62	br s, 1H	131.7 (2C)	131.7 (2C)
4.40	d, *J* = 9.4 Hz, 1H	4.40	br d, *J* = 9.5 Hz, 1H	131.4 (2C)	131.4 (2C)
4.36	d, J = 9.4 Hz, 1H	4.36	d, J = 9.5 Hz, 1H	128.6 (2C)	128.6 (2C)
3.79	s, 3H	3.78	s, 3H	127.0	127.0
3.73	s, 3H	3.73	s, 3H	113.4 (2C)	113.4 (2C)
3.67	s, 3H	3.67	s, 3H	107.3	107.2
3.34	m, 2H	3.34	m, 2H	95.2	95.2
2.80	s, 3H	2.80	s, 3H	92.8	92.8
2.02	m, 1H	2.02	m, 1H	90.0	90.0
1.90	m, 2H	1.91	m, 2H	89.6	89.6
1.88	m, 1H	1.89	m, 1H	83.1	83.1
				80.9	80.9
				63.6	63.6
				58.5	58.5
				56.5	56.5
				55.8	55.8
				55.5	55.4
				54.3	54.3
				46.3	46.3
				32.7	32.7
				21.7	21.7

[S3] Salim, A. A.; Pawlus, A. D.; Chai, H.-B. ; Farnsworth, N. R.; Kinghorn, A. D.; Carcache-Blanco, E. J. *Bioorg. Med. Chem. Lett.* **2007**, *17*, 109-112.



20
$C_{33}H_{37}NO_8$
MW = 575.65 g/mol

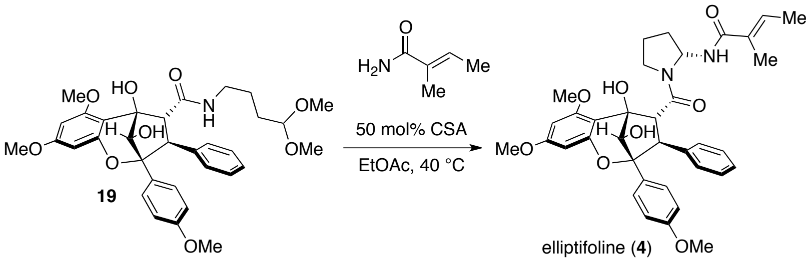
((3S,4R,5R,10S)-5,10-dihydroxy-6,8-dimethoxy-2-(4-methoxyphenyl)-3-phenyl-2,3,4,5-tetrahydro-2,5-methanobenzo[b]oxepin-4-yl)((S)-2-ethoxypyrrolidin-1-yl)methanone ((±)-20): Aglain **20** was prepared using the procedure above, except MeOH was not added, and the reaction vessel was sealed. After quenching, the mixture was concentrated and purified using preparative TLC (49:1 $CHCl_3$/MeOH) using a TLC plate that was neutralized with a MeOH/triethylamine solution (99:1 MeOH/triethylamine). Fractions from the prep. TLC were further purified using reverse phase preparative HPLC (Gilson PLC2020 system, Waters SunFire™ Prep C18 OBD™ 5μm 19X50 mm column, 20.0 mL/min flow rate, 30:70 MeCN/H_2O to 80:20 MeCN/H_2O gradient, 10 min). Ethyl hemiaminal derivative (±)-**20** (6 mg, 12% yield) was isolated as a white solid. ***R$_f$*** = 0.46 (4:1 EtOAc/hexanes); **m.p.** 195-200 °C; **IR** νmax (film): 3468, 2975, 1618, 1590, 1518, 1496, 1457, 1437, 1252, 1214, 1202, 1181, 1148, 1130, 1096, 1080 cm^{-1}; **^{1}H NMR** (400 MHz, $CDCl_3$) δ (rotamers observed) 7.42 (d, *J* = 9.0 Hz, 2H), 7.17 (d, *J* = 7.2 Hz, 2H), 7.00 (dd, *J* = 7.2, 7.0 Hz, 2H), 6.95 (t, *J* = 7.0 Hz, 1H), 6.68 (d, *J* = 9.0 Hz, 2H), 6.10 (d, *J* = 2.2 Hz, 1H), 6.04 (d, *J* = 2.2 Hz, 1H), 5.69 (d, *J* = 4.0 Hz, 1H), 5.66 (s, 1H), 4.82 (s, 1H), 4.61 (d, *J* = 9.2 Hz, 1H), 4.22 (d, *J* = 9.2 Hz, 1H), 3.78 (s, 3H), 3.72 (s, 3H), 3.70 (s, 3H), 3.46-3.41 (m, 1H), 3.37-3.30 (m, 1H), 3.24 (s, 1H), 2.88 (dt, *J* = 14.0, 7.2 Hz, 1H), 2.73 (dt, *J* = 14.0, 7.2 Hz, 1H), 2.05-1.93 (ovrlp m, 2H), 1.88-1.74 (ovrlp m, 2H), 0.76 (t, *J* = 7.2 Hz, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 169.1, 161.1, 158.8, 157.8, 153.8, 141.9, 130.5 (2C), 130.3, 130.1 (2C), 127.9 (2C), 126.0, 113.1 (2C), 105.1, 94.5, 92.2, 89.2, 86.4, 81.7, 80.1, 63.3, 61.7, 57.1, 56.0, 55.4, 55.2, 45.2, 32.9, 21.0, 15.0; **HR-MS**: *m/z* Calcd for $[C_{33}H_{37}NO_8+Na]^+$ 598.2417, found 598.2416 (-0.17 ppm).



21
$C_{31}H_{31}NO_7$
MW = 529.58

(4bR,5aR,10aR,11S,14R)-14-hydroxy-2,4-dimethoxy-12-(4-methoxyphenyl)-11-phenyl-5a,6,7,8,11,12-hexahydro-4b,12-methanobenzo[6,7]oxepino[4,5-e]pyrrolo[2,1-b][1,3]oxazin-10(10aH)-one ((±)-21): Aglain **21** was prepared using the procedure above, except MeOH was not added, and the reaction vessel was sealed. After quenching, the mixture was concentrated and purified using preparative TLC (49:1 $CHCl_3$/MeOH) using a TLC plate that was neutralized with a MeOH/triethylamine solution (99:1 MeOH/triethylamine). Fractions from the prep. TLC were further purified using reverse phase preparative HPLC (Gilson PLC2020 system, Waters SunFire™ Prep C18 OBD™ 5μm 19X50 mm column, 20.0 mL/min flow rate, 30:70 MeCN/H_2O to 80:20 MeCN/H_2O gradient, 10 min). Cyclic intermediate (±)-**21** (1.5 mg, 2% yield) was isolated as a white solid. ***R$_f$*** = 0.46 (4:1 EtOAc/hexanes); **IR** νmax (film): 3530, 2962, 1614, 1261, 1091 cm^{-1}; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.37

(d, J = 8.8 Hz, 2H), 7.15 (d, J = 7.6 Hz, 2H), 7.06 (dd, J = 7.6, 7.2 Hz, 2H), 7.00 (t, J = 7.2 Hz, 1H), 6.66 (d, J = 8.8 Hz, 2H), 6.04 (d, J = 2.4 Hz, 1H), 6.01 (d, J = 2.4 Hz, 1H), 5.68 (dd, J = 6.4 Hz, 1H), 4.82 (s, 1H), 4.23 (d, J = 10.6 Hz, 1H), 4.12 (d, J = 10.6 Hz, 1H), 3.75 (s, 3H), 3.714 (s, 3H), 3.708 (s, 3H), 3.57 (brdd, J = 10.8, 9.2 Hz, 1H), 3.42 (ddd, J = 10.8, 6.8, 4.4 Hz, 1H), 2.85 (s, 1H), 2.44 (ddd, J = 14.0, 7.6, 6.4 Hz, 1H), 2.37 (ddd, J = 14.0, 7.6, 6.4 Hz, 1H), 2.13 (dddd, J = 13.4, 7.6, 7.2, 4.4 Hz, 1H), 1.92 (brddd, J = 13.4, 9.2, 7.2 Hz, 1H); **^{13}C NMR** (100 MHz, CDCl$_3$) δ 167.7, 161.3, 158.9, 158.5, 154.5, 141.2, 130.4 (2C), 130.0 (3C), 128.1 (2C), 126.2, 112.9 (2C), 105.5, 94.1, 93.3, 91.1, 90.7 (2C), 85.8, 60.0, 55.8, 55.4, 55.2, 51.2, 43.6, 31.5, 22.5; **HR-MS**: *m/z* Calcd for $[C_{31}H_{31}NO_7+H]^+$ 530.2179, found 530.2164 (+2.8 ppm).



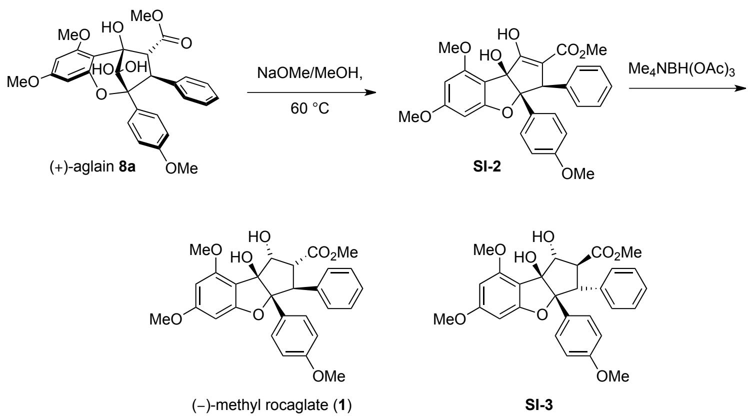
Procedure to Prepare elliptifoline (4): A dry flask was charged with aglain amide **19** (38 mg, 0.064 mmol, 1.0 equiv.) and a stir bar under argon. (+)-**19** was dissolved in EtOAc (6.0 mL) and chilled to 0 °C. Under argon, CSA (7.5 mg, 0.032 mmol, 0.5 equiv.) and tigloyl amide (32 mg, 0.32 mmol, 5 equiv.) were added, and the reaction was warmed up to rt then heated at 40 °C for 6 h. Triethylamine (5 μL, 0.032 mmol, 0.5 equiv.) was added and stirred for 30 min. Water (2 mL) was added to the reaction, and the organic layer was separated and dried over sodium sulfate. The organic layer was concentrated and purified using preparative TLC (49:1 CHCl$_3$/MeOH) using a TLC plate that was neutralized with a MeOH/triethylamine solution (99:1 MeOH/triethylamine). Elliptifoline **4** was isolated (32 mg, 0.051 mmol, 81%) as a white solid. The reaction of (±)-**19** to (±)-**4** was reacted and purified in the exact same fashion and was crystallized *via* slow evaporation in CH$_2$Cl$_2$ (200 μL) and 2,2,4-trimethylpentane (100 μL). White solid; **R_f** = 0.24 (1:4 hexanes/EtOAc); $[\alpha]_D^{20}$ = + 172° (c = 0.2, CHCl$_3$); **m.p.** 185 ºC; **IR** vmax (film): 3441, 3018, 1621, 1517, 1215, 1149, 751 cm^{-1}; ^{1}H NMR (500 MHz, CDCl$_3$) δ 7.40 (d, J = 9.0 Hz, 2H), 7.11 (br dd, J = 6.5, 2.5 Hz, 1H), 6.91-6.88 (overlapping m, 3H), 6.67-6.58 (m, 1H), 6.63 (d, J = 9.0 Hz, 2H), 6.14-6.01 (m, 1H), 6.10 (d, J = 2.0 Hz, 1H), 6.05 (d, J = 2.0 Hz, 1H), 5.38 (d, J = 8.0 Hz, 1H), 4.78 (s, 1H), 4.46 (d, J = 9.0 Hz, 1H), 4.14 (d, J = 9.0 Hz, 1H), 3.81 (s, 3H), 3.72 (s, 3H), 3.68 (s, 3H), 3.66 (s, 1H), 3.60 (m, 1H), 3.21 (ddd, J = 12.0, 9.8, 7.0 Hz, 1H), 2.07 (ddd, J = 12.5, 12.5, 6.5 Hz, 1H), 2.00-1.89 (ovrlp m, 2H), 1.78-1.71 (m, 1H), 1.64 (dd, J = 7.0, 1.5 Hz, 3H), 1.48 (br s, 3H); ^{13}C NMR (100 MHz, CDCl$_3$) δ 169.8, 167.7, 161.2, 158.7, 157.9, 153.8, 141.9, 132.0, 130.8, 130.41 (2C), 130.37 (C1'), 130.2 (2C), 127.9 (2C), 125.7, 112.9 (2C), 105.2, 94.5, 92.2, 89.2, 81.9, 80.00, 63.6, 62.6, 57.2, 56.1, 55.4, 55.2, 46.1, 34.6, 21.6, 14.0, 12.2; **HR-MS**: *m/z* Calcd for $[C_{36}H_{40}N_2O_8+Na]^+$ 651.2682, found 651.2663 (-2.9

ppm).

Table SI-3. Comparison of ^{1}H and ^{13}C spectra for natural and synthetic elliptifoline (**4**)

^{1}H Literature[S4]		^{1}H Observed		^{13}C Literature[S4]	^{13}C Observed
Chemical Shift (ppm)	Appearance	Chemical Shift (ppm)	Appearance	Chemical Shift (ppm)	Chemical Shift (ppm)
7.41	m, 2H	7.40	d, *J* = 9.0 Hz, 2H	169.9	169.8
7.11	m, 2H	7.11	m, 2H	167.9	167.7
6.91	m, 1H	6.90	m, 1H	161.0	161.2
6.89	m, 2H	6.89	m, 2H	158.4	158.7
6.63	m, 1H	6.63	m, 1H	158.1	157.9
6.60	m, 2H	6.63	d, J = 9.0 Hz, 2H	153.7	153.8
6.09	m, 1H	6.10	d, *J* = 2.0 Hz, 1H	141.8	141.9
6.06	m, 1H	6.05	d, *J* = 2.0 Hz, 1H	131.8	132.0
6.02	m, 1H	6.08	m, 1H	130.7	130.4
5.88	s, 1H	5.75	s, 1H	130.4	130.4
5.57	d, *J* = 7.9 Hz, 1H	5.38	d, *J* = 8.0 Hz, 1H	130.2	130.2
4.80	s, 1H	4.78	s, 1H	127.7	127.9
4.62	s, 1H	3.66	s, 1H	125.6	125.7
4.45	d, *J* = 9.2 Hz	4.46	d, *J* = 9.0 Hz, 1H	112.6	112.9
4.15	d, *J* = 9.2 Hz	4.15	d, *J* = 9.0 Hz, 1H	105.4	105.2
3.80	m, 3H	3.81	s, 3H	94.2	94.5
3.71	m, 3H	3.72	s, 3H	91.9	92.2
3.66	s, 3H	3.68	s, 3H	88.9	89.2
3.58	m, 1H	3.60	m, 1H	81.9	81.9
3.21	m, 1H	3.22	m, 1H	79.7	80.0
2.02	m, 2H	2.08	m, 1H	63.7	63.6
1.84	m, 2H	1.94	m, 2H	62.3	62.6
		1.75	m, 1H	57.1	57.2
1.63	d, *J* = 7.0, 3H	1.64	dd, *J* = 7.0, 1.5 Hz, 3H	56.0	56.1
1.47	s, 3H	1.48	br s, 3H	55.2	55.4
				55.0	55.2
				46.1	46.1
				34.5	34.6
				21.4	21.6
				13.9	14.0
				12.0	12.2

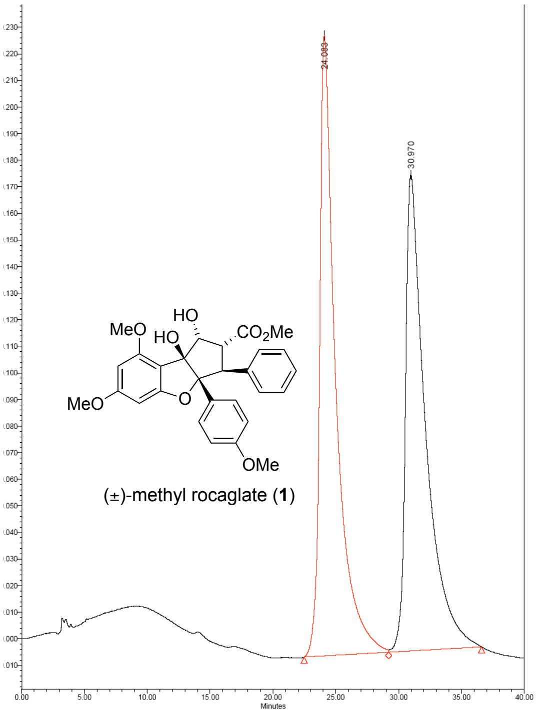
[S4] Wang, S. K.; Cheng, Y.J.; Duh, C.-Y. *J. Nat. Prod.* **2001**, *64*, 92-94.



Procedure to prepare (−)-methyl rocaglate 1 from enantioenriched (+)-8a: Enantioenriched (+)-**8a** was prepared using the following procedure: a 16 x 100 mm Pyrex test tube was flame dried under vacuum and then charged with anhydrous 3-hydroxyflavone **5** (dried overnight in vacuum oven) (100 mg, 1.0 equiv, 0.305 mmol), methyl cinnamate **6a** (247 mg, 5.0 equiv, 1.52 mmol), and TADDOL **17** (276 mg, 0.305 mmol, 1.0 equiv) in anhydrous CH_2Cl_2 (0.05M; 6.0mL). After degassing with argon for 10 min, the mixture was stirred and irradiated at -78 ^oC in the Rayonet RPR-3100 (315 < λ < 400 nm) for 10 h. The solution was concentrated in *vacuo* to afford a brown-yellow oil. Silica gel was washed successively with 80:20:03 hexanes/EtOAc/NEt_3 (one column length) and 80:20 hexanes/EtOAc (one column length) to neutralize acidity. Purification *via* flash chromatography using a gradient of hexanes/EtOAc (80:20 to 30:70) afforded cyclopenta[*bc*]benzopyran **8a**, a light yellow foam, as a mixture of isomers (107 mg, 0.210 mmol, 69%). This mixture of isomers was used without further purification in a base mediated ketol rearrangement to form a cyclopenta[*bc*]benzofuran **SI-2** using the following procedure:[S5] To a solution of **8a** (107 mg, 0.210 mmol, 1 equiv) in MeOH (4 mL) under an inert atmosphere was added a solution of freshly prepared NaOMe in methanol (0.3 M, 1.8 mL, 0.540 mmol, 2.6 equiv) at rt. The resulting solution was stirred for 30 min at 60 °C. After removal of the MeOH under vacuum, the crude reaction mixture was quenched with a sat. NH_4Cl solution (10 mL) and HCl (1M, 5 mL) giving a yellowish, cloudy solution which was extracted with EtOAc (3 x 10 mL). The combined organic layers were then washed with brine (10 mL), dried over sodium sulfate, filtered, and concentrated *in vacuo* to afford quantitatively a crude yellow oil **SI-2** (107 mg, 0.24 mmol) which was used without further purification in the next step:[S5] To a solution of trimethoxy-cyclopenta[*b*]benzofurans **SI-2** (107 mg, 0.21 mmol, 1.0 equiv.) in CH_3CN (6.0 mL) at 0 °C under inert atmosphere were added successively acetic acid (115 μL, 2.10 mmol, 10 equiv.) and $Me_4NBH(OAc)_3$ (340 mg, 1.26 mmol, 6 equiv). The resulting yellow solution was stirred for 12 h at 0 °C to rt before being quenched with a sat. NH_4Cl solution (4 mL). The mixture was then extracted with EtOAc (3 x 5 mL) and the combined organic layers were washed with sat. $NaHCO_3$ (20 mL), dried over Na_2SO_4, filtered, and concentrated *in vacuo*. Note: removal of the generated AcOH by a basic wash ($NaHCO_3$) prior to concentration avoided degradation of the crude material. The crude material was purified by flash chromatography (gradient of EtOAc/hexane, 10:90 → 40:60) to afford methyl rocaglate (**1**) (61 mg, 0.124 mmol, 52% over two steps) and its diastereomer **SI-3** (19 mg, 0.039 mmol, (16% over two steps).

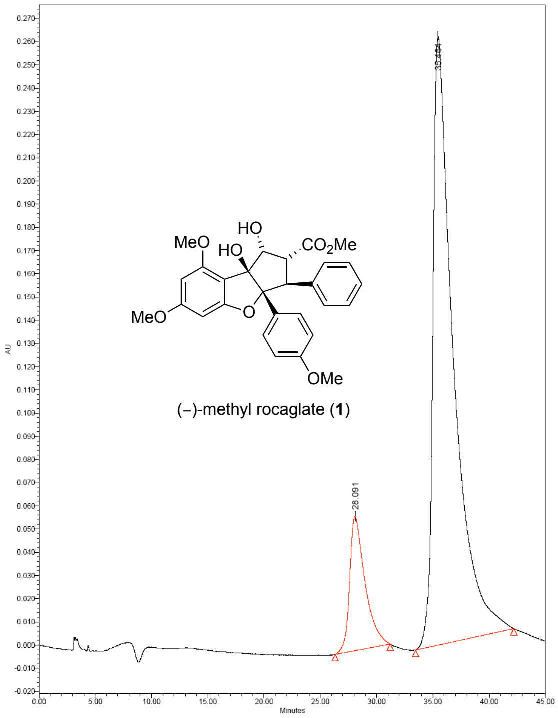
Chiral HPLC Analysis of racemic methyl rocaglate (**1**): Regis Pirkle covalent (R,R) WHELK-O 1 column was used, with an isocratic mobile phase of isopropanol/hexanes (20:80) with a flow rate of 1.0 mL/min for 40 min.

[S5] Roche, S. P.; Cencic, R.; Pelletier J. ; Porco Jr., J. A. *Angew. Chem. Int. Ed.* **2010**, *49*, 6533-6538.



	Name	Retention Time (min)	Area (µV*sec)	% Area	Height (µV)	Int Type	Amount	Units	Peak Type	Peak Codes
1		24.083	20723418	51.00	233307	BV			Unknown	
2		30.970	19907670	49.00	178959	VB			Unknown	

Chiral HPLC Analysis of enantioenriched (−)-methyl rocaglate (**1**): *Regis Pirkle covalent (R,R) WHELK-O 1* column was used, with an isocratic mobile phase of isopropanol/hexanes (20:80) with a flow rate of 1.0 mL/min for 45 min.



	Name	Retention Time (min)	Area (µV*sec)	% Area	Height (µV)	Int Type	Amount	Units	Peak Type	Peak Codes
1		28.091	5524911	14.16	57885	BB			Unknown	
2		35.464	33481711	85.84	262284	BB			Unknown	

After HPLC analysis of enantioenriched methyl rocaglate (**1**), the optical rotation was measured. $[\alpha]_D^{20}$ = -32 ° (71.5% ee), consistent with previous literature reports for (−)-methyl rocaglate.[S2] All other spectroscopic properties were identical to previous reports.

[S2] Gerard, B.; Jones II, G.; Porco Jr., J. A. *J. Am. Chem. Soc.* **2004**, *126*, 13620–13621.

D. X-ray Crystallographic Data

X-ray crystallographic data for enantiopure **(+)-9a**

(Absolute and relative stereochemistry)

Crystals of compound **(+)-9a** suitable for X-ray analysis were obtained by slow evaporation from isopropanol, then another recrystallization by slow evaporation from acetonitrile. Crystallographic data have been deposited with the Cambridge Crystallographic Data Centre (CCDC #833990). Copies of the data can be obtained free of charge on application to the CCDC, 12 Union Road, Cambridge CB21EZ, UK (fax: (+44)- 1223-336-033; e-mail: deposit@ccdc.cam.ac.uk.

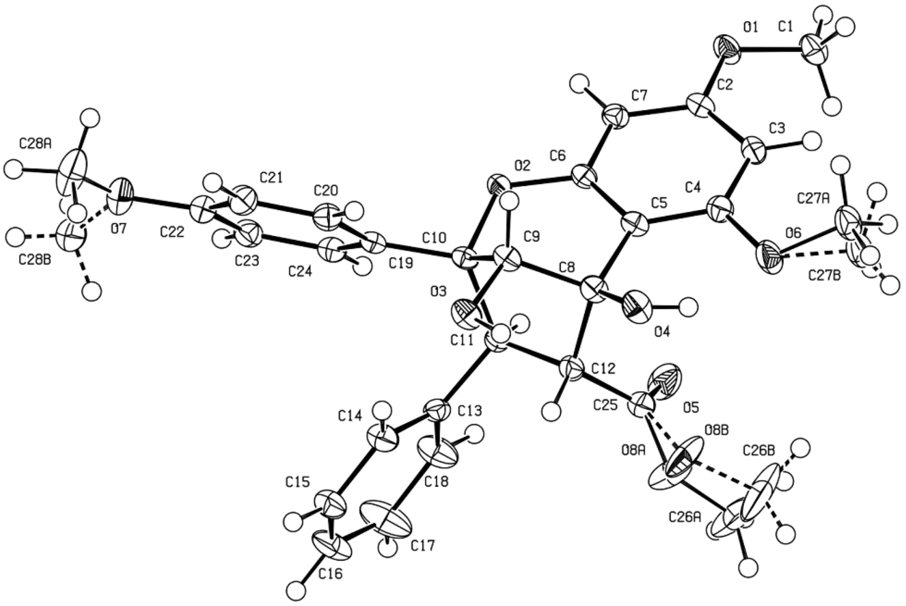


Table SI-4. Crystal data and structure refinement for the absolute stereochemistry of the reduced aglain **(+)-9a**.

Identification code **9a**

Crystal data

$C_{28}H_{28}O_8$	$F(000) = 1040$
$M_r = 492.50$	$D_x = 1.374$ Mg m^{-3}
Orthorhombic, $P2_12_12_1$	Cu $K\alpha$ radiation, $\lambda = 1.54178$ Å
Hall symbol: P 2ac 2ab	Cell parameters from 9257 reflections
$a = 6.3478$ (2) Å	$\theta = 13.7$–$131.9°$
$b = 12.4544$ (4) Å	$\mu = 0.84$ mm^{-1}
$c = 30.1079$ (10) Å	$T = 100$ K
$V = 2380.27$ (13) Å^3	Block, colorless

$Z = 4$	0.20 × 0.08 × 0.06 mm

Data collection

Bruker Proteum-R diffractometer	4168 independent reflections
Radiation source: rotating anode	4141 reflections with $I > 2\sigma(I)$
graphite	$R_{\text{int}} = 0.033$
ϕ & ω scans	$\theta_{\text{max}} = 66.2°$, $\theta_{\text{min}} = 3.8°$
Absorption correction: multi-scan *SADABS* (Sheldrick, 1996)	$h = -7 \rightarrow 7$
$T_{\text{min}} = 0.686$, $T_{\text{max}} = 0.753$	$k = -14 \rightarrow 14$
120163 measured reflections	$l = -35 \rightarrow 35$

Refinement

Refinement on F^2	Secondary atom site location: difference Fourier map
Least-squares matrix: full	Hydrogen site location: inferred from neighbouring sites
$R[F^2 > 2\sigma(F^2)] = 0.024$	H-atom parameters constrained
$wR(F^2) = 0.061$	$w = 1/[\sigma^2(F_o^2) + (0.0333P)^2 + 0.5417P]$ where $P = (F_o^2 + 2F_c^2)/3$
$S = 1.04$	$(\Delta/\sigma)_{\text{max}} = 0.002$
4168 reflections	$\Delta\rangle_{\text{max}} = 0.22$ e Å^{-3}
367 parameters	$\Delta\rangle_{\text{min}} = -0.17$ e Å^{-3}
13 restraints	Absolute structure: Flack H D (1983), Acta Cryst. A39, 876-881
Primary atom site location: structure-invariant direct methods	Flack parameter: -0.03 (11)

Special details

Geometry. All esds (except the esd in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell esds are taken into account individually in the estimation of esds in distances, angles and torsion angles; correlations between esds in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell esds is used for estimating esds involving l.s. planes.

Refinement. Refinement of F^2 against ALL reflections. The weighted R-factor wR and goodness of fit S are based on F^2, conventional R-factors R are based on F, with F set to zero for negative F^2. The threshold expression of $F^2 > 2\text{sigma}(F^2)$ is used only for calculating R-factors(gt) etc. and is not relevant to the choice of reflections for refinement. R-factors based on F^2 are statistically about twice as large as those based on F, and R- factors based on ALL data will be even larger.

The crystallized compound was known to be a single enantiomer with >98% ee separated by chiral chromatography. The absolute structure was determined unambiguously from the crystal data alone, with all relevant indicators of correctness in agreement. Upon completion of refinement with XL, OLEX2 calculates and outputs values for these parameters. This output is given here:

Bijvoet pair analysis using Gaussian distribution Bijvoet pairs (all): 1742 Bijvoet pairs (used): 1737 Bijvoet pairs coverage: 0.99 G: 1.01 (3) P2(true): 1.000 P3(true): 1.000 P3(false): 0.000 P3(racemic twin): 0.000 Hooft y: -0.005 (15) Flack x: -0.03 (11)

CheckCIF alerts and response:

Alert level B PLAT220_ALERT_2_B Large Non-Solvent C Ueq(max)/Ueq(min) ···4.52 Ratio PLAT230_ALERT_2_B Hirshfeld Test Diff for O7 –C28A .. 8.28 su PLAT413_ALERT_2_B Short Inter XH3 .. XHn H17 .. H28F .. 1.92 Ang. Alert level C PLAT213_ALERT_2_C Atom C26B has ADP max/min Ratio ···.. 3.20 prola PLAT222_ALERT_3_C Large Non-Solvent H Uiso(max)/Uso(min) ···5.60 Ratio

The structure includes three disordered OMe groups, each refined with its own occupancy free variable, and the diffuse electron densities associated with these disorders give rise to the level B and level C alerts. Anisotropic refinement of the major and minor components C26A and C26B leads to somewhat prolate ellipsoids, and the riding H atoms have correspondingly large isotropic thermal parameters. The short inter-molecular H17 .. H28F contact is most likely due to imprecise positions for the three hydrogen atoms on C28B, which is part of a minor (23%) component of the C28 disorder. The relatively low electron density for the minor component atom C28B also likely gives rise to a slightly mis-oriented thermal ellipsoid for this atom, generating the Hirshfield test alert.

Despite the slight anomalies for these disordered groups, the chemical characteristics of inter-est for this research, the regio- and stereochemistry, are unambiguous.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å^2)

	x	*y*	*z*	U_{iso}*/U_{eq}	Occ. (<1)
O2	0.63728 (13)	0.45064 (6)	0.32457 (2)	0.01780 (17)	
O3	0.13731 (13)	0.52418 (7)	0.37597 (3)	0.02269 (18)	
H3	0.0785	0.5843	0.3784	0.034*	
O1	1.13444 (13)	0.63226 (7)	0.23874 (3)	0.02269 (18)	
O6	0.60473 (17)	0.83364 (7)	0.31928 (3)	0.0327 (2)	
O4	0.28545 (14)	0.72388 (7)	0.35232 (3)	0.02514 (19)	
H4	0.3497	0.7816	0.3473	0.038*	
O7	0.28132 (17)	0.00827 (7)	0.37268 (3)	0.0366 (2)	
O8A	0.6000 (12)	0.7690 (9)	0.4474 (3)	0.0379 (15)	0.60 (3)
O5	0.86467 (16)	0.69235 (8)	0.41110 (3)	0.0346 (2)	
C16	0.4986 (2)	0.35964 (12)	0.53217 (4)	0.0340 (3)	

H16	0.4800	0.3289	0.5608	0.041*	
C17	0.6947 (3)	0.39232 (15)	0.51847 (5)	0.0464 (4)	
H17	0.8119	0.3850	0.5378	0.056*	
C11	0.59038 (18)	0.50155 (9)	0.40315 (4)	0.0169 (2)	
H11	0.7457	0.5023	0.3977	0.020*	
C18	0.7226 (2)	0.43616 (12)	0.47635 (4)	0.0324 (3)	
H18	0.8594	0.4576	0.4671	0.039*	
C24	0.56519 (19)	0.26001 (10)	0.38010 (4)	0.0201 (2)	
H24	0.6999	0.2841	0.3896	0.024*	
C1	1.2536 (2)	0.72764 (10)	0.23044 (4)	0.0245 (3)	
H1C	1.2801	0.7649	0.2586	0.037*	
H1A	1.1741	0.7749	0.2105	0.037*	
H1B	1.3881	0.7085	0.2166	0.037*	
C7	0.87442 (19)	0.54562 (9)	0.28002 (4)	0.0182 (2)	
H7	0.9316	0.4789	0.2706	0.022*	
C9	0.31375 (18)	0.53313 (9)	0.34756 (4)	0.0188 (2)	
H9	0.2726	0.5249	0.3157	0.023*	
C10	0.48211 (18)	0.45127 (9)	0.36091 (4)	0.0166 (2)	
C12	0.51390 (19)	0.62024 (9)	0.40371 (4)	0.0188 (2)	
H12	0.3914	0.6256	0.4245	0.023*	
C13	0.55406 (19)	0.44888 (9)	0.44792 (4)	0.0179 (2)	
C15	0.3287 (2)	0.37175 (11)	0.50404 (4)	0.0279 (3)	
H15	0.1928	0.3491	0.5133	0.033*	
C22	0.3203 (2)	0.11561 (10)	0.36849 (4)	0.0239 (3)	
C21	0.1751 (2)	0.18818 (10)	0.35177 (4)	0.0248 (3)	
H21	0.0417	0.1637	0.3417	0.030*	
C6	0.70610 (18)	0.54864 (9)	0.30923 (4)	0.0168 (2)	
C23	0.5177 (2)	0.15195 (10)	0.38233 (4)	0.0225 (3)	
H23	0.6192	0.1025	0.3932	0.027*	
C3	0.8684 (2)	0.73938 (10)	0.27651 (4)	0.0211 (2)	
H3A	0.9226	0.8048	0.2650	0.025*	
C5	0.61287 (19)	0.64468 (9)	0.32260 (4)	0.0185 (2)	
C2	0.95809 (19)	0.64148 (10)	0.26473 (4)	0.0188 (2)	
C19	0.41916 (19)	0.33482 (9)	0.36415 (3)	0.0176 (2)	
C8	0.43202 (18)	0.63886 (9)	0.35552 (4)	0.0194 (2)	
C25	0.6803 (2)	0.69747 (10)	0.41900 (4)	0.0224 (3)	
C20	0.2249 (2)	0.29713 (10)	0.34979 (4)	0.0218 (3)	
H20	0.1242	0.3464	0.3384	0.026*	
C4	0.6981 (2)	0.73928 (10)	0.30537 (4)	0.0215 (2)	

C14	0.3552 (2)	0.41686 (10)	0.46227 (4)	0.0244 (3)	
H14	0.2369	0.4260	0.4433	0.029*	
C28A	0.0882 (3)	-0.03279 (14)	0.35960 (8)	0.0402 (6)	0.772 (4)
H28B	0.0824	-0.1097	0.3665	0.060*	0.772 (4)
H28A	0.0702	-0.0223	0.3276	0.060*	0.772 (4)
H28C	-0.0248	0.0046	0.3755	0.060*	0.772 (4)
C27A	0.6151 (3)	0.92590 (12)	0.28969 (6)	0.0284 (5)	0.809 (4)
H27C	0.7575	0.9562	0.2904	0.043*	0.809 (4)
H27B	0.5137	0.9803	0.2994	0.043*	0.809 (4)
H27A	0.5810	0.9033	0.2594	0.043*	0.809 (4)
C27B	0.7203 (15)	0.9325 (6)	0.3066 (3)	0.0284 (5)	0.191 (4)
H27E	0.8609	0.9315	0.3201	0.043*	0.191 (4)
H27F	0.6429	0.9956	0.3172	0.043*	0.191 (4)
H27D	0.7336	0.9359	0.2742	0.043*	0.191 (4)
C26A	0.7445 (11)	0.8444 (10)	0.4661 (4)	0.059 (2)	0.60 (3)
H26B	0.8594	0.8057	0.4809	0.088*	0.60 (3)
H26C	0.6710	0.8894	0.4879	0.088*	0.60 (3)
H26A	0.8024	0.8897	0.4425	0.088*	0.60 (3)
C28B	0.3506 (12)	-0.0556 (5)	0.4031 (2)	0.0358 (18)	0.228 (4)
H28E	0.2468	-0.1123	0.4085	0.054*	0.228 (4)
H28F	0.3740	-0.0150	0.4306	0.054*	0.228 (4)
H28D	0.4835	-0.0878	0.3933	0.054*	0.228 (4)
O8B	0.588 (2)	0.7847 (10)	0.4360 (6)	0.043 (2)	0.40 (3)
C26B	0.741 (2)	0.8716 (9)	0.4494 (8)	0.074 (3)	0.40 (3)
H26E	0.8468	0.8416	0.4697	0.112*	0.40 (3)
H26F	0.6649	0.9296	0.4644	0.112*	0.40 (3)
H26D	0.8116	0.8999	0.4229	0.112*	0.40 (3)

Atomic displacement parameters (Å^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
O2	0.0202 (4)	0.0168 (4)	0.0164 (4)	0.0000 (3)	0.0037 (3)	0.0016 (3)
O3	0.0162 (4)	0.0276 (4)	0.0244 (4)	0.0026 (3)	0.0039 (3)	0.0038 (3)
O1	0.0223 (4)	0.0221 (4)	0.0237 (4)	0.0013 (4)	0.0093 (4)	0.0037 (3)
O6	0.0459 (6)	0.0176 (4)	0.0344 (5)	0.0052 (4)	0.0212 (5)	0.0044 (4)
O4	0.0232 (4)	0.0229 (4)	0.0294 (4)	0.0084 (4)	0.0053 (4)	0.0056 (4)
O7	0.0516 (6)	0.0207 (4)	0.0376 (5)	-0.0083 (4)	-0.0002 (5)	0.0013 (4)
O8A	0.0295 (17)	0.044 (3)	0.040 (3)	-0.0019 (17)	-0.0018 (16)	-0.025 (2)

O5	0.0276 (5)	0.0330 (5)	0.0434 (6)	-0.0090 (4)	0.0080 (4)	-0.0113 (4)
C16	0.0411 (8)	0.0420 (8)	0.0189 (6)	0.0115 (7)	0.0057 (6)	0.0104 (6)
C17	0.0318 (8)	0.0819 (12)	0.0256 (7)	0.0110 (8)	-0.0040 (6)	0.0175 (8)
C11	0.0165 (5)	0.0174 (5)	0.0169 (5)	0.0006 (5)	0.0005 (4)	-0.0001 (4)
C18	0.0225 (6)	0.0514 (9)	0.0233 (6)	0.0014 (6)	0.0001 (5)	0.0066 (6)
C24	0.0199 (6)	0.0241 (6)	0.0165 (5)	-0.0005 (5)	0.0007 (4)	-0.0006 (5)
C1	0.0226 (6)	0.0263 (6)	0.0247 (6)	-0.0020 (5)	0.0051 (5)	0.0042 (5)
C7	0.0195 (6)	0.0188 (5)	0.0163 (5)	0.0022 (5)	-0.0001 (5)	0.0009 (4)
C9	0.0156 (5)	0.0234 (6)	0.0173 (5)	0.0010 (5)	0.0004 (4)	0.0027 (5)
C10	0.0149 (5)	0.0211 (6)	0.0137 (5)	-0.0002 (5)	0.0024 (4)	0.0006 (4)
C12	0.0210 (6)	0.0171 (6)	0.0182 (5)	0.0005 (5)	0.0044 (5)	0.0004 (4)
C13	0.0214 (6)	0.0172 (5)	0.0152 (5)	0.0033 (5)	0.0007 (5)	-0.0018 (4)
C15	0.0303 (7)	0.0308 (6)	0.0225 (6)	-0.0012 (6)	0.0079 (5)	0.0017 (5)
C22	0.0306 (7)	0.0199 (6)	0.0211 (6)	-0.0031 (5)	0.0029 (5)	-0.0009 (5)
C21	0.0244 (6)	0.0268 (6)	0.0233 (6)	-0.0056 (5)	-0.0028 (5)	-0.0003 (5)
C6	0.0179 (5)	0.0188 (5)	0.0136 (5)	0.0009 (5)	-0.0015 (4)	0.0030 (4)
C23	0.0259 (6)	0.0218 (6)	0.0198 (6)	0.0032 (5)	0.0016 (5)	0.0019 (5)
C3	0.0249 (6)	0.0184 (5)	0.0199 (5)	-0.0011 (5)	0.0030 (5)	0.0035 (4)
C5	0.0185 (5)	0.0213 (6)	0.0156 (5)	0.0020 (5)	0.0008 (5)	0.0019 (4)
C2	0.0184 (6)	0.0238 (6)	0.0142 (5)	0.0006 (5)	0.0015 (4)	0.0025 (5)
C19	0.0204 (6)	0.0201 (6)	0.0123 (5)	-0.0009 (5)	0.0025 (4)	0.0002 (4)
C8	0.0185 (6)	0.0198 (6)	0.0199 (6)	0.0047 (5)	0.0028 (5)	0.0020 (5)
C25	0.0292 (7)	0.0203 (6)	0.0177 (5)	0.0002 (5)	0.0012 (5)	0.0005 (5)
C20	0.0230 (6)	0.0236 (6)	0.0188 (6)	-0.0008 (5)	-0.0035 (5)	0.0009 (5)
C4	0.0267 (6)	0.0179 (6)	0.0198 (5)	0.0028 (5)	0.0027 (5)	0.0010 (5)
C14	0.0235 (6)	0.0303 (6)	0.0196 (6)	-0.0012 (5)	0.0002 (5)	0.0012 (5)
C28A	0.0288 (10)	0.0215 (9)	0.0704 (14)	-0.0027 (7)	0.0067 (10)	-0.0081 (9)
C27A	0.0347 (11)	0.0179 (7)	0.0325 (10)	0.0052 (7)	0.0084 (8)	0.0067 (7)
C27B	0.0347 (11)	0.0179 (7)	0.0325 (10)	0.0052 (7)	0.0084 (8)	0.0067 (7)
C26A	0.052 (3)	0.055 (4)	0.069 (4)	-0.018 (2)	0.008 (3)	-0.044 (3)
C28B	0.054 (4)	0.023 (3)	0.030 (3)	-0.001 (3)	0.002 (3)	0.000 (2)
O8B	0.053 (3)	0.019 (2)	0.056 (6)	0.0084 (18)	-0.012 (3)	-0.020 (3)
C26B	0.099 (6)	0.024 (3)	0.101 (9)	-0.011 (3)	-0.037 (6)	-0.021 (4)

Geometric parameters (Å, º)

O2—C6	1.3762 (13)	C12—C25	1.5012 (17)
O2—C10	1.4722 (13)	C12—C8	1.5583 (16)
O3—C9	1.4138 (14)	C12—H12	1.0000

O3—H3	0.8400	C13—C14	1.3924 (18)
O1—C2	1.3706 (14)	C15—C14	1.3877 (18)
O1—C1	1.4303 (15)	C15—H15	0.9500
O6—C4	1.3811 (15)	C22—C21	1.3856 (18)
O6—C27A	1.4553 (18)	C22—C23	1.3961 (19)
O6—C27B	1.484 (7)	C21—C20	1.3944 (17)
O4—C8	1.4128 (14)	C21—H21	0.9500
O4—H4	0.8400	C6—C5	1.3939 (16)
O7—C28B	1.290 (6)	C23—H23	0.9500
O7—C22	1.3654 (15)	C3—C4	1.3871 (17)
O7—C28A	1.386 (2)	C3—C2	1.3917 (17)
O8A—C25	1.336 (8)	C3—H3A	0.9500
O8A—C26A	1.429 (11)	C5—C4	1.3963 (17)
O5—C25	1.1958 (17)	C5—C8	1.5186 (16)
C16—C17	1.373 (2)	C19—C20	1.3887 (17)
C16—C15	1.379 (2)	C25—O8B	1.335 (12)
C16—H16	0.9500	C20—H20	0.9500
C17—C18	1.392 (2)	C14—H14	0.9500
C17—H17	0.9500	C28A—H28B	0.9800
C11—C13	1.5165 (15)	C28A—H28A	0.9800
C11—C12	1.5560 (15)	C28A—H28C	0.9800
C11—C10	1.5755 (15)	C27A—H27C	0.9800
C11—H11	1.0000	C27A—H27B	0.9800
C18—C13	1.3794 (18)	C27A—H27A	0.9800
C18—H18	0.9500	C27B—H27E	0.9800
C24—C23	1.3808 (17)	C27B—H27F	0.9800
C24—C19	1.3994 (17)	C27B—H27D	0.9800
C24—H24	0.9500	C26A—H26B	0.9800
C1—H1C	0.9800	C26A—H26C	0.9800
C1—H1A	0.9800	C26A—H26A	0.9800
C1—H1B	0.9800	C28B—H28E	0.9800
C7—C6	1.3843 (17)	C28B—H28F	0.9800
C7—C2	1.3854 (17)	C28B—H28D	0.9800
C7—H7	0.9500	O8B—C26B	1.510 (18)
C9—C10	1.5307 (16)	C26B—H26E	0.9800
C9—C8	1.5346 (16)	C26B—H26F	0.9800
C9—H9	1.0000	C26B—H26D	0.9800
C10—C19	1.5075 (16)		

C6—O2—C10	117.19 (8)	C22—C21—H21	120.0
C9—O3—H3	109.5	C20—C21—H21	120.0
C2—O1—C1	117.51 (9)	O2—C6—C7	115.73 (10)
C4—O6—C27A	117.83 (10)	O2—C6—C5	121.96 (10)
C4—O6—C27B	114.6 (3)	C7—C6—C5	122.31 (11)
C27A—O6—C27B	33.4 (4)	C24—C23—C22	119.83 (12)
C8—O4—H4	109.5	C24—C23—H23	120.1
C28B—O7—C22	127.4 (3)	C22—C23—H23	120.1
C28B—O7—C28A	106.0 (3)	C4—C3—C2	118.54 (11)
C22—O7—C28A	119.70 (13)	C4—C3—H3A	120.7
C25—O8A—C26A	116.4 (6)	C2—C3—H3A	120.7
C17—C16—C15	119.47 (12)	C6—C5—C4	116.90 (10)
C17—C16—H16	120.3	C6—C5—C8	117.94 (10)
C15—C16—H16	120.3	C4—C5—C8	125.14 (10)
C16—C17—C18	120.35 (13)	O1—C2—C7	115.51 (10)
C16—C17—H17	119.8	O1—C2—C3	123.58 (11)
C18—C17—H17	119.8	C7—C2—C3	120.89 (10)
C13—C11—C12	110.73 (9)	C20—C19—C24	118.04 (11)
C13—C11—C10	118.63 (9)	C20—C19—C10	122.72 (10)
C12—C11—C10	104.48 (9)	C24—C19—C10	119.16 (10)
C13—C11—H11	107.5	O4—C8—C5	114.67 (9)
C12—C11—H11	107.5	O4—C8—C9	108.07 (9)
C10—C11—H11	107.5	C5—C8—C9	107.98 (9)
C13—C18—C17	120.77 (13)	O4—C8—C12	113.25 (9)
C13—C18—H18	119.6	C5—C8—C12	111.27 (9)
C17—C18—H18	119.6	C9—C8—C12	100.43 (9)
C23—C24—C19	121.40 (11)	O5—C25—O8B	123.3 (6)
C23—C24—H24	119.3	O5—C25—O8A	122.5 (3)
C19—C24—H24	119.3	O8B—C25—O8A	17.3 (7)
O1—C1—H1C	109.5	O5—C25—C12	126.40 (11)
O1—C1—H1A	109.5	O8B—C25—C12	109.3 (6)
H1C—C1—H1A	109.5	O8A—C25—C12	110.8 (3)
O1—C1—H1B	109.5	C19—C20—C21	121.12 (12)
H1C—C1—H1B	109.5	C19—C20—H20	119.4
H1A—C1—H1B	109.5	C21—C20—H20	119.4
C6—C7—C2	118.92 (11)	O6—C4—C3	121.57 (10)
C6—C7—H7	120.5	O6—C4—C5	116.05 (10)
C2—C7—H7	120.5	C3—C4—C5	122.37 (11)
O3—C9—C10	109.98 (9)	C15—C14—C13	120.48 (12)

O3—C9—C8	111.14 (9)	C15—C14—H14	119.8
C10—C9—C8	100.89 (9)	C13—C14—H14	119.8
O3—C9—H9	111.5	O7—C28A—H28B	109.5
C10—C9—H9	111.5	O7—C28A—H28A	109.5
C8—C9—H9	111.5	O7—C28A—H28C	109.5
O2—C10—C19	102.72 (8)	O6—C27A—H27C	109.5
O2—C10—C9	105.99 (8)	O6—C27A—H27B	109.5
C19—C10—C9	118.21 (9)	O6—C27A—H27A	109.5
O2—C10—C11	108.08 (9)	O6—C27B—H27E	109.5
C19—C10—C11	116.47 (9)	O6—C27B—H27F	109.5
C9—C10—C11	104.59 (9)	H27E—C27B—H27F	109.5
C25—C12—C11	113.10 (10)	O6—C27B—H27D	109.5
C25—C12—C8	115.15 (10)	H27E—C27B—H27D	109.5
C11—C12—C8	103.62 (9)	H27F—C27B—H27D	109.5
C25—C12—H12	108.2	O7—C28B—H28E	109.5
C11—C12—H12	108.2	O7—C28B—H28F	109.5
C8—C12—H12	108.2	H28E—C28B—H28F	109.5
C18—C13—C14	118.53 (11)	O7—C28B—H28D	109.5
C18—C13—C11	118.90 (11)	H28E—C28B—H28D	109.5
C14—C13—C11	122.52 (10)	H28F—C28B—H28D	109.5
C16—C15—C14	120.38 (12)	C25—O8B—C26B	113.8 (11)
C16—C15—H15	119.8	O8B—C26B—H26E	109.5
C14—C15—H15	119.8	O8B—C26B—H26F	109.5
O7—C22—C21	123.49 (12)	H26E—C26B—H26F	109.5
O7—C22—C23	116.90 (12)	O8B—C26B—H26D	109.5
C21—C22—C23	119.61 (11)	H26E—C26B—H26D	109.5
C22—C21—C20	119.97 (12)	H26F—C26B—H26D	109.5

X-ray crystallographic data for ponapensin (±)-3
(Absolute and relative stereochemistry)

Crystals of compound **3** suitable for X-ray analysis were obtained by slow evaporation from benzene/hexanes. Crystallographic data have been deposited with the Cambridge Crystallographic Data Centre (CCDC #833744). Copies of the data can be obtained free of charge on application to the CCDC, 12 Union Road, Cambridge CB21EZ, UK (fax: (+44)- 1223-336-033; e-mail: deposit@ccdc.cam.ac.uk.

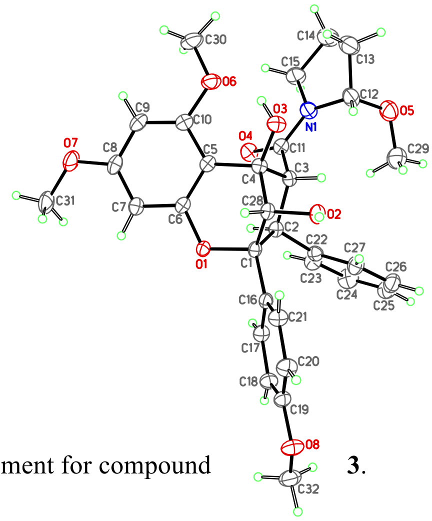


Table SI-5. Crystal data and structure refinement for compound **3**.

Identification code	**3**	
Empirical formula	C44 H47 N O8	
Formula weight	717.83	
Temperature	173(2) K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P-1	
Unit cell dimensions	a = 11.6354(9) Å	α= 71.620(4)°.
	b = 12.6447(10) Å	β= 69.603(4)°.
	c = 15.6781(11) Å	γ = 63.746(4)°.
Volume	1903.0(2) Å^3	
Z	2	
Density (calculated)	1.253 Mg/m^3	
Absorption coefficient	0.086 mm^{-1}	
F(000)	764	

Crystal size	0.30 x 0.15 x 0.05 mm^3
Theta range for data collection	1.83 to 26.37°.
Index ranges	-14<=h<=14, -15<=k<=15, -19<=l<=19
Reflections collected	31176
Independent reflections	7763 [R(int) = 0.0324]
Completeness to theta = 26.37°	99.7 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.9957 and 0.9748
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	7763 / 66 / 574
Goodness-of-fit on F^2	1.017
Final R indices [I>2sigma(I)]	R1 = 0.0435, wR2 = 0.1015
R indices (all data)	R1 = 0.0640, wR2 = 0.1135
Largest diff. peak and hole	0.269 and -0.231 e.Å^{-3}

Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (Å^{2}x 10^3) for compound **2**. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
O(1)	11264(1)	-2264(1)	-5237(1)	24(1)
O(2)	14602(1)	-3584(1)	-4862(1)	27(1)
O(3)	13601(1)	-5304(1)	-3710(1)	28(1)
O(4)	10306(1)	-3029(1)	-2324(1)	33(1)
O(5)	13686(1)	-4033(1)	-1225(1)	47(1)
O(6)	11431(1)	-5739(1)	-2853(1)	35(1)
O(7)	7915(1)	-3872(1)	-4343(1)	42(1)
O(8)	13807(1)	1285(1)	-7953(1)	39(1)
N(1)	12054(1)	-4177(1)	-1714(1)	32(1)
C(1)	12367(1)	-2237(1)	-5001(1)	22(1)
C(2)	11866(2)	-1989(1)	-3979(1)	23(1)
C(3)	12428(2)	-3239(1)	-3372(1)	23(1)
C(4)	12712(1)	-4117(1)	-3988(1)	23(1)
C(5)	11445(1)	-4083(1)	-4079(1)	24(1)
C(6)	10801(1)	-3162(1)	-4711(1)	23(1)
C(7)	9630(2)	-3052(1)	-4847(1)	28(1)
C(8)	9074(2)	-3885(2)	-4302(1)	31(1)

C(9)	9658(2)	-4801(2)	-3633(1)	32(1)
C(10)	10813(2)	-4880(1)	-3522(1)	28(1)
C(11)	11508(2)	-3450(1)	-2429(1)	25(1)
C(12)	13428(2)	-4711(2)	-1662(1)	37(1)
C(13)	13502(2)	-5893(2)	-1005(2)	51(1)
C(14)	12173(2)	-5567(2)	-290(2)	55(1)
C(15)	11210(2)	-4595(2)	-843(1)	40(1)
C(16)	12766(1)	-1297(1)	-5771(1)	23(1)
C(17)	11959(2)	-91(1)	-5806(1)	27(1)
C(18)	12255(2)	796(2)	-6525(1)	30(1)
C(19)	13400(2)	480(1)	-7225(1)	29(1)
C(20)	14204(2)	-719(2)	-7214(1)	34(1)
C(21)	13888(2)	-1597(2)	-6500(1)	30(1)
C(22)	12201(2)	-1079(1)	-3779(1)	26(1)
C(23)	11219(2)	-230(2)	-3266(1)	34(1)
C(24)	11517(2)	544(2)	-2997(1)	45(1)
C(25)	12800(2)	484(2)	-3243(1)	44(1)
C(26)	13786(2)	-344(2)	-3765(1)	40(1)
C(27)	13489(2)	-1117(2)	-4034(1)	34(1)
C(28)	13392(1)	-3529(1)	-4922(1)	22(1)
C(29)	13723(2)	-2908(2)	-1775(2)	53(1)
C(30)	10734(2)	-6445(2)	-2167(1)	48(1)
C(31)	7257(2)	-2933(2)	-4998(2)	46(1)
C(32)	13028(2)	2528(2)	-7962(1)	45(1)
C(1S)	8790(3)	-747(2)	507(2)	76(1)
C(2S)	7459(3)	-259(2)	799(2)	70(1)
C(3S)	6688(2)	-300(2)	358(2)	73(1)
C(4S)	7225(3)	-839(3)	-388(2)	75(1)
C(5S)	8555(3)	-1336(2)	-699(2)	75(1)
C(6S)	9352(2)	-1291(2)	-252(2)	78(1)
C(7S)	12139(3)	7989(2)	1452(2)	81(1)
C(8S)	12603(3)	7193(3)	882(2)	84(1)
C(9S)	13095(2)	6004(3)	1217(2)	75(1)
C(10S)	13113(2)	5601(2)	2125(2)	63(1)
C(11S)	12644(2)	6389(2)	2695(2)	57(1)
C(12S)	12171(2)	7585(2)	2361(2)	66(1)

Bond lengths [Å] and angles [°] for compound **3**.

O(1)-C(6)	1.3789(17)
O(1)-C(1)	1.4690(17)
O(2)-C(28)	1.4128(18)
O(3)-C(4)	1.4287(17)
O(4)-C(11)	1.2264(18)
O(5)-C(29)	1.423(2)
O(5)-C(12)	1.426(2)
O(6)-C(10)	1.3825(19)
O(6)-C(30)	1.428(2)
O(7)-C(8)	1.3649(19)
O(7)-C(31)	1.424(2)
O(8)-C(19)	1.3714(19)
O(8)-C(32)	1.423(2)
N(1)-C(11)	1.354(2)
N(1)-C(12)	1.457(2)
N(1)-C(15)	1.476(2)
C(1)-C(16)	1.509(2)
C(1)-C(28)	1.535(2)
C(1)-C(2)	1.5852(19)
C(2)-C(22)	1.511(2)
C(2)-C(3)	1.550(2)
C(3)-C(11)	1.518(2)
C(3)-C(4)	1.550(2)
C(4)-C(5)	1.511(2)
C(4)-C(28)	1.533(2)
C(5)-C(6)	1.385(2)
C(5)-C(10)	1.404(2)
C(6)-C(7)	1.392(2)
C(7)-C(8)	1.382(2)
C(8)-C(9)	1.392(2)
C(9)-C(10)	1.372(2)
C(12)-C(13)	1.510(3)
C(13)-C(14)	1.529(3)
C(14)-C(15)	1.518(3)
C(16)-C(17)	1.388(2)

C(16)-C(21)	1.396(2)
C(17)-C(18)	1.386(2)
C(18)-C(19)	1.388(2)
C(19)-C(20)	1.383(2)
C(20)-C(21)	1.383(2)
C(22)-C(23)	1.387(2)
C(22)-C(27)	1.392(2)
C(23)-C(24)	1.385(2)
C(24)-C(25)	1.378(3)
C(25)-C(26)	1.381(3)
C(26)-C(27)	1.382(2)
C(1S)-C(2S)	1.353(4)
C(1S)-C(6S)	1.376(4)
C(2S)-C(3S)	1.334(4)
C(3S)-C(4S)	1.357(3)
C(4S)-C(5S)	1.354(4)
C(5S)-C(6S)	1.370(4)
C(7S)-C(12S)	1.362(4)
C(7S)-C(8S)	1.360(4)
C(8S)-C(9S)	1.347(4)
C(9S)-C(10S)	1.356(4)
C(10S)-C(11S)	1.353(3)
C(11S)-C(12S)	1.352(3)
C(6)-O(1)-C(1)	116.44(11)
C(29)-O(5)-C(12)	114.42(14)
C(10)-O(6)-C(30)	118.08(14)
C(8)-O(7)-C(31)	116.76(13)
C(19)-O(8)-C(32)	117.31(13)
C(11)-N(1)-C(12)	130.00(14)
C(11)-N(1)-C(15)	119.35(14)
C(12)-N(1)-C(15)	110.54(13)
O(1)-C(1)-C(16)	103.51(11)
O(1)-C(1)-C(28)	106.30(11)
C(16)-C(1)-C(28)	117.17(12)
O(1)-C(1)-C(2)	108.00(11)
C(16)-C(1)-C(2)	117.02(12)

C(28)-C(1)-C(2)	104.15(11)
C(22)-C(2)-C(3)	110.37(12)
C(22)-C(2)-C(1)	119.00(12)
C(3)-C(2)-C(1)	104.41(11)
C(11)-C(3)-C(4)	112.59(12)
C(11)-C(3)-C(2)	114.16(12)
C(4)-C(3)-C(2)	102.95(11)
O(3)-C(4)-C(5)	113.31(12)
O(3)-C(4)-C(28)	109.55(11)
C(5)-C(4)-C(28)	108.54(12)
O(3)-C(4)-C(3)	113.03(12)
C(5)-C(4)-C(3)	111.31(11)
C(28)-C(4)-C(3)	100.20(11)
C(6)-C(5)-C(10)	116.67(14)
C(6)-C(5)-C(4)	118.62(13)
C(10)-C(5)-C(4)	124.58(14)
O(1)-C(6)-C(5)	121.89(13)
O(1)-C(6)-C(7)	115.08(13)
C(5)-C(6)-C(7)	123.01(14)
C(8)-C(7)-C(6)	117.85(15)
O(7)-C(8)-C(7)	124.27(15)
O(7)-C(8)-C(9)	114.48(14)
C(7)-C(8)-C(9)	121.22(15)
C(10)-C(9)-C(8)	119.15(15)
C(9)-C(10)-O(6)	122.63(14)
C(9)-C(10)-C(5)	121.97(15)
O(6)-C(10)-C(5)	115.39(14)
O(4)-C(11)-N(1)	120.53(14)
O(4)-C(11)-C(3)	121.22(13)
N(1)-C(11)-C(3)	118.13(13)
O(5)-C(12)-N(1)	110.90(14)
O(5)-C(12)-C(13)	107.05(16)
N(1)-C(12)-C(13)	102.23(15)
C(12)-C(13)-C(14)	103.22(17)
C(15)-C(14)-C(13)	104.35(16)
N(1)-C(15)-C(14)	104.68(15)
C(17)-C(16)-C(21)	117.56(14)

C(17)-C(16)-C(1)	120.00(13)
C(21)-C(16)-C(1)	122.29(13)
C(18)-C(17)-C(16)	121.88(14)
C(17)-C(18)-C(19)	119.50(15)
O(8)-C(19)-C(20)	116.10(14)
O(8)-C(19)-C(18)	124.35(14)
C(20)-C(19)-C(18)	119.55(15)
C(21)-C(20)-C(19)	120.35(15)
C(20)-C(21)-C(16)	121.10(15)
C(23)-C(22)-C(27)	118.36(15)
C(23)-C(22)-C(2)	119.33(14)
C(27)-C(22)-C(2)	122.14(13)
C(24)-C(23)-C(22)	120.78(18)
C(25)-C(24)-C(23)	120.19(17)
C(24)-C(25)-C(26)	119.71(17)
C(27)-C(26)-C(25)	120.14(18)
C(26)-C(27)-C(22)	120.81(16)
O(2)-C(28)-C(4)	109.52(12)
O(2)-C(28)-C(1)	111.68(12)
C(4)-C(28)-C(1)	100.33(11)
C(2S)-C(1S)-C(6S)	119.5(3)
C(3S)-C(2S)-C(1S)	120.6(2)
C(2S)-C(3S)-C(4S)	120.7(2)
C(5S)-C(4S)-C(3S)	120.2(3)
C(4S)-C(5S)-C(6S)	119.4(2)
C(5S)-C(6S)-C(1S)	119.6(2)
C(12S)-C(7S)-C(8S)	120.1(2)
C(9S)-C(8S)-C(7S)	120.0(2)
C(8S)-C(9S)-C(10S)	119.9(2)
C(9S)-C(10S)-C(11S)	120.2(2)
C(12S)-C(11S)-C(10S)	120.2(2)
C(11S)-C(12S)-C(7S)	119.4(2)

Symmetry transformations used to generate equivalent atoms:

Anisotropic displacement parameters ($\text{Å}^2 \times 10^3$) for compound **3**. The anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2 a^{*2}U^{11} + ... + 2 h k a^* b^* U^{12}]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
O(1)	21(1)	27(1)	26(1)	-5(1)	-6(1)	-12(1)
O(2)	17(1)	34(1)	28(1)	-12(1)	-1(1)	-7(1)
O(3)	22(1)	25(1)	28(1)	-5(1)	-2(1)	-4(1)
O(4)	22(1)	41(1)	29(1)	-10(1)	1(1)	-9(1)
O(5)	51(1)	58(1)	38(1)	-5(1)	-16(1)	-24(1)
O(6)	34(1)	31(1)	35(1)	3(1)	-6(1)	-16(1)
O(7)	31(1)	48(1)	57(1)	-7(1)	-12(1)	-23(1)
O(8)	41(1)	36(1)	31(1)	0(1)	0(1)	-19(1)
N(1)	27(1)	41(1)	24(1)	-2(1)	-3(1)	-14(1)
C(1)	18(1)	28(1)	22(1)	-8(1)	-2(1)	-10(1)
C(2)	18(1)	27(1)	23(1)	-8(1)	-1(1)	-7(1)
C(3)	18(1)	26(1)	23(1)	-8(1)	-2(1)	-7(1)
C(4)	19(1)	23(1)	23(1)	-7(1)	-2(1)	-5(1)
C(5)	22(1)	25(1)	25(1)	-10(1)	0(1)	-9(1)
C(6)	21(1)	26(1)	23(1)	-10(1)	1(1)	-11(1)
C(7)	24(1)	30(1)	30(1)	-11(1)	-5(1)	-10(1)
C(8)	23(1)	36(1)	40(1)	-16(1)	-2(1)	-14(1)
C(9)	29(1)	32(1)	38(1)	-9(1)	1(1)	-18(1)
C(10)	28(1)	25(1)	28(1)	-9(1)	-2(1)	-9(1)
C(11)	23(1)	28(1)	23(1)	-9(1)	0(1)	-10(1)
C(12)	32(1)	45(1)	31(1)	-4(1)	-10(1)	-13(1)
C(13)	46(1)	49(1)	51(1)	6(1)	-19(1)	-16(1)
C(14)	54(1)	62(1)	42(1)	14(1)	-14(1)	-29(1)
C(15)	40(1)	49(1)	25(1)	0(1)	-1(1)	-22(1)
C(16)	22(1)	28(1)	22(1)	-6(1)	-5(1)	-12(1)
C(17)	22(1)	32(1)	26(1)	-9(1)	-1(1)	-10(1)
C(18)	30(1)	25(1)	31(1)	-5(1)	-6(1)	-9(1)
C(19)	31(1)	34(1)	24(1)	-2(1)	-4(1)	-18(1)
C(20)	28(1)	38(1)	26(1)	-8(1)	4(1)	-12(1)
C(21)	28(1)	29(1)	27(1)	-7(1)	-1(1)	-9(1)
C(22)	29(1)	27(1)	22(1)	-5(1)	-6(1)	-11(1)
C(23)	35(1)	34(1)	34(1)	-13(1)	-4(1)	-13(1)
C(24)	54(1)	39(1)	43(1)	-22(1)	-6(1)	-15(1)
C(25)	67(1)	42(1)	40(1)	-11(1)	-17(1)	-29(1)

C(26)	45(1)	48(1)	38(1)	-7(1)	-11(1)	-27(1)
C(27)	33(1)	38(1)	35(1)	-13(1)	-5(1)	-16(1)
C(28)	18(1)	26(1)	24(1)	-10(1)	-2(1)	-7(1)
C(29)	63(1)	56(1)	53(1)	-9(1)	-20(1)	-29(1)
C(30)	55(1)	42(1)	45(1)	7(1)	-7(1)	-31(1)
C(31)	29(1)	50(1)	68(1)	-13(1)	-18(1)	-17(1)
C(32)	47(1)	35(1)	47(1)	5(1)	-10(1)	-21(1)
C(1S)	105(2)	68(2)	77(2)	21(1)	-52(2)	-54(2)
C(2S)	108(2)	58(1)	41(1)	-6(1)	-19(1)	-29(2)
C(3S)	54(1)	95(2)	49(1)	-17(1)	-2(1)	-15(1)
C(4S)	71(2)	108(2)	64(2)	-29(2)	-14(1)	-43(2)
C(5S)	86(2)	64(2)	67(2)	-35(1)	8(1)	-27(1)
C(6S)	45(1)	53(1)	106(2)	8(2)	-7(2)	-16(1)
C(7S)	73(2)	55(2)	87(2)	14(1)	-21(2)	-18(1)
C(8S)	70(2)	135(3)	38(1)	-5(2)	-15(1)	-36(2)
C(9S)	50(1)	112(2)	85(2)	-64(2)	5(1)	-35(2)
C(10S)	38(1)	46(1)	97(2)	-7(1)	-8(1)	-20(1)
C(11S)	50(1)	88(2)	41(1)	-1(1)	-16(1)	-35(1)
C(12S)	60(2)	72(2)	78(2)	-39(1)	-8(1)	-26(1)

Hydrogen coordinates (x 10^4) and isotropic displacement parameters (Å^{2}x 10 ^{3})
for compound **3**.

	x	y	z	U(eq)
H(2O)	15220(20)	-3938(18)	-5302(15)	50(6)
H(3O)	13110(20)	-5678(19)	-3328(16)	60(7)
H(2)	10911(16)	-1745(13)	-3825(10)	19(4)
H(3)	13268(17)	-3347(14)	-3322(11)	26(4)
H(7)	9243(16)	-2402(15)	-5298(12)	30(4)
H(9)	9231(18)	-5329(16)	-3275(12)	36(5)
H(12)	14030(17)	-4778(15)	-2290(13)	35(5)
H(13B)	13580(20)	-6472(19)	-1393(15)	58(6)
H(13A)	14260(20)	-6195(19)	-728(15)	61(6)
H(14B)	11950(20)	-6250(20)	-1(16)	67(7)

H(14A)	12210(30)	-5180(20)	202(19)	90(9)
H(15B)	10620(18)	-3892(16)	-492(12)	38(5)
H(15A)	10690(20)	-4893(18)	-1002(14)	52(6)
H(17)	11152(16)	144(14)	-5320(11)	27(4)
H(18)	11660(17)	1596(16)	-6522(12)	34(5)
H(20)	14990(19)	-954(16)	-7708(13)	44(5)
H(21)	14415(18)	-2415(17)	-6517(12)	40(5)
H(23)	10360(20)	-176(16)	-3126(13)	41(5)
H(24)	10830(20)	1111(19)	-2636(15)	56(6)
H(25)	13010(20)	1023(19)	-3078(15)	57(6)
H(26)	14640(20)	-378(18)	-3939(14)	51(6)
H(27)	14186(18)	-1727(16)	-4372(12)	37(5)
H(28)	13523(15)	-3909(14)	-5448(11)	25(4)
H(29A)	12861	-2401	-1914	79
H(29B)	14405	-3039	-2356	79
H(29C)	13929	-2510	-1435	79
H(30A)	10594	-6939	-2464	72
H(30B)	9877	-5914	-1854	72
H(30C)	11252	-6967	-1711	72
H(31A)	7839	-2979	-5623	69
H(31B)	7031	-2154	-4854	69
H(31C)	6447	-3019	-4970	69
H(32A)	13002	2740	-7404	67
H(32B)	12128	2692	-7974	67
H(32C)	13419	3007	-8513	67
H(1SA)	9334	-714	823	91
H(2SA)	7068	117	1324	84
H(3SA)	5754	52	569	88
H(4SA)	6666	-867	-694	90
H(5SA)	8932	-1713	-1222	90
H(6SA)	10286	-1634	-465	94
H(7SA)	11793	8827	1215	97
H(8SA)	12579	7476	249	101
H(9SA)	13429	5448	818	90
H(10A)	13457	4762	2361	75
H(11A)	12647	6102	3332	68
H(12A)	11863	8139	2757	79

Hydrogen bonds for compound **3**. [Å and °].

D-H...A	d(D-H)	d(H...A)	d(D...A)	<(DHA)
O(2)-H(2O)...O(3)#1	0.87(2)	1.87(2)	2.7354(15)	174(2)
O(3)-H(3O)...O(6)	0.85(2)	1.86(2)	2.6228(16)	148(2)

Symmetry transformations used to generate equivalent atoms:

#1 -x+3,-y-1,-z-1

X-ray crystallographic data for Elliptifoline (+/-)-4

(Relative stereochemistry)

Crystals of compound **4** suitable for X-ray analysis were obtained by slow evaporation from CH_2Cl_2/isooctane. Crystallographic data has been deposited with the Cambridge Crystallographic Data Centre (CCDC #833988). Copies of the data can be obtained free of charge on application to the CCDC, 12 Union Road, Cambridge CB21EZ, UK (fax: (+44)- 1223-336-033; e-mail: deposit@ccdc.cam.ac.uk.

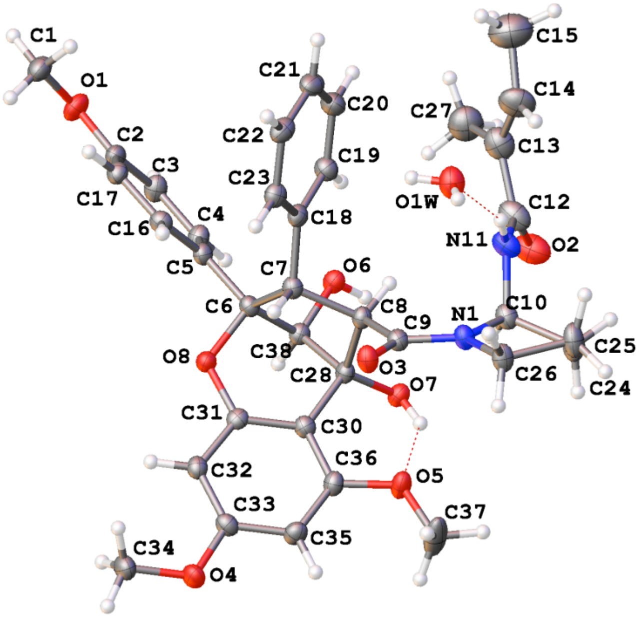


Table SI-6. Crystal data and structure refinement for natural product elliptifoline **4**.

Identification code 833988

Crystal data

$C_{36}H_{40}N_{2}O_{8}\cdot H_{2}0$	$V = 7317.1\ (7)\ Å^3$
$M_r = 646.72$	$Z = 8$
Orthorhombic, *Pbcn*	Cu $K\alpha$ radiation, $\lambda = 1.54178$ Å
$a = 24.1823\ (14)$ Å	$\mu = 0.69\ mm^{-1}$
$b = 12.2311\ (7)$ Å	$T = 100$ K
$c = 24.7388\ (13)$ Å	0.12 × 0.11 × 0.09 mm

Data collection

Bruker Proteum-R diffractometer	6426 independent reflections
Absorption correction: multi-scan *SADABS* (Sheldrick, 1996)	5972 reflections with $I > 2\sigma(I)$
$T_{\text{min}} = 0.696$, $T_{\text{max}} = 0.753$	$R_{\text{int}} = 0.051$
148848 measured reflections	

Refinement

$R[F^2 > 2\sigma(F^2)] = 0.061$	0 restraints
$wR(F^2) = 0.167$	H atoms treated by a mixture of independent and constrained refinement
$S = 1.05$	$\Delta\rangle_{\text{max}} = 1.00$ e Å^{-3}
6426 reflections	$\Delta\rangle_{\text{min}} = -0.42$ e Å^{-3}
437 parameters	

Data collection: *APEX2* (Bruker, 2006); cell refinement: *SAINT* (Bruker, 2006); data reduction: *SAINT* (Bruker, 2006); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1990); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: OLEX2 (Dolmanov, *et al.* 2009); software used to prepare material for publication: PublCIF v.1.9.5_c (IUCr).

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Sheldrick, G. M. (1996). *SADABS*. University of Göttingen, Germany.

Sheldrick, G. M. (1997). *SHELXL97*. University of Göttingen, Germany.

Bruker (2006). *SAINT*. Bruker Analytical X-ray Instruments Inc., Madison, Wisconsin, USA.

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Dolmanov, O. V., *et al.* (2009). OLEX2: A complete structure solution, refinement and analysis program. J. Appl. Cryst. 42, 339-341 (2009).

Spek, A. L. (2005). *PLATON*, A Multipurpose Crystallographic Tool, Utrecht University, Utrecht, The Netherlands.

Supplementary materials

Crystal data

$C_{36}H_{40}N_2O_8\cdot H_20$	$F(000) = 2752$
$M_r = 646.72$	$D_x = 1.174$ Mg m^{-3}
Orthorhombic, *Pbcn*	Cu $K\alpha$ radiation, $\lambda = 1.54178$ Å
Hall symbol: -P 2n 2ab	Cell parameters from 9098 reflections
$a = 24.1823$ (14) Å	$\theta = 3.6$–$65.8°$
$b = 12.2311$ (7) Å	$\mu = 0.69$ mm^{-1}
$c = 24.7388$ (13) Å	$T = 100$ K
$V = 7317.1$ (7) Å^3	Prism, colorless
$Z = 8$	0.12 × 0.11 × 0.09 mm

Data collection

Bruker Proteum-R diffractometer	6426 independent reflections
Radiation source: rotating anode	5972 reflections with $I > 2\sigma(I)$
multilayer	$R_{\mathrm{int}} = 0.051$
ϕ & ω scans	$\theta_{\max} = 66.5°$, $\theta_{\min} = 3.6°$
Absorption correction: multi-scan *SADABS* (Sheldrick, 1996)	$h = -28\rightarrow28$
$T_{\min} = 0.696$, $T_{\max} = 0.753$	$k = -14\rightarrow14$
148848 measured reflections	$l = -29\rightarrow27$

Refinement

Refinement on F^2	Primary atom site location: structure-invariant direct methods
Least-squares matrix: full	Secondary atom site location: difference Fourier map
$R[F^2 > 2\sigma(F^2)] = 0.061$	Hydrogen site location: inferred from neighbouring sites
$wR(F^2) = 0.167$	H atoms treated by a mixture of independent and constrained refinement
$S = 1.05$	$w = 1/[\sigma^2(F_o^2) + (0.0747P)^2 + 12.3954P]$ where $P = (F_o^2 + 2F_c^2)/3$

6426 reflections	$(\Delta/\sigma)_{max} < 0.001$
437 parameters	$\Delta\rangle_{max}$ = 1.00 e Å^{-3}
0 restraints	$\Delta\rangle_{min}$ = -0.42 e Å^{-3}

Special details

Geometry. All esds (except the esd in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell esds are taken into account individually in the estimation of esds in distances, angles and torsion angles; correlations between esds in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell esds is used for estimating esds involving l.s. planes.

Refinement. Refinement of F^2 against ALL reflections. The weighted R-factor wR and goodness of fit S are based on F^2, conventional R-factors R are based on F, with F set to zero for negative F^2. The threshold expression of $F^2 > 2\text{sigma}(F^2)$ is used only for calculating R-factors(gt) etc. and is not relevant to the choice of reflections for refinement. R-factors based on F^2 are statistically about twice as large as those based on F, and R- factors based on ALL data will be even larger.

CheckCIF Alerts and Responses:

Alert level A PLAT601_ALERT_2_A Structure Contains Solvent Accessible VOIDS of . 646 A**3

Response: The void spaces contained disordered, partial occupancy solvent molecules. After unsuccessful attempts to assign and refine solvent molecules, PLATON/SQUEEZE (Spek, 2005) was applied to remove the residual density peaks in the voids.

Alert level B DIFMX01_ALERT_2_B The maximum difference density is > 0.1*ZMAX*1.00 _refine_diff_density_max given = 1.004 Test value = 0.800 PLAT420_ALERT_2_B D-H Without Acceptor O1W - H1WA ··· ? Alert level C

DIFMX02_ALERT_1_C The maximum difference density is > 0.1*ZMAX*0.75 The relevant atom site should be identified. PLAT097_ALERT_2_B Large Reported Max. (Positive) Residual Density 1.00 eA-3 PLAT094_ALERT_2_C Ratio of Maximum

/ Minimum Residual Density ···. 2.40

Response: These alerts arise due to several residual density peaks in the region of C13, C14, C15 and C27. It appears that there is a slight rotational disorder in this pendant group, possibly corresponding to a torsional rotation about the C10-N11 bond. Refinement of a disorder was attempted, but the refinement was not stable, probably due to the SQUEEZE correction. Refinement with the un-SQUEEZEd data was also attempted, but again ADPs and bond distances were not stable for the minor component, possibly due to the un-accounted-for electron density of the disordered solvent nearby. In all cases the major component was well behaved and refined to a fractional occupancy greater than 0.85, meaning that the single component description provides an adequate model for the purposes of this study. Further refinement of the disorder was therefore not attempted.

PLAT042_ALERT_1_C Calc. and Reported MoietyFormula Strings Differ ?

Response: This alert is incorrect; the formulas match exactly.

PLAT220_ALERT_2_C Large Non-Solvent C Ueq(max)/Ueq(min) ··· 3.7 Ratio
PLAT222_ALERT_3_C Large Non-Solvent H Uiso(max)/Uiso(min) .. 4.6 Ratio
PLAT230_ALERT_2_C Hirshfeld Test Diff for C14 – C15 .. 5.3 su

Response: These alerts also arised due to the slight disorder, which results in larger-than-normal ADPs, particularly for the terminal methyl carbon, C15, which further triggers the Hirshfeld test alert.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å^2)

	x	*y*	*z*	U_{iso}*/U_{eq}	
O1	0.65939 (7)	0.76166 (14)	0.41089 (7)	0.0303 (4)	
O2	0.59242 (8)	0.04097 (19)	0.26062 (8)	0.0430 (5)	
O3	0.44870 (7)	0.12637 (13)	0.45243 (6)	0.0245 (4)	
O4	0.25832 (7)	0.40085 (14)	0.43582 (7)	0.0279 (4)	
O5	0.36672 (7)	0.13888 (13)	0.34146 (7)	0.0278 (4)	
O6	0.54565 (6)	0.35068 (13)	0.30354 (6)	0.0222 (4)	
H6	0.5403	0.3186	0.2740	0.027*	
O7	0.45475 (7)	0.21678 (13)	0.28945 (6)	0.0217 (4)	
H7	0.4310	0.1672	0.2927	0.026*	

N1	0.48591 (8)	0.01825 (15)	0.38838 (8)	0.0219 (4)	
O8	0.44981 (6)	0.46722 (13)	0.40169 (6)	0.0208 (3)	
C1	0.67899 (11)	0.7873 (2)	0.46375 (11)	0.0308 (6)	
H1A	0.6961	0.7223	0.4798	0.046*	
H1B	0.6480	0.8112	0.4863	0.046*	
H1C	0.7064	0.8460	0.4614	0.046*	
C2	0.62044 (10)	0.68032 (19)	0.40752 (10)	0.0236 (5)	
C3	0.60572 (11)	0.6489 (2)	0.35552 (10)	0.0263 (5)	
H3	0.6218	0.6843	0.3252	0.032*	
C4	0.56749 (10)	0.56580 (19)	0.34794 (9)	0.0237 (5)	
H4	0.5571	0.5457	0.3123	0.028*	
C5	0.54405 (9)	0.51130 (18)	0.39184 (9)	0.0204 (5)	
C6	0.50307 (9)	0.41958 (18)	0.38483 (9)	0.0197 (5)	
C7	0.51335 (9)	0.31234 (18)	0.41983 (9)	0.0194 (5)	
H7A	0.4855	0.3118	0.4497	0.023*	
C8	0.49935 (10)	0.21613 (18)	0.38117 (9)	0.0199 (5)	
H8	0.5341	0.1934	0.3623	0.024*	
C9	0.47565 (9)	0.11710 (19)	0.41013 (9)	0.0206 (5)	
C10	0.51643 (10)	-0.0055 (2)	0.33838 (9)	0.0242 (5)	
H10	0.5048	0.0457	0.3090	0.029*	
N11	0.57580 (9)	0.00456 (18)	0.34846 (8)	0.0287 (5)	
H11	0.5894	-0.0100	0.3807	0.034*	
C12	0.60969 (12)	0.0364 (3)	0.30779 (11)	0.0377 (7)	
C13	0.66763 (13)	0.0689 (3)	0.32241 (12)	0.0414 (7)	
C14	0.69552 (12)	0.0121 (3)	0.35938 (13)	0.0468 (8)	
H14	0.6762	-0.0437	0.3782	0.056*	
C15	0.75343 (17)	0.0294 (4)	0.37304 (18)	0.0709 (11)	
H15A	0.7686	0.0879	0.3504	0.106*	
H15B	0.7742	-0.0382	0.3667	0.106*	
H15C	0.7565	0.0502	0.4112	0.106*	
C16	0.55831 (9)	0.54610 (19)	0.44344 (9)	0.0222 (5)	
H16	0.5419	0.5116	0.4739	0.027*	
C17	0.59618 (10)	0.63035 (19)	0.45166 (9)	0.0223 (5)	
H17	0.6052	0.6532	0.4873	0.027*	
C18	0.56975 (10)	0.29809 (18)	0.44514 (9)	0.0212 (5)	
C19	0.61764 (10)	0.2884 (2)	0.41437 (10)	0.0255 (5)	
H19	0.6156	0.2948	0.3761	0.031*	
C20	0.66822 (11)	0.2696 (2)	0.43884 (11)	0.0305 (6)	
H20	0.7006	0.2634	0.4173	0.037*	
C21	0.67192 (11)	0.2598 (2)	0.49454 (11)	0.0300 (6)	
H21	0.7066	0.2454	0.5112	0.036*	

C22	0.62469 (11)	0.2711 (2)	0.52580 (10)	0.0277 (5)	
H22	0.6271	0.2660	0.5640	0.033*	
C23	0.57390 (10)	0.28990 (19)	0.50147 (9)	0.0236 (5)	
H23	0.5417	0.2973	0.5232	0.028*	
C24	0.49777 (12)	-0.1221 (2)	0.32536 (10)	0.0313 (6)	
H24A	0.4626	-0.1219	0.3048	0.038*	
H24B	0.5262	-0.1614	0.3042	0.038*	
C25	0.49016 (13)	-0.1736 (2)	0.38089 (11)	0.0335 (6)	
H25A	0.4652	-0.2376	0.3791	0.040*	
H25B	0.5261	-0.1968	0.3963	0.040*	
C26	0.46455 (11)	-0.08182 (19)	0.41408 (10)	0.0257 (5)	
H26A	0.4237	-0.0845	0.4123	0.031*	
H26B	0.4763	-0.0863	0.4524	0.031*	
C27	0.68963 (15)	0.1641 (3)	0.29232 (14)	0.0518 (8)	
H27A	0.6970	0.1429	0.2548	0.078*	
H27B	0.7240	0.1889	0.3093	0.078*	
H27C	0.6624	0.2234	0.2930	0.078*	
C28	0.46081 (9)	0.27235 (18)	0.33928 (9)	0.0192 (5)	
C30	0.40652 (9)	0.30522 (19)	0.36592 (9)	0.0205 (5)	
C31	0.40403 (9)	0.40252 (18)	0.39444 (9)	0.0196 (5)	
C32	0.35521 (10)	0.43984 (19)	0.41827 (9)	0.0214 (5)	
H32	0.3540	0.5078	0.4368	0.026*	
C33	0.30861 (10)	0.37468 (19)	0.41400 (9)	0.0224 (5)	
C34	0.25548 (11)	0.4966 (2)	0.46835 (11)	0.0309 (6)	
H34A	0.2639	0.5609	0.4462	0.046*	
H34B	0.2824	0.4912	0.4978	0.046*	
H34C	0.2182	0.5038	0.4835	0.046*	
C35	0.31018 (10)	0.2727 (2)	0.38846 (10)	0.0250 (5)	
H35	0.2781	0.2278	0.3869	0.030*	
C36	0.35944 (10)	0.23860 (19)	0.36550 (9)	0.0222 (5)	
C37	0.32367 (14)	0.0602 (3)	0.34457 (15)	0.0543 (10)	
H37A	0.2896	0.0911	0.3294	0.081*	
H37B	0.3175	0.0401	0.3824	0.081*	
H37C	0.3342	-0.0050	0.3240	0.081*	
C38	0.49407 (9)	0.37621 (18)	0.32756 (9)	0.0199 (5)	
H38	0.4725	0.4290	0.3050	0.024*	
O1W	0.60059 (9)	0.00666 (18)	0.46674 (8)	0.0341 (4)	
H1WA	0.6010 (18)	0.072 (4)	0.4754 (18)	0.077 (14)*	
H1WB	0.5810 (15)	-0.034 (3)	0.4934 (16)	0.057 (10)*	

Atomic displacement parameters (Å^{2})

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
O1	0.0352 (10)	0.0263 (9)	0.0293 (9)	-0.0122 (8)	0.0003 (7)	-0.0019 (7)
O2	0.0397 (11)	0.0634 (14)	0.0259 (10)	0.0069 (10)	0.0067 (8)	0.0109 (9)
O3	0.0320 (9)	0.0206 (8)	0.0210 (8)	-0.0002 (7)	0.0090 (7)	0.0010 (6)
O4	0.0232 (9)	0.0288 (9)	0.0317 (9)	0.0015 (7)	0.0065 (7)	-0.0055 (7)
O5	0.0311 (9)	0.0228 (9)	0.0296 (9)	-0.0073 (7)	0.0108 (7)	-0.0071 (7)
O6	0.0238 (8)	0.0245 (8)	0.0183 (8)	-0.0030 (7)	0.0044 (6)	-0.0015 (6)
O7	0.0244 (8)	0.0232 (8)	0.0176 (8)	-0.0046 (6)	0.0028 (6)	-0.0014 (6)
N1	0.0266 (10)	0.0197 (10)	0.0194 (10)	0.0016 (8)	0.0060 (8)	0.0017 (8)
O8	0.0201 (8)	0.0199 (8)	0.0223 (8)	-0.0009 (6)	0.0013 (6)	-0.0017 (6)
C1	0.0326 (13)	0.0262 (13)	0.0337 (14)	-0.0044 (11)	-0.0062 (11)	-0.0031 (11)
C2	0.0222 (12)	0.0189 (11)	0.0298 (13)	-0.0014 (9)	-0.0004 (10)	-0.0018 (9)
C3	0.0322 (13)	0.0239 (12)	0.0229 (12)	-0.0039 (10)	0.0067 (10)	0.0009 (10)
C4	0.0305 (13)	0.0225 (12)	0.0182 (11)	-0.0020 (10)	0.0005 (9)	-0.0004 (9)
C5	0.0224 (11)	0.0176 (11)	0.0213 (11)	0.0008 (9)	0.0008 (9)	0.0001 (9)
C6	0.0206 (11)	0.0199 (11)	0.0186 (11)	0.0018 (9)	0.0017 (9)	0.0007 (9)
C7	0.0223 (11)	0.0194 (11)	0.0166 (10)	0.0004 (9)	0.0032 (9)	0.0013 (9)
C8	0.0229 (11)	0.0181 (11)	0.0187 (11)	-0.0008 (9)	0.0024 (9)	-0.0006 (9)
C9	0.0223 (11)	0.0205 (11)	0.0190 (11)	0.0013 (9)	0.0010 (9)	0.0014 (9)
C10	0.0295 (13)	0.0240 (12)	0.0191 (11)	0.0034 (10)	0.0039 (9)	0.0020 (9)
N11	0.0287 (11)	0.0374 (12)	0.0201 (10)	0.0063 (9)	0.0066 (8)	0.0062 (9)
C12	0.0385 (15)	0.0478 (17)	0.0268 (14)	0.0094 (13)	0.0080 (12)	0.0086 (12)
C13	0.0450 (17)	0.0420 (16)	0.0373 (15)	0.0027 (13)	0.0104 (13)	0.0046 (13)
C14	0.0332 (15)	0.0568 (19)	0.0502 (18)	-0.0044 (14)	0.0115 (13)	0.0105 (15)
C15	0.058 (2)	0.087 (3)	0.067 (2)	-0.008 (2)	-0.006 (2)	0.006 (2)
C16	0.0220 (11)	0.0243 (12)	0.0201 (11)	0.0004 (9)	0.0025 (9)	0.0015 (9)
C17	0.0250 (12)	0.0218 (11)	0.0202 (11)	0.0007 (9)	-0.0026 (9)	-0.0016 (9)
C18	0.0253 (12)	0.0172 (11)	0.0211 (11)	-0.0001 (9)	-0.0014 (9)	0.0015 (9)
C19	0.0261 (12)	0.0266 (12)	0.0238 (12)	0.0014 (10)	0.0018 (10)	0.0006 (10)
C20	0.0243 (12)	0.0313 (14)	0.0360 (14)	0.0025 (10)	0.0006 (11)	-0.0026 (11)
C21	0.0270 (13)	0.0240 (12)	0.0389 (14)	0.0017 (10)	-0.0086 (11)	0.0026 (11)
C22	0.0345 (14)	0.0226 (12)	0.0261 (13)	-0.0039 (10)	-0.0075 (10)	0.0049 (10)
C23	0.0284 (12)	0.0199 (11)	0.0224 (12)	-0.0020 (9)	0.0011 (9)	0.0031 (9)
C24	0.0452 (15)	0.0240 (12)	0.0248 (12)	0.0013 (11)	0.0086 (11)	-0.0019 (10)
C25	0.0505 (17)	0.0201 (12)	0.0300 (13)	0.0034 (11)	0.0125 (12)	0.0000 (10)
C26	0.0344 (13)	0.0193 (12)	0.0235 (12)	0.0000 (10)	0.0081 (10)	0.0033 (9)
C27	0.0522 (19)	0.0508 (19)	0.0524 (19)	-0.0062 (16)	0.0095 (16)	0.0050 (16)
C28	0.0219 (11)	0.0193 (11)	0.0165 (10)	-0.0008 (9)	0.0024 (9)	-0.0018 (9)
C30	0.0225 (12)	0.0213 (11)	0.0176 (11)	0.0009 (9)	0.0024 (9)	0.0018 (9)

C31	0.0228 (11)	0.0214 (11)	0.0145 (10)	-0.0007 (9)	-0.0021 (9)	0.0029 (9)
C32	0.0254 (12)	0.0199 (11)	0.0189 (11)	0.0020 (9)	-0.0012 (9)	0.0005 (9)
C33	0.0218 (11)	0.0246 (12)	0.0208 (11)	0.0024 (9)	0.0040 (9)	0.0025 (9)
C34	0.0285 (13)	0.0308 (13)	0.0334 (13)	0.0051 (11)	0.0010 (11)	-0.0086 (11)
C35	0.0233 (12)	0.0264 (12)	0.0251 (12)	-0.0052 (10)	0.0036 (9)	-0.0011 (10)
C36	0.0281 (12)	0.0200 (11)	0.0184 (11)	-0.0018 (9)	0.0026 (9)	-0.0008 (9)
C37	0.0532 (19)	0.0340 (16)	0.076 (2)	-0.0231 (14)	0.0365 (18)	-0.0226 (16)
C38	0.0227 (11)	0.0198 (11)	0.0172 (11)	-0.0012 (9)	0.0012 (9)	0.0018 (9)
O1W	0.0452 (11)	0.0296 (10)	0.0276 (10)	0.0007 (9)	0.0086 (8)	0.0024 (8)

Geometric parameters (Å, º)

O1—C2	1.372 (3)	C15—H15B	0.9800
O1—C1	1.426 (3)	C15—H15C	0.9800
O2—C12	1.241 (3)	C16—C17	1.393 (3)
O3—C9	1.238 (3)	C16—H16	0.9500
O4—C33	1.368 (3)	C17—H17	0.9500
O4—C34	1.423 (3)	C18—C19	1.391 (3)
O5—C36	1.368 (3)	C18—C23	1.401 (3)
O5—C37	1.420 (3)	C19—C20	1.384 (4)
O6—C38	1.416 (3)	C19—H19	0.9500
O6—H6	0.8400	C20—C21	1.386 (4)
O7—C28	1.415 (3)	C20—H20	0.9500
O7—H7	0.8400	C21—C22	1.386 (4)
N1—C9	1.346 (3)	C21—H21	0.9500
N1—C10	1.469 (3)	C22—C23	1.387 (4)
N1—C26	1.473 (3)	C22—H22	0.9500
O8—C31	1.372 (3)	C23—H23	0.9500
O8—C6	1.474 (3)	C24—C25	1.523 (4)
C1—H1A	0.9800	C24—H24A	0.9900
C1—H1B	0.9800	C24—H24B	0.9900
C1—H1C	0.9800	C25—C26	1.523 (3)
C2—C17	1.382 (3)	C25—H25A	0.9900
C2—C3	1.389 (3)	C25—H25B	0.9900
C3—C4	1.387 (3)	C26—H26A	0.9900
C3—H3	0.9500	C26—H26B	0.9900
C4—C5	1.395 (3)	C27—H27A	0.9800
C4—H4	0.9500	C27—H27B	0.9800
C5—C16	1.389 (3)	C27—H27C	0.9800
C5—C6	1.507 (3)	C28—C30	1.523 (3)

C6—C38	1.528 (3)	C28—C38	1.531 (3)
C6—C7	1.591 (3)	C30—C31	1.385 (3)
C7—C18	1.511 (3)	C30—C36	1.400 (3)
C7—C8	1.554 (3)	C31—C32	1.397 (3)
C7—H7A	1.0000	C32—C33	1.384 (3)
C8—C9	1.520 (3)	C32—H32	0.9500
C8—C28	1.554 (3)	C33—C35	1.399 (3)
C8—H8	1.0000	C34—H34A	0.9800
C10—N11	1.462 (3)	C34—H34B	0.9800
C10—C24	1.530 (3)	C34—H34C	0.9800
C10—H10	1.0000	C35—C36	1.384 (3)
N11—C12	1.355 (3)	C35—H35	0.9500
N11—H11	0.8800	C37—H37A	0.9800
C12—C13	1.501 (4)	C37—H37B	0.9800
C13—C14	1.331 (5)	C37—H37C	0.9800
C13—C27	1.481 (4)	C38—H38	1.0000
C14—C15	1.456 (5)	O1W—H1WA	0.83 (5)
C14—H14	0.9500	O1W—H1WB	0.95 (4)
C15—H15A	0.9800		
C2—O1—C1	116.31 (19)	C20—C19—H19	119.7
C33—O4—C34	117.29 (19)	C18—C19—H19	119.7
C36—O5—C37	119.1 (2)	C19—C20—C21	120.4 (2)
C38—O6—H6	109.5	C19—C20—H20	119.8
C28—O7—H7	109.5	C21—C20—H20	119.8
C9—N1—C10	127.31 (19)	C20—C21—C22	119.5 (2)
C9—N1—C26	120.61 (18)	C20—C21—H21	120.2
C10—N1—C26	112.06 (18)	C22—C21—H21	120.2
C31—O8—C6	116.09 (17)	C21—C22—C23	120.3 (2)
O1—C1—H1A	109.5	C21—C22—H22	119.9
O1—C1—H1B	109.5	C23—C22—H22	119.9
H1A—C1—H1B	109.5	C22—C23—C18	120.5 (2)
O1—C1—H1C	109.5	C22—C23—H23	119.8
H1A—C1—H1C	109.5	C18—C23—H23	119.8
H1B—C1—H1C	109.5	C25—C24—C10	103.4 (2)
O1—C2—C17	124.3 (2)	C25—C24—H24A	111.1
O1—C2—C3	115.6 (2)	C10—C24—H24A	111.1
C17—C2—C3	120.0 (2)	C25—C24—H24B	111.1
C4—C3—C2	119.9 (2)	C10—C24—H24B	111.1
C4—C3—H3	120.0	H24A—C24—H24B	109.0
C2—C3—H3	120.0	C26—C25—C24	103.3 (2)

C3—C4—C5	121.1 (2)	C26—C25—H25A	111.1
C3—C4—H4	119.5	C24—C25—H25A	111.1
C5—C4—H4	119.5	C26—C25—H25B	111.1
C16—C5—C4	117.9 (2)	C24—C25—H25B	111.1
C16—C5—C6	119.8 (2)	H25A—C25—H25B	109.1
C4—C5—C6	122.2 (2)	N1—C26—C25	103.74 (19)
O8—C6—C5	104.35 (17)	N1—C26—H26A	111.0
O8—C6—C38	105.97 (17)	C25—C26—H26A	111.0
C5—C6—C38	117.29 (19)	N1—C26—H26B	111.0
O8—C6—C7	107.97 (17)	C25—C26—H26B	111.0
C5—C6—C7	116.63 (18)	H26A—C26—H26B	109.0
C38—C6—C7	103.93 (17)	C13—C27—H27A	109.5
C18—C7—C8	111.38 (18)	C13—C27—H27B	109.5
C18—C7—C6	117.51 (18)	H27A—C27—H27B	109.5
C8—C7—C6	104.78 (17)	C13—C27—H27C	109.5
C18—C7—H7A	107.6	H27A—C27—H27C	109.5
C8—C7—H7A	107.6	H27B—C27—H27C	109.5
C6—C7—H7A	107.6	O7—C28—C30	114.48 (18)
C9—C8—C7	113.31 (18)	O7—C28—C38	106.74 (17)
C9—C8—C28	116.16 (19)	C30—C28—C38	108.41 (18)
C7—C8—C28	101.90 (17)	O7—C28—C8	115.50 (18)
C9—C8—H8	108.4	C30—C28—C8	110.19 (18)
C7—C8—H8	108.4	C38—C28—C8	100.27 (17)
C28—C8—H8	108.4	C31—C30—C36	118.0 (2)
O3—C9—N1	121.1 (2)	C31—C30—C28	119.0 (2)
O3—C9—C8	121.6 (2)	C36—C30—C28	123.0 (2)
N1—C9—C8	117.25 (19)	O8—C31—C30	121.8 (2)
N11—C10—N1	109.45 (19)	O8—C31—C32	116.0 (2)
N11—C10—C24	113.8 (2)	C30—C31—C32	122.2 (2)
N1—C10—C24	102.30 (19)	C33—C32—C31	117.9 (2)
N11—C10—H10	110.3	C33—C32—H32	121.1
N1—C10—H10	110.3	C31—C32—H32	121.1
C24—C10—H10	110.3	O4—C33—C32	124.0 (2)
C12—N11—C10	119.4 (2)	O4—C33—C35	114.3 (2)
C12—N11—H11	120.3	C32—C33—C35	121.7 (2)
C10—N11—H11	120.3	O4—C34—H34A	109.5
O2—C12—N11	120.5 (3)	O4—C34—H34B	109.5
O2—C12—C13	121.9 (3)	H34A—C34—H34B	109.5
N11—C12—C13	117.5 (2)	O4—C34—H34C	109.5
C14—C13—C27	125.0 (3)	H34A—C34—H34C	109.5
C14—C13—C12	120.0 (3)	H34B—C34—H34C	109.5

C27—C13—C12	115.0 (3)	C36—C35—C33	118.5 (2)
C13—C14—C15	124.8 (3)	C36—C35—H35	120.7
C13—C14—H14	117.6	C33—C35—H35	120.7
C15—C14—H14	117.6	O5—C36—C35	123.9 (2)
C14—C15—H15A	109.5	O5—C36—C30	114.7 (2)
C14—C15—H15B	109.5	C35—C36—C30	121.4 (2)
H15A—C15—H15B	109.5	O5—C37—H37A	109.5
C14—C15—H15C	109.5	O5—C37—H37B	109.5
H15A—C15—H15C	109.5	H37A—C37—H37B	109.5
H15B—C15—H15C	109.5	O5—C37—H37C	109.5
C5—C16—C17	121.6 (2)	H37A—C37—H37C	109.5
C5—C16—H16	119.2	H37B—C37—H37C	109.5
C17—C16—H16	119.2	O6—C38—C6	109.88 (18)
C2—C17—C16	119.4 (2)	O6—C38—C28	111.04 (18)
C2—C17—H17	120.3	C6—C38—C28	100.79 (17)
C16—C17—H17	120.3	O6—C38—H38	111.6
C19—C18—C23	118.6 (2)	C6—C38—H38	111.6
C19—C18—C7	122.3 (2)	C28—C38—H38	111.6
C23—C18—C7	119.0 (2)	H1WA—O1W—H1WB	109 (4)
C20—C19—C18	120.7 (2)		

E. B3LYP/6-31G** Calculation For Equilibrium Geometry of Intermediate 21 and Acyliminium Intermediate 22

The calculations were performed using the program *Spartan '10* by Wavefunction, Inc. First a MMFF equilibrium conformer calculation was performed, and the resulting structure was subjected to an equilibrium geometry optimization using B3LYP/6-31G* level of theory to give the coordinates of cyclic intermediate **21** (Table SI-7). Similarly, a MMFF equilibrium conformer calculation was performed on acyliminium intermediate **22** and the resulting structure was subjected to an equilibrium geometry optimization using B3LYP/6-31G** level of theory to give the coordinates listed in Table SI-8.

Table SI-7. Coordinates of B3LYP/6-31G* Equilibrium Geometry for Cyclic Intermediate **21**

Atom	X (Å)	Y (Å)	Z (Å)
C(1)	3.091	1.369	0.134
C(2)	1.095	3.155	-0.701
C(3)	1.735	0.984	0.294
C(4)	3.432	2.609	-0.406
C(5)	2.435	3.501	-0.821
C(6)	0.774	1.911	-0.145
H(7)	4.461	2.916	-0.533
H(8)	0.284	3.801	-1.008
O(9)	4.056	0.484	0.528
O(10)	2.887	4.68	-1.334
O(11)	-0.571	1.682	-0.047
C(12)	1.194	-0.303	0.931
C(13)	-1.024	0.372	0.413
C(14)	-0.595	-0.682	-0.715
H(15)	-0.309	-0.096	-1.592
C(16)	0.659	-1.329	-0.105
H(17)	0.319	-2.189	0.483
C(18)	5.413	0.899	0.477
H(19)	5.584	1.792	1.091
H(20)	5.738	1.1	-0.552
H(21)	5.994	0.068	0.881
C(22)	1.926	5.628	-1.772
H(23)	1.315	5.231	-2.593
H(24)	2.496	6.488	-2.128
H(25)	1.267	5.941	-0.952
C(26)	-0.132	0.059	1.643
H(27)	-0.039	0.946	2.282
O(28)	-0.596	-1.052	2.392
H(29)	0.195	-1.381	2.858
O(30)	2.106	-0.937	1.828
C(31)	-2.509	0.562	0.643

C(32)	-5.268	1.051	0.967
C(33)	-3.13	0.38	1.887
C(34)	-3.297	1.001	-0.427
C(35)	-4.661	1.246	-0.28
C(36)	-4.491	0.616	2.048
H(37)	-2.552	0.034	2.735
H(38)	-2.839	1.166	-1.397
H(39)	-5.234	1.585	-1.136
H(40)	-4.974	0.472	3.01
C(41)	-1.611	-1.716	-1.162
C(42)	-3.407	-3.687	-2.065
C(43)	-2.269	-2.555	-0.251
C(44)	-1.863	-1.885	-2.529
C(45)	-2.754	-2.862	-2.979
C(46)	-3.16	-3.53	-0.699
H(47)	-2.089	-2.437	0.814
H(48)	-1.34	-1.259	-3.248
H(49)	-2.93	-2.979	-4.046
H(50)	-3.666	-4.167	0.023
H(51)	-4.102	-4.448	-2.412
O(52)	-6.593	1.256	1.228
C(53)	-7.423	1.698	0.166
H(54)	-7.095	2.669	-0.227
H(55)	-8.424	1.801	0.592
H(56)	-7.453	0.969	-0.655
C(57)	1.819	-1.799	-0.952
O(58)	1.923	-1.761	-2.17
N(59)	2.809	-2.238	-0.105
C(60)	2.653	-2.183	1.344
H(61)	1.968	-2.979	1.673
C(62)	4.069	-2.409	1.883
H(63)	4.067	-2.952	2.833
H(64)	4.517	-1.427	2.049
C(65)	4.783	-3.172	0.749
H(66)	5.869	-3.049	0.777
H(67)	4.571	-4.245	0.822
C(68)	4.158	-2.601	-0.537
H(69)	4.11	-3.322	-1.358
H(70)	4.692	-1.714	-0.898

Table SI-8. Coordinates of B3LYP/6-31G** Equilibrium Geometry of Acyliminium Intermediate **22**

Atom	X (Å)	Y (Å)	Z (Å)
C(1)	3.091	1.369	0.134
C(2)	1.095	3.155	-0.701

C(3)	1.735	0.984	0.294
C(4)	3.432	2.609	-0.406
C(5)	2.435	3.501	-0.821
C(6)	0.774	1.911	-0.145
H(7)	4.461	2.916	-0.533
H(8)	0.284	3.801	-1.008
O(9)	4.056	0.484	0.528
O(10)	2.887	4.68	-1.334
O(11)	-0.571	1.682	-0.047
C(12)	1.194	-0.303	0.931
C(13)	-1.024	0.372	0.413
C(14)	-0.595	-0.682	-0.715
H(15)	-0.309	-0.096	-1.592
C(16)	0.659	-1.329	-0.105
H(17)	0.319	-2.189	0.483
C(18)	5.413	0.899	0.477
H(19)	5.584	1.792	1.091
H(20)	5.738	1.1	-0.552
H(21)	5.994	0.068	0.881
C(22)	1.926	5.628	-1.772
H(23)	1.315	5.231	-2.593
H(24)	2.496	6.488	-2.128
H(25)	1.267	5.941	-0.952
C(26)	-0.132	0.059	1.643
H(27)	-0.039	0.946	2.282
O(28)	-0.596	-1.052	2.392
H(29)	0.195	-1.381	2.858
O(30)	2.106	-0.937	1.828
C(31)	-2.509	0.562	0.643
C(32)	-5.268	1.051	0.967
C(33)	-3.13	0.38	1.887
C(34)	-3.297	1.001	-0.427
C(35)	-4.661	1.246	-0.28
C(36)	-4.491	0.616	2.048
H(37)	-2.552	0.034	2.735
H(38)	-2.839	1.166	-1.397
H(39)	-5.234	1.585	-1.136
H(40)	-4.974	0.472	3.01
C(41)	-1.611	-1.716	-1.162
C(42)	-3.407	-3.687	-2.065
C(43)	-2.269	-2.555	-0.251
C(44)	-1.863	-1.885	-2.529
C(45)	-2.754	-2.862	-2.979
C(46)	-3.16	-3.53	-0.699
H(47)	-2.089	-2.437	0.814

H(48)	-1.34	-1.259	-3.248
H(49)	-2.93	-2.979	-4.046
H(50)	-3.666	-4.167	0.023
H(51)	-4.102	-4.448	-2.412
O(52)	-6.593	1.256	1.228
C(53)	-7.423	1.698	0.166
H(54)	-7.095	2.669	-0.227
H(55)	-8.424	1.801	0.592
H(56)	-7.453	0.969	-0.655
C(57)	1.819	-1.799	-0.952
O(58)	1.923	-1.761	-2.17
N(59)	2.809	-2.238	-0.105
C(60)	2.653	-2.183	1.344
H(61)	1.968	-2.979	1.673
C(62)	4.069	-2.409	1.883
H(63)	4.067	-2.952	2.833
H(64)	4.517	-1.427	2.049
C(65)	4.783	-3.172	0.749
H(66)	5.869	-3.049	0.777
H(67)	4.571	-4.245	0.822
C(68)	4.158	-2.601	-0.537
H(69)	4.11	-3.322	-1.358
H(70)	4.692	-1.714	-0.898

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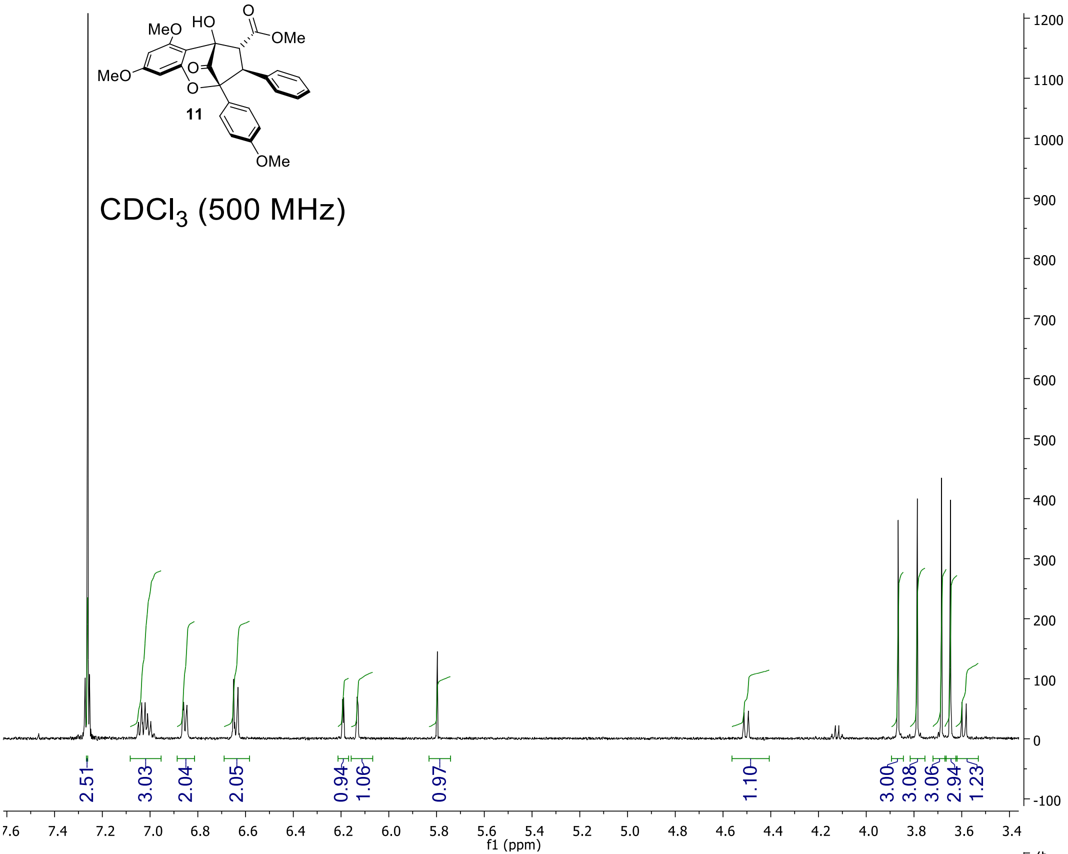

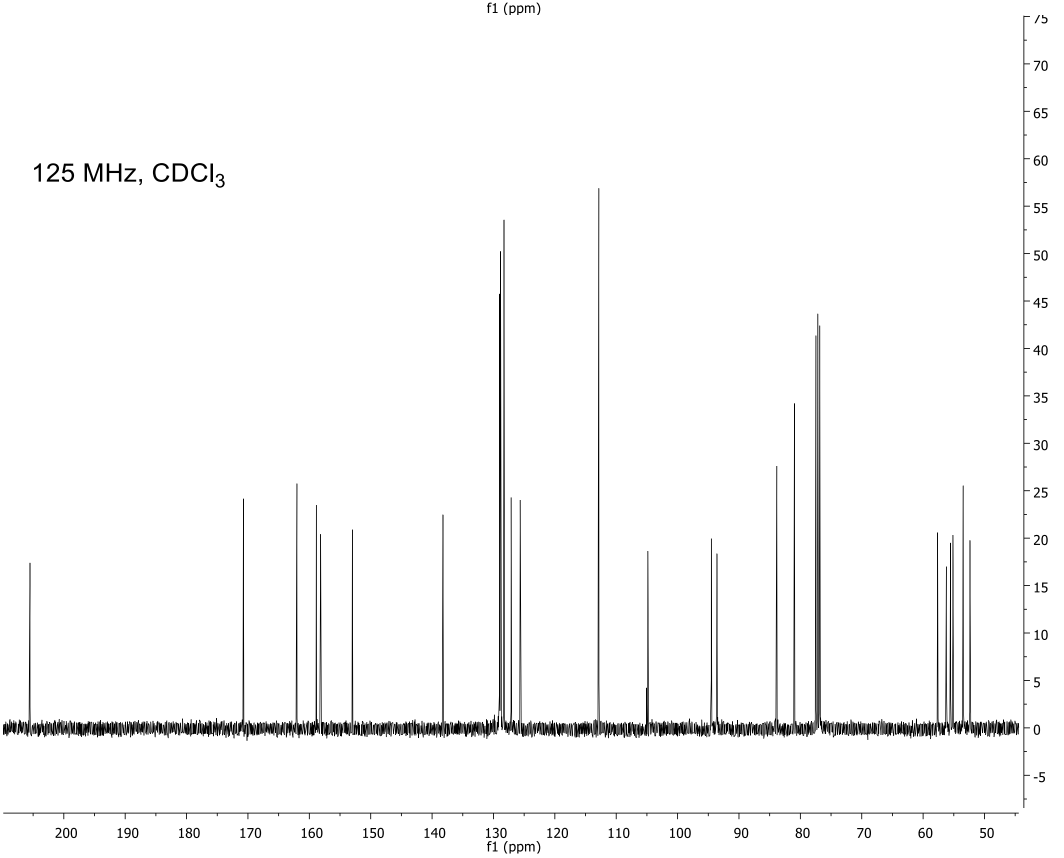

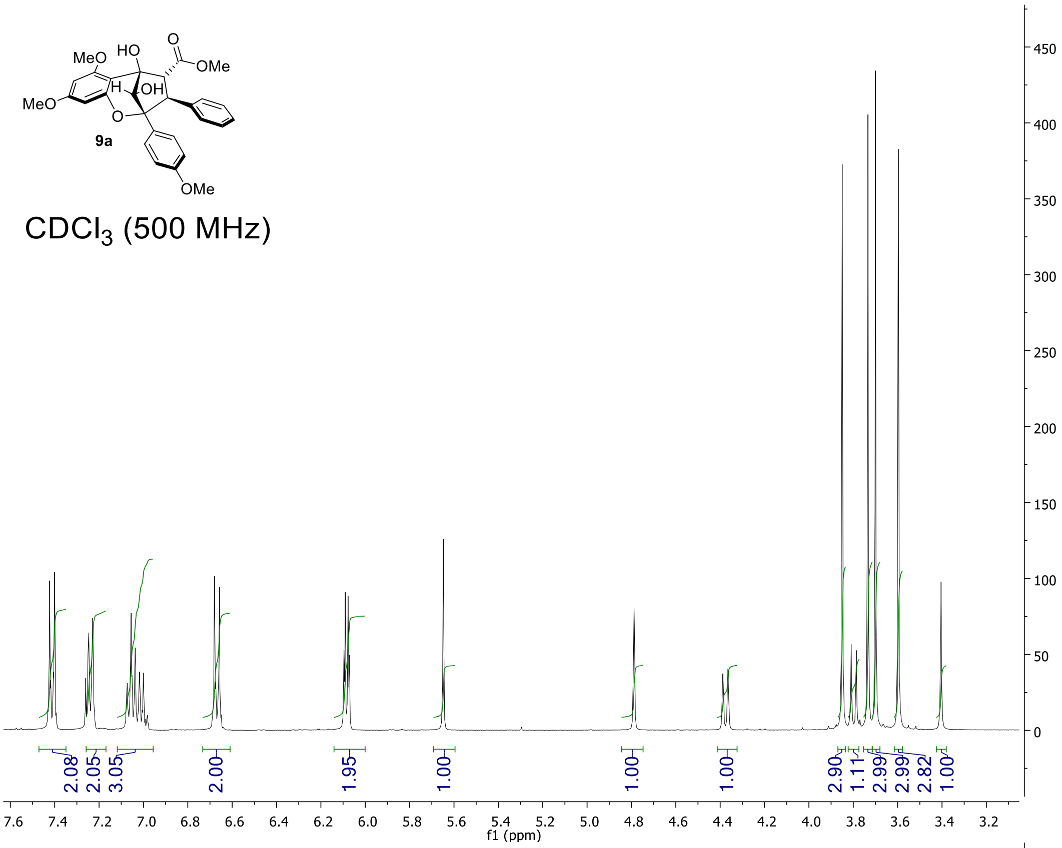
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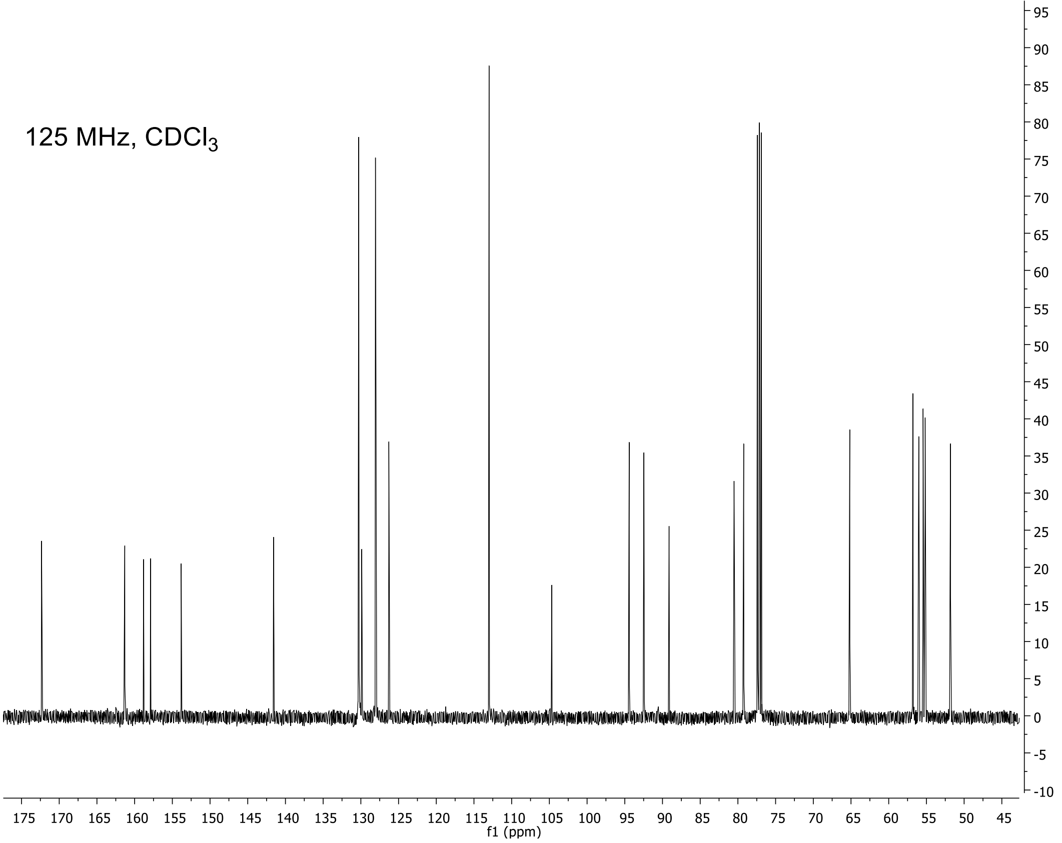
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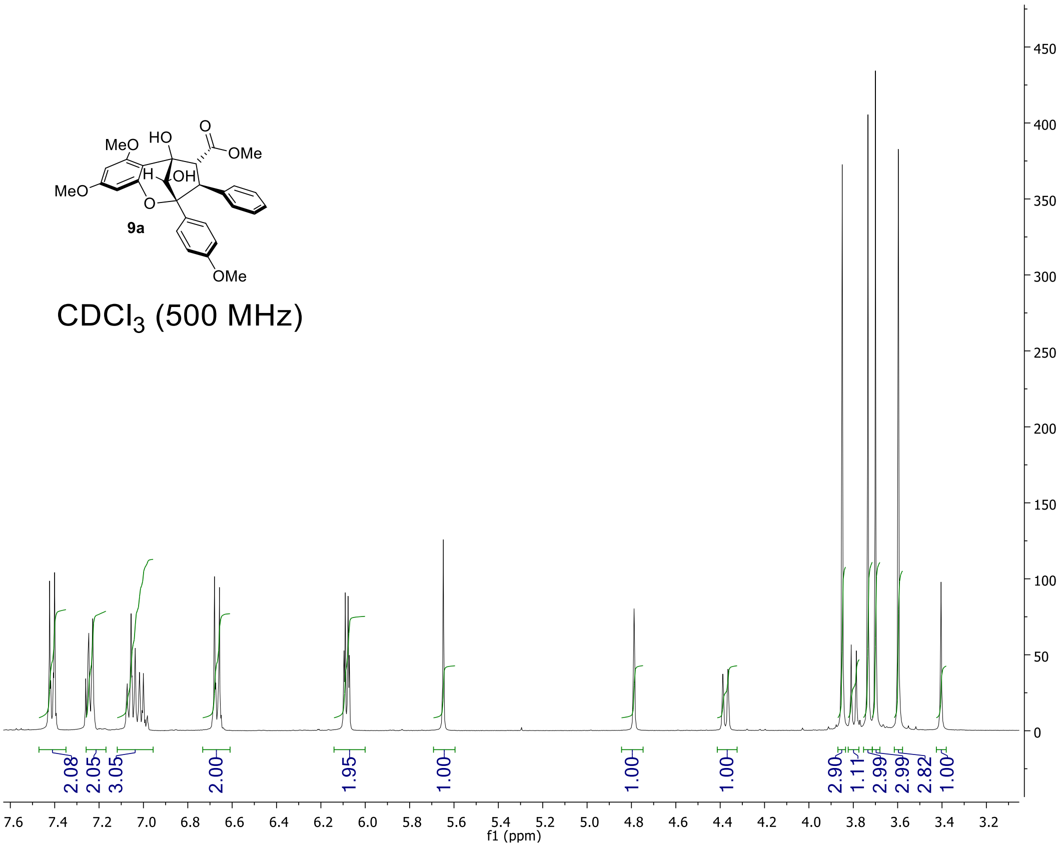
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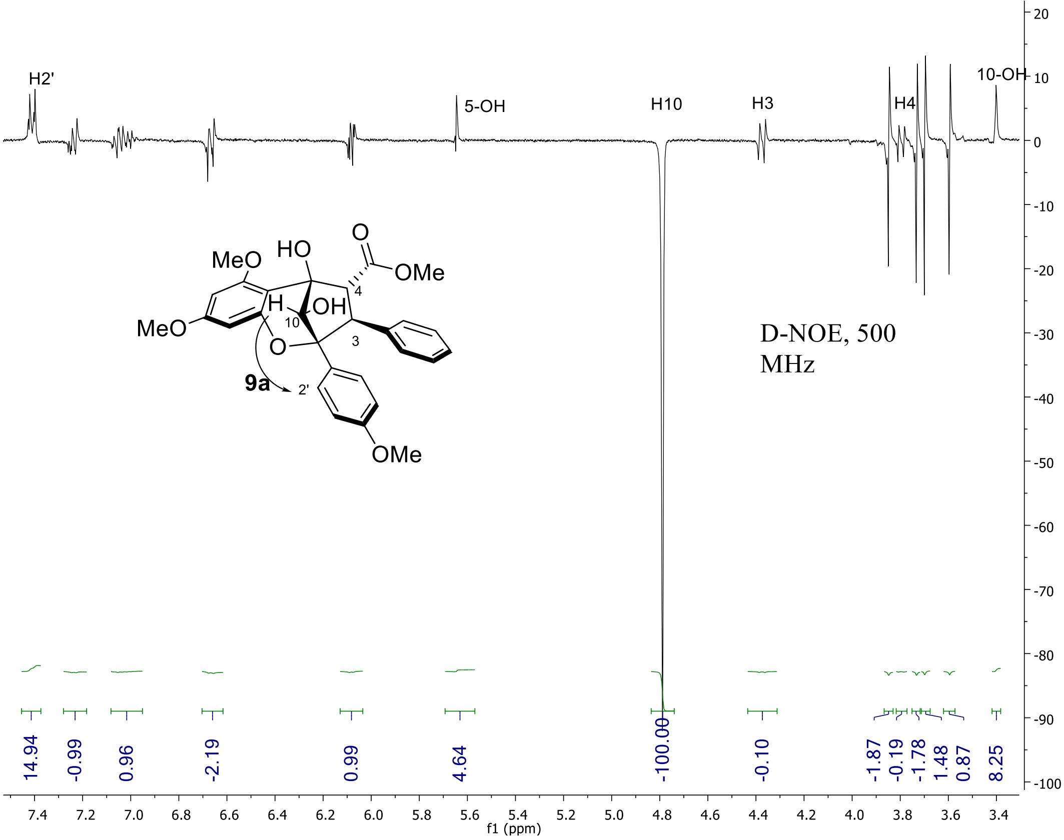
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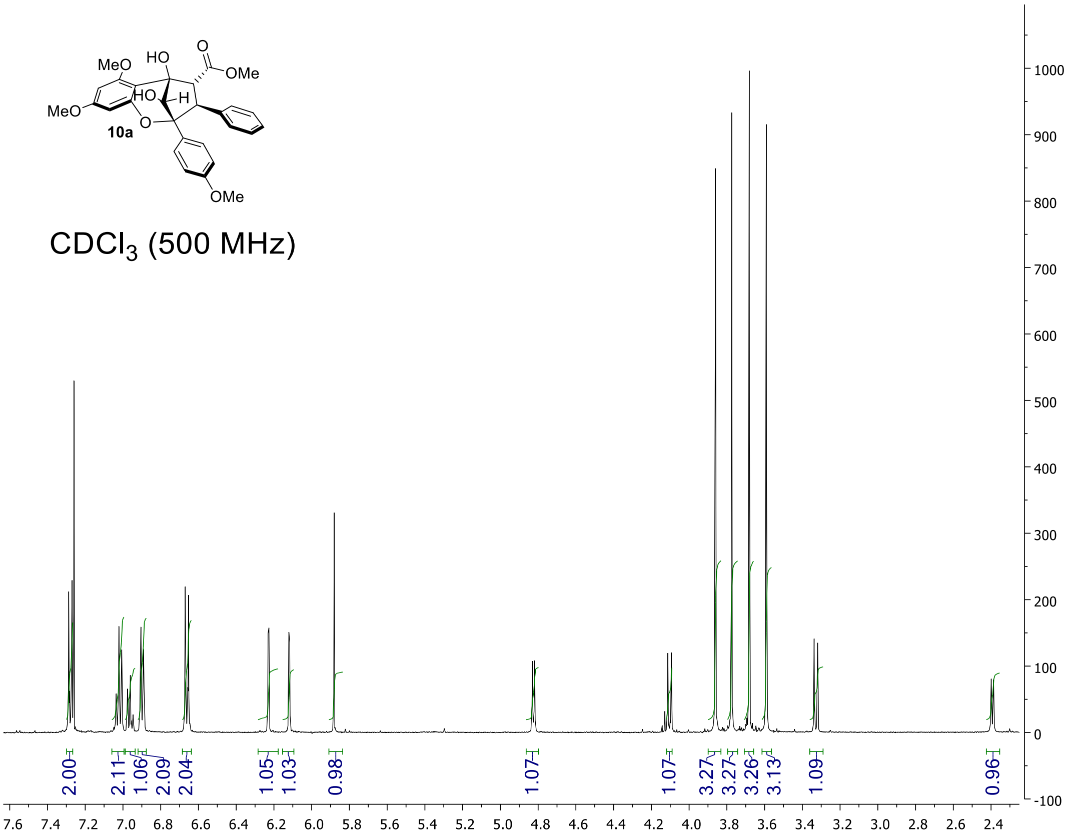
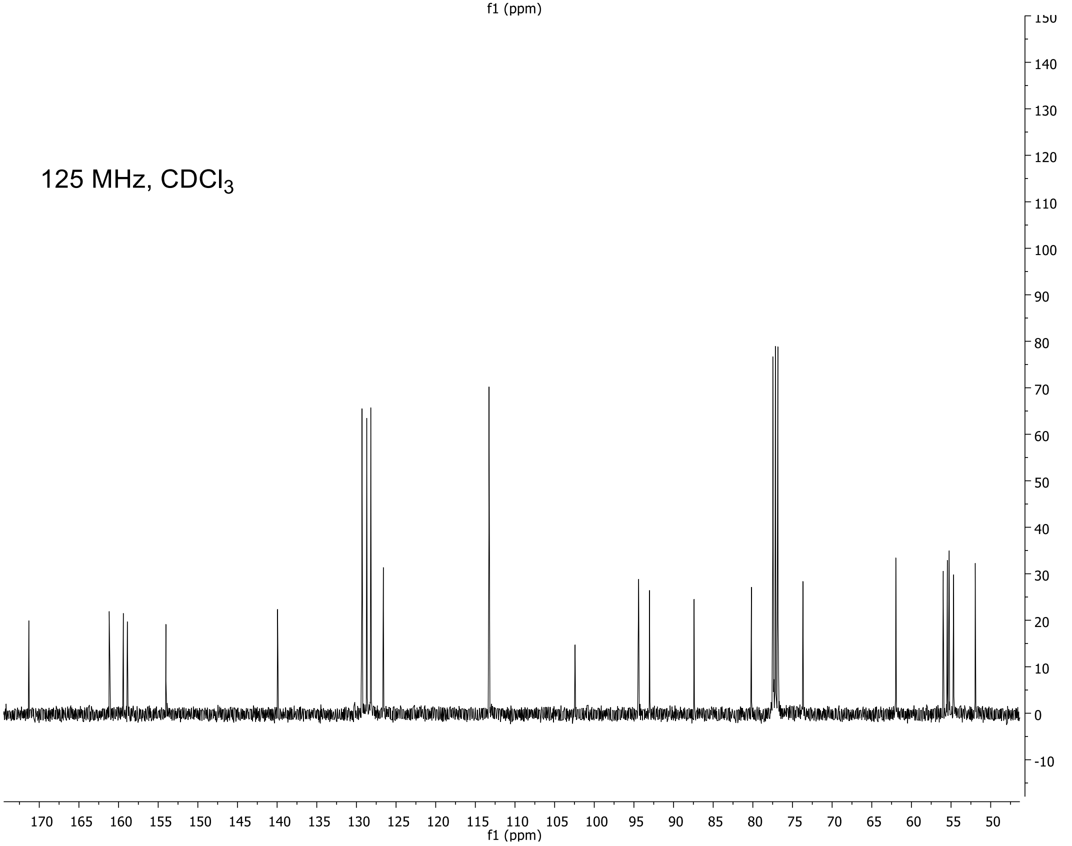
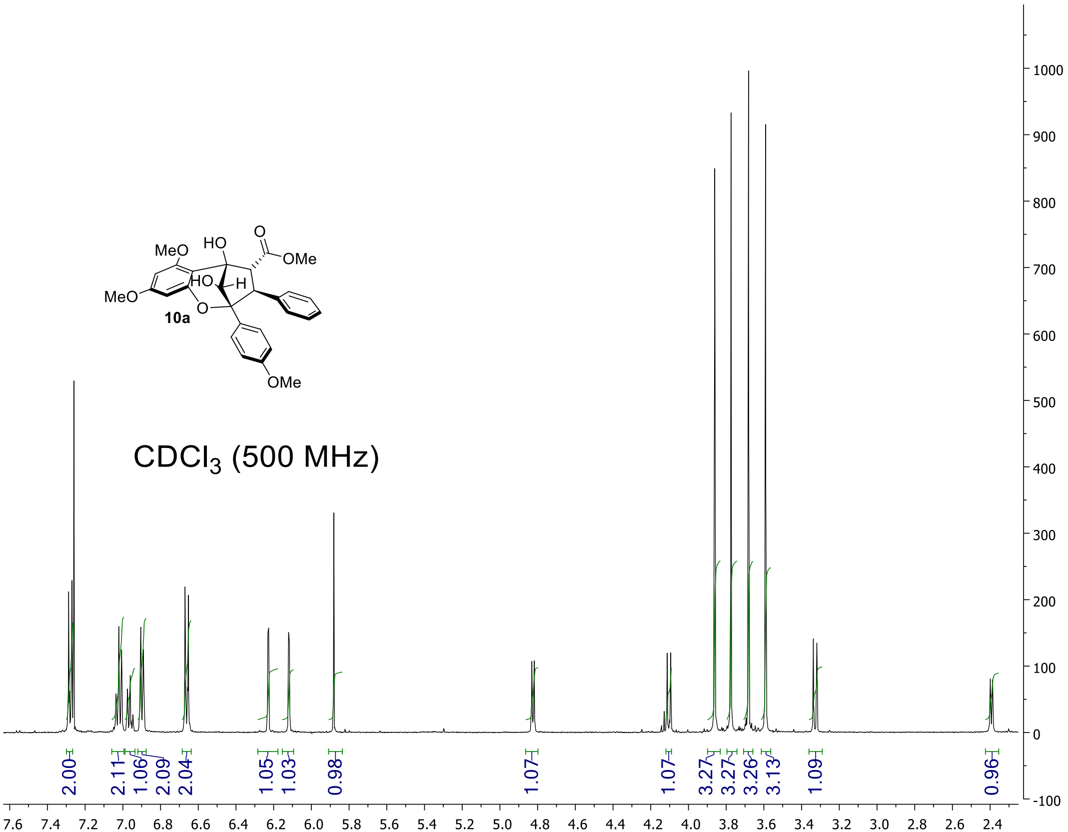
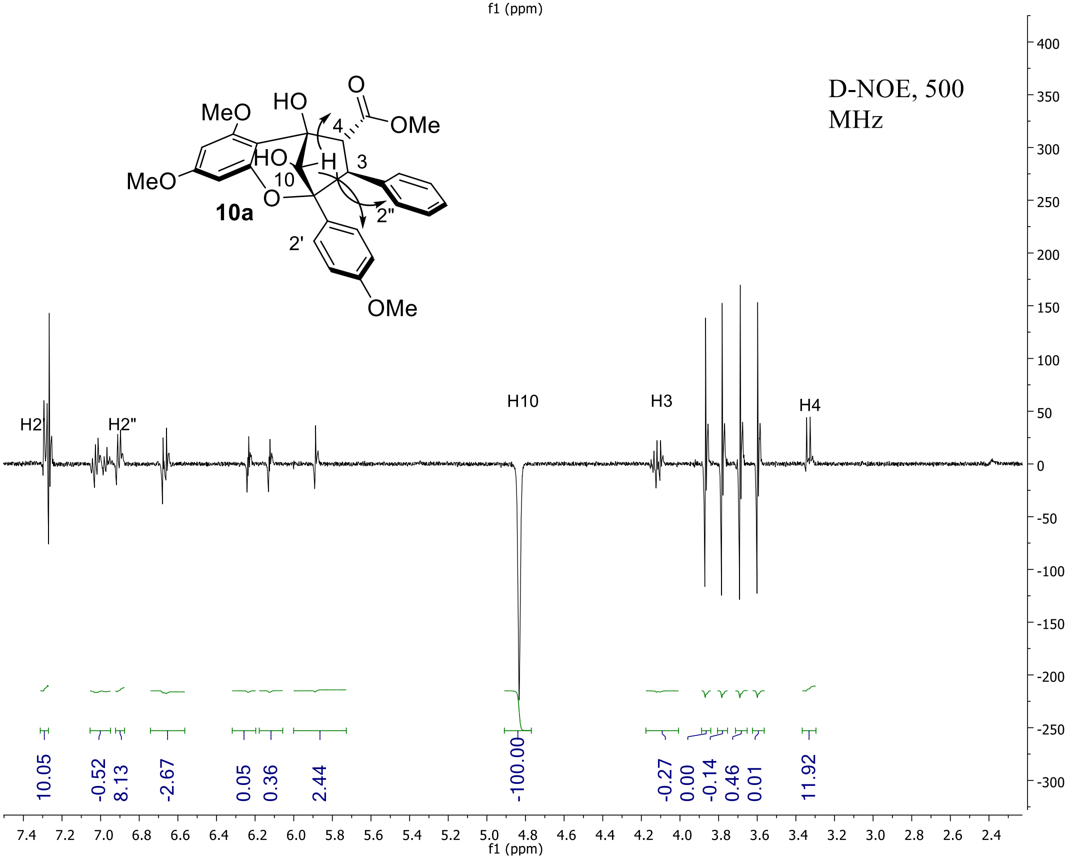
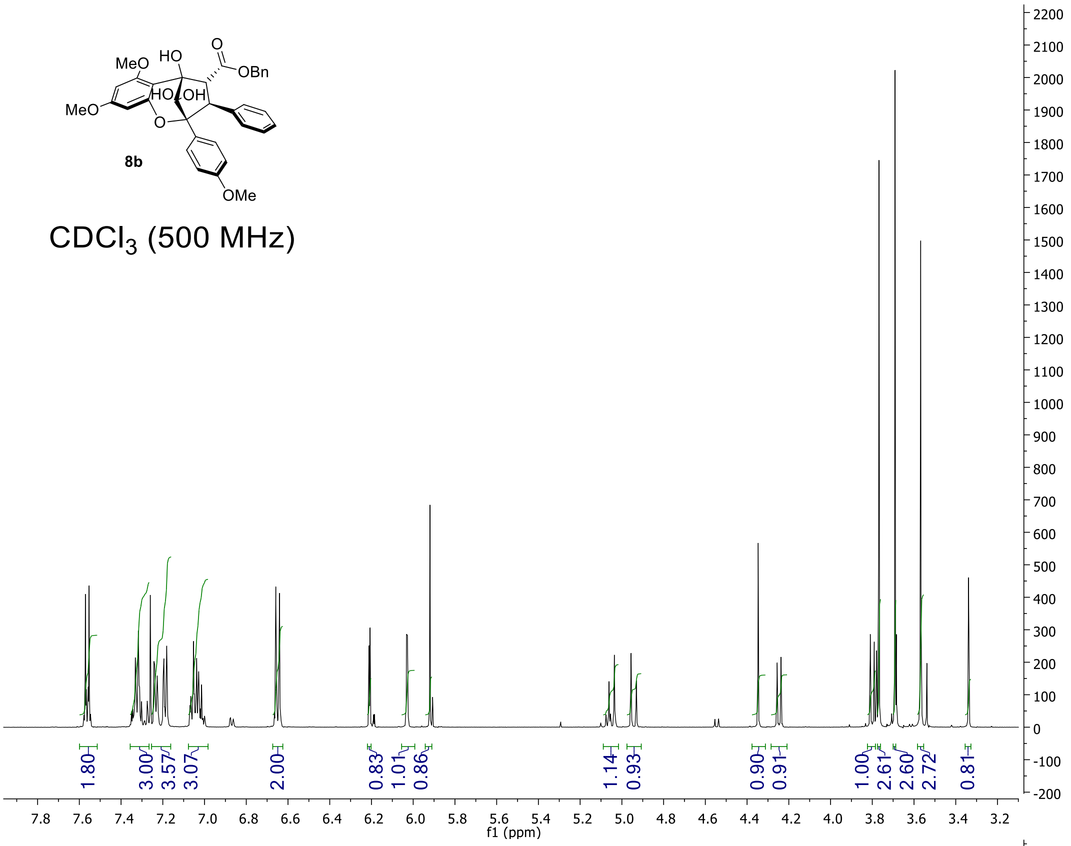
-90
-100

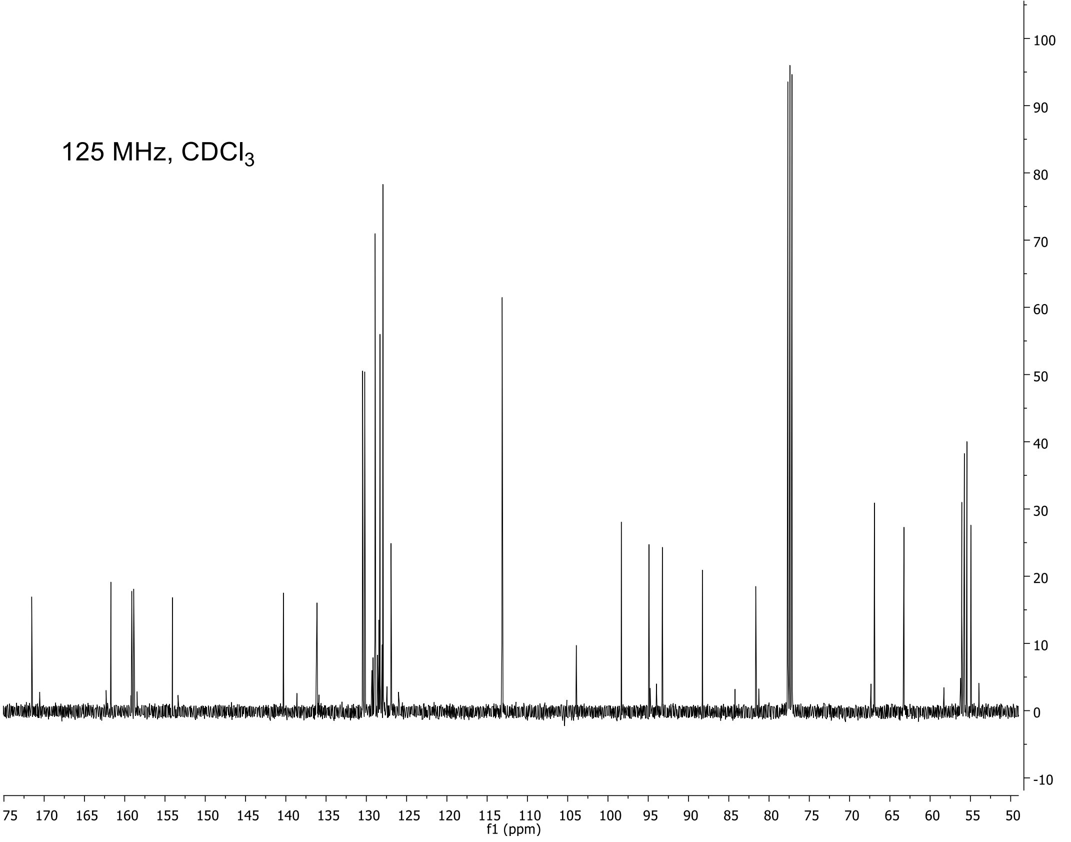

MeO
HO
O
OMe
HO
H
MeO
O
10a
OMe
CDCl$_3$ (500 MHz)
2.00
2.11
1.06
2.09
2.04
1.05
1.03
0.98
1.07
1.07
3.27
3.27
3.26
3.13
1.09
0.96
1000
900
800
700
600
500
400
300
200
100
0
-100
7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4
f1 (ppm)

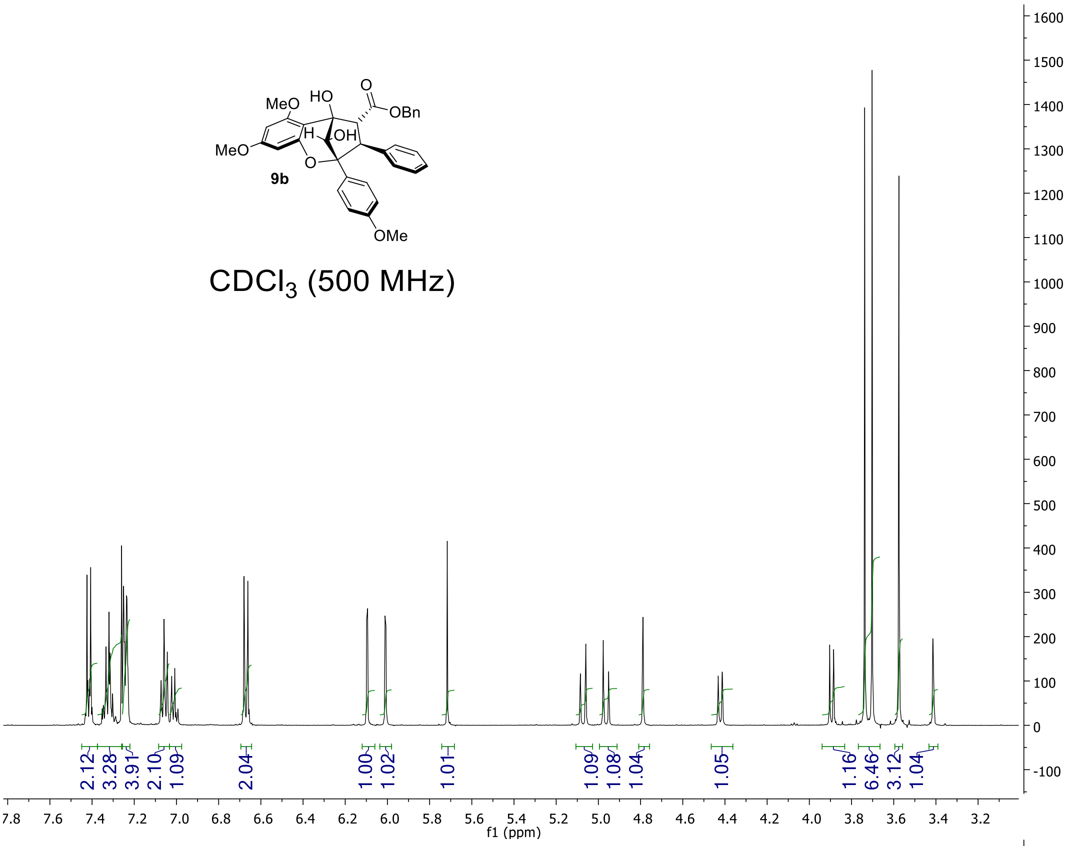

125 MHz, CDCl$_3$
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50
f1 (ppm)

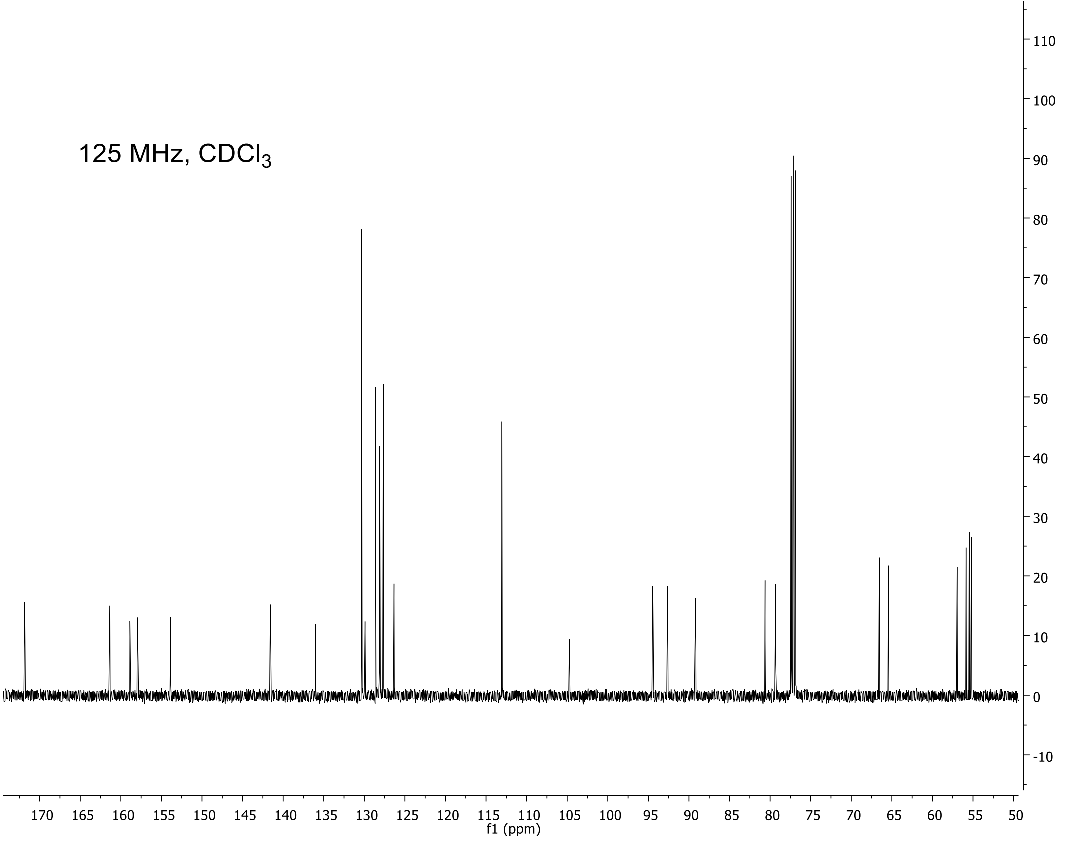

MeO
HO
O
OMe
MeO
HO
H
10a
O
OMe
CDCl$_3$ (500 MHz)
2.00
2.11
1.06
2.09
2.04
1.05
1.03
0.98
1.07
1.07
3.27
3.27
3.26
3.13
1.09
0.96
7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4
f1 (ppm)
1000 900 800 700 600 500 400 300 200 100 0 -100

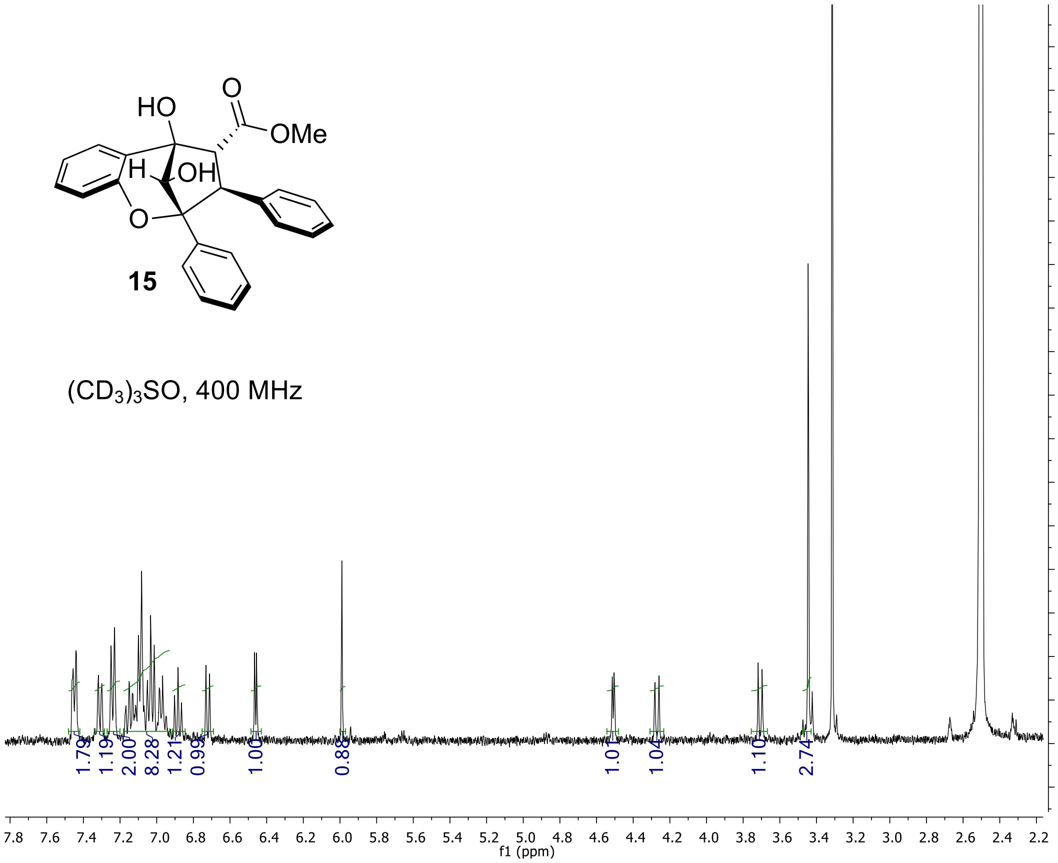

D-NOE, 500 MHz
MeO
HO
O
4
OMe
3
HO
H
10
MeO
O
10a
2"
2'
OMe
H2
H2"
H10
H3
H4
10.05
-0.52
8.13
-2.67
0.05
0.36
2.44
-100.00
-0.27
0.00
-0.14
0.46
0.01
11.92
7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4
f1 (ppm)
400 350 300 250 200 150 100 50 0 -50 -100 -150 -200 -250 -300

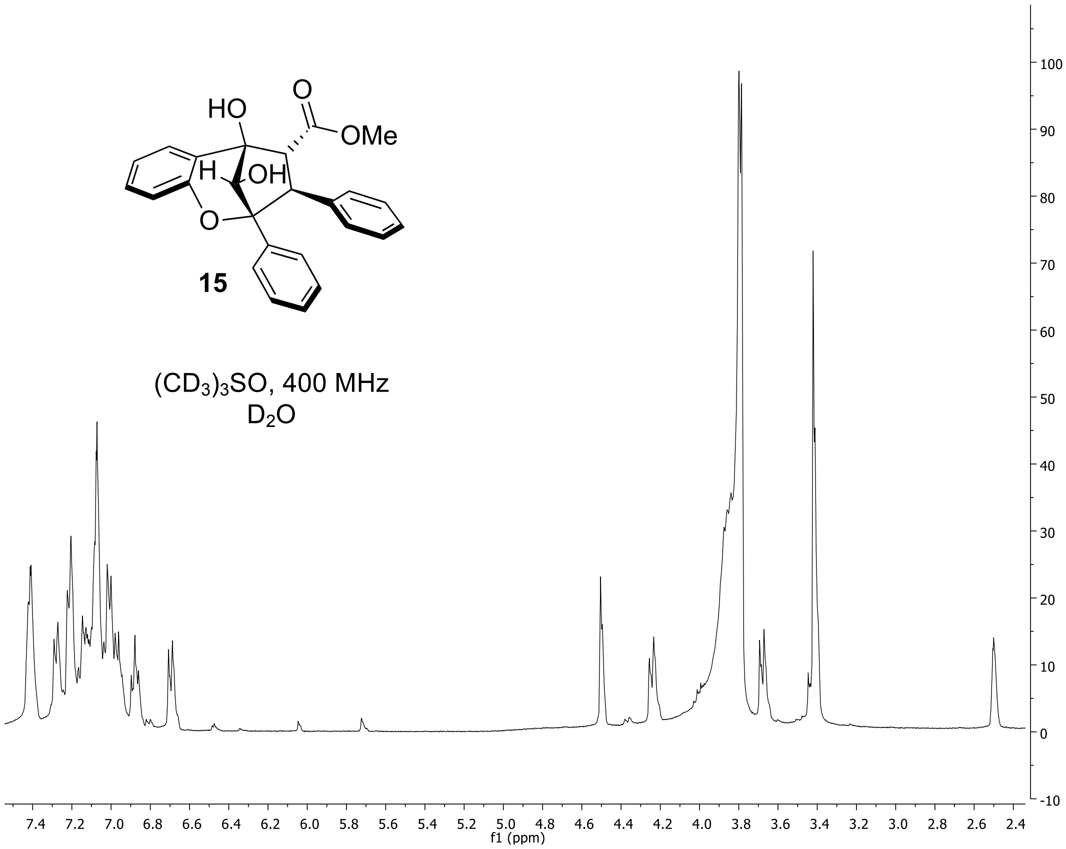

MeO
HO
O
OBn
MeO
HO
OH
O
8b
OMe
CDCl$_3$ (500 MHz)
1.80
3.00
3.57
3.07
2.00
0.83
1.01
0.86
1.14
0.93
0.90
0.91
1.00
2.61
2.60
2.72
0.81
7.8 7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2
f1 (ppm)
2200 2100 2000 1900 1800 1700 1600 1500 1400 1300 1200 1100 1000 900 800 700 600 500 400 300 200 100 0 -100 -200

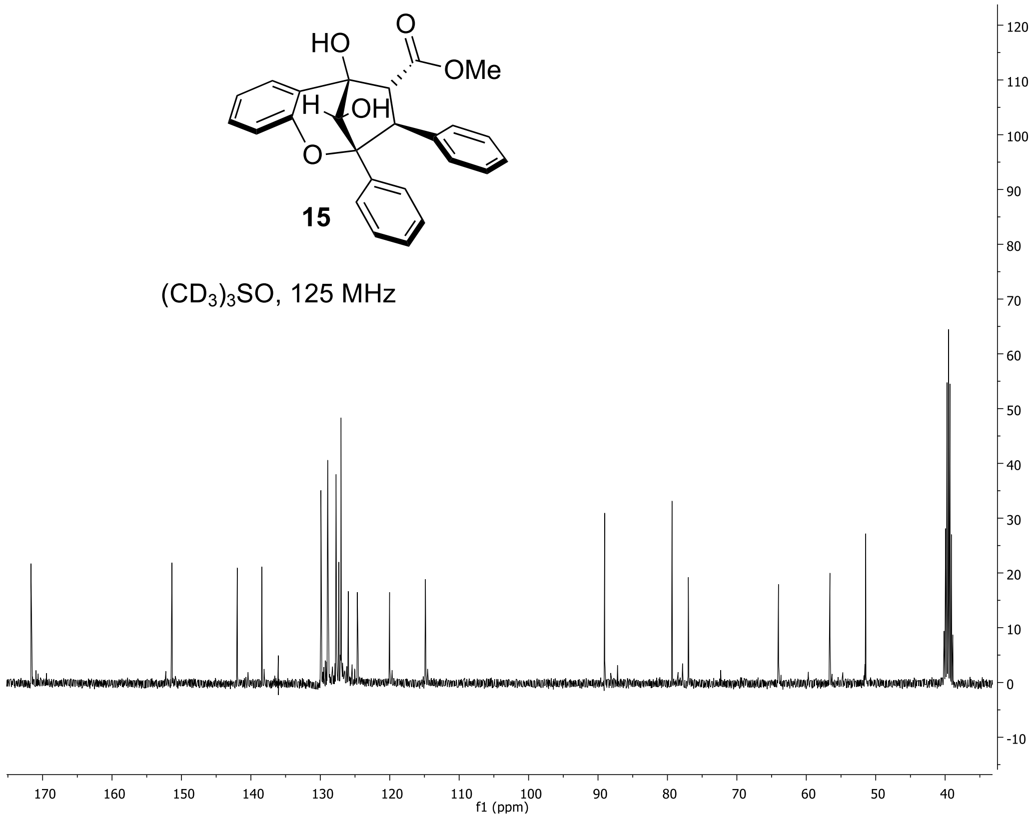

125 MHz, CDCl$_3$
75 170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50
f1 (ppm)
100 90 80 70 60 50 40 30 20 10 0 -10

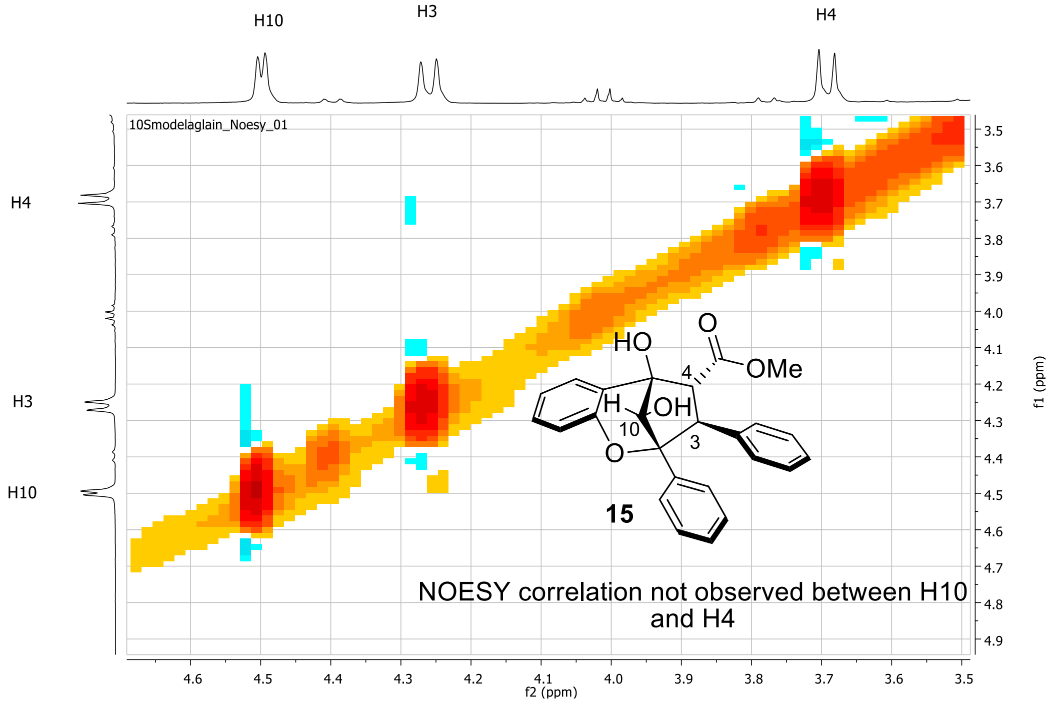

MeO
HO
O
OBn
H
OH
MeO
O
9b
OMe
CDCl$_3$ (500 MHz)
2.12
3.28
3.91
2.10
1.09
2.04
1.00
1.02
1.01
1.09
1.08
1.04
1.05
1.16
6.46
3.12
1.04
7.8 7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2
f1 (ppm)
1600 1500 1400 1300 1200 1100 1000 900 800 700 600 500 400 300 200 100 0 -100

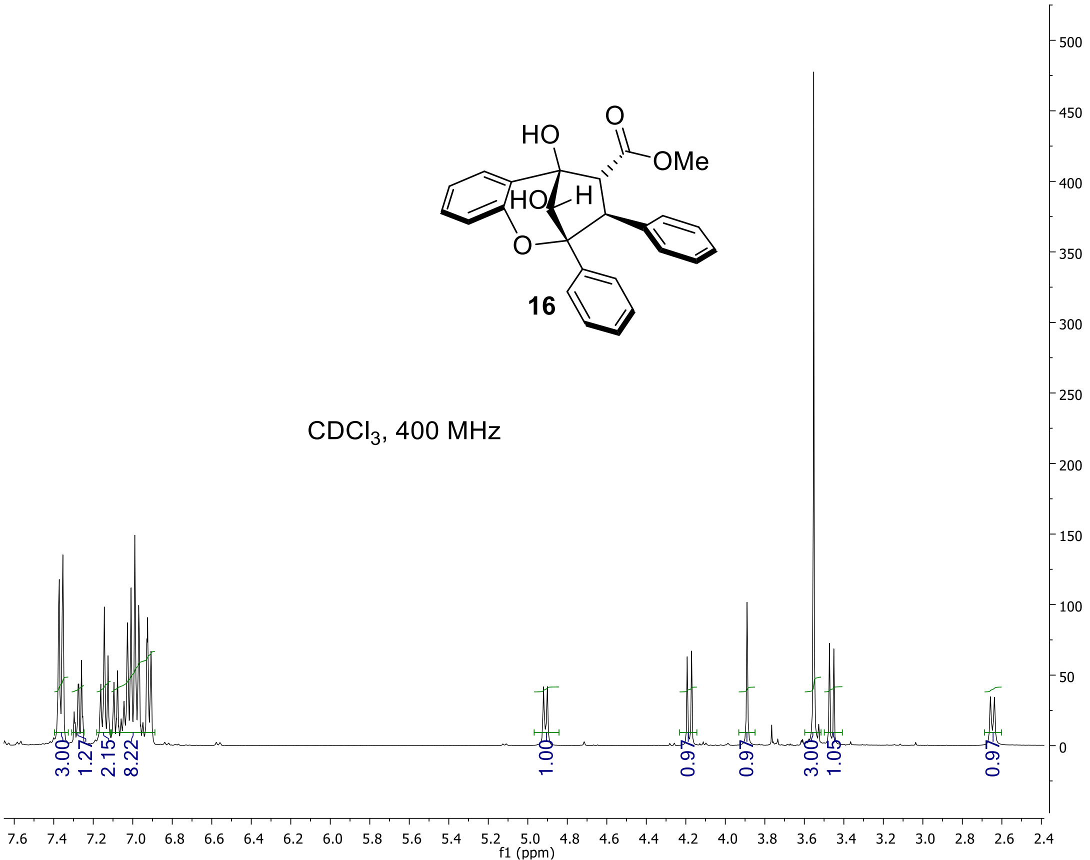

125 MHz, CDCl$_3$
170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50
f1 (ppm)
110 100 90 80 70 60 50 40 30 20 10 0 -10

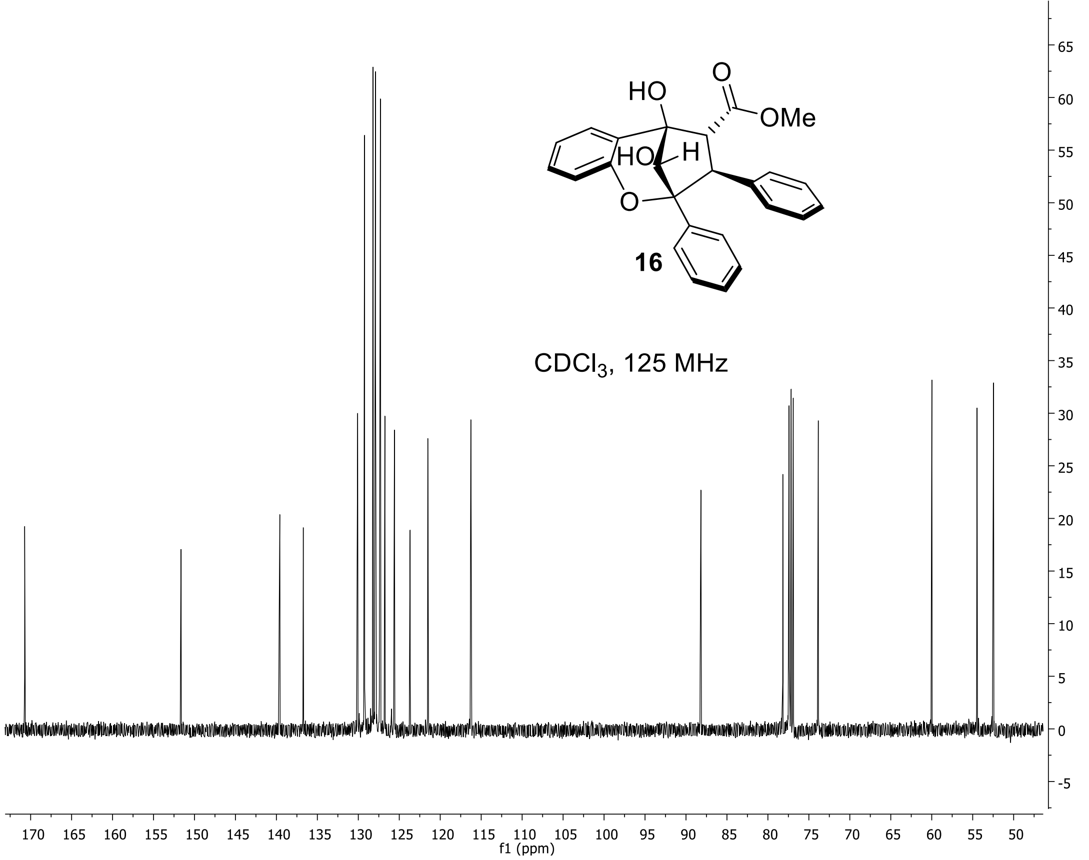

HO
O
OMe
H
OH
O
15
(CD3)3SO, 400 MHz
1.79
1.19
2.00
8.28
1.21
0.99
1.00
0.88
1.01
1.04
1.10
2.74
7.8 7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2
f1 (ppm)
32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0 -2

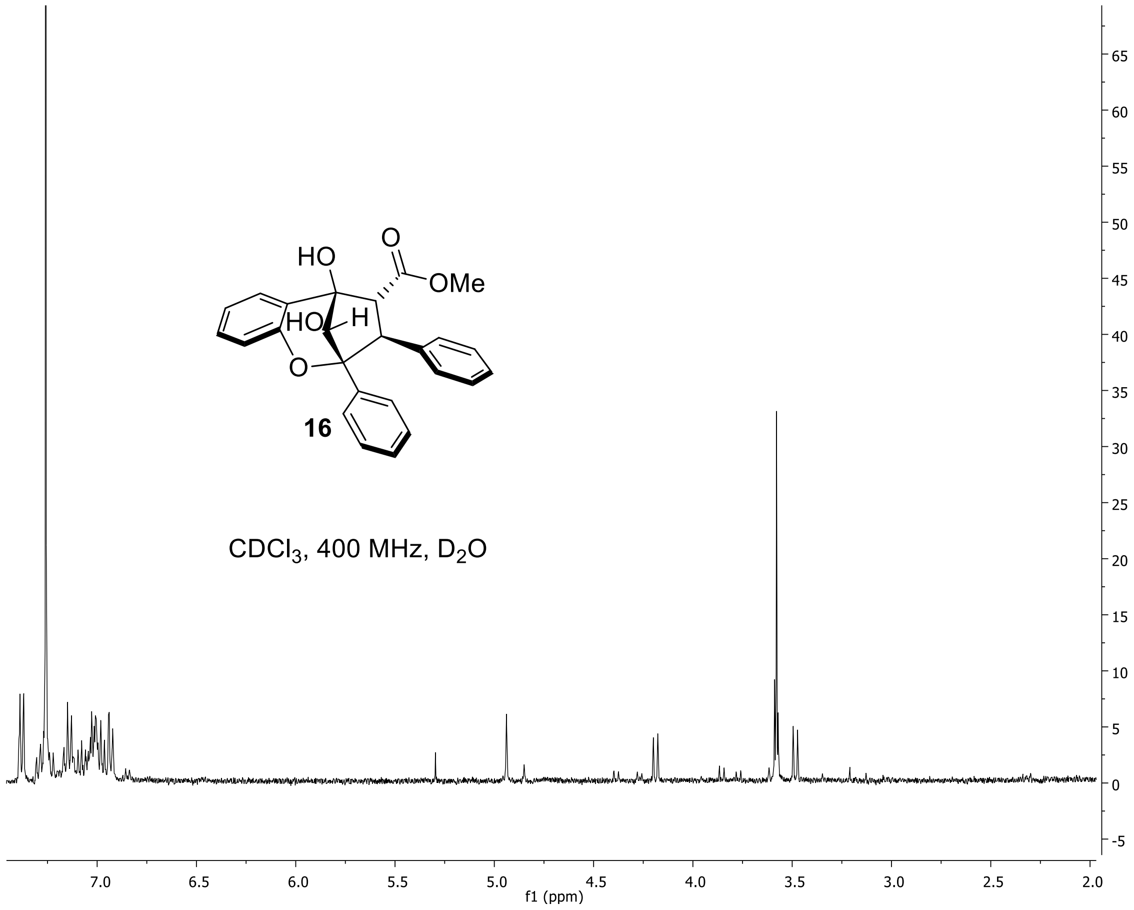

HO
O
OMe
H
OH
O
15
(CD3)3SO, 400 MHz
D2O
7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4
f1 (ppm)
100 90 80 70 60 50 40 30 20 10 0 -10

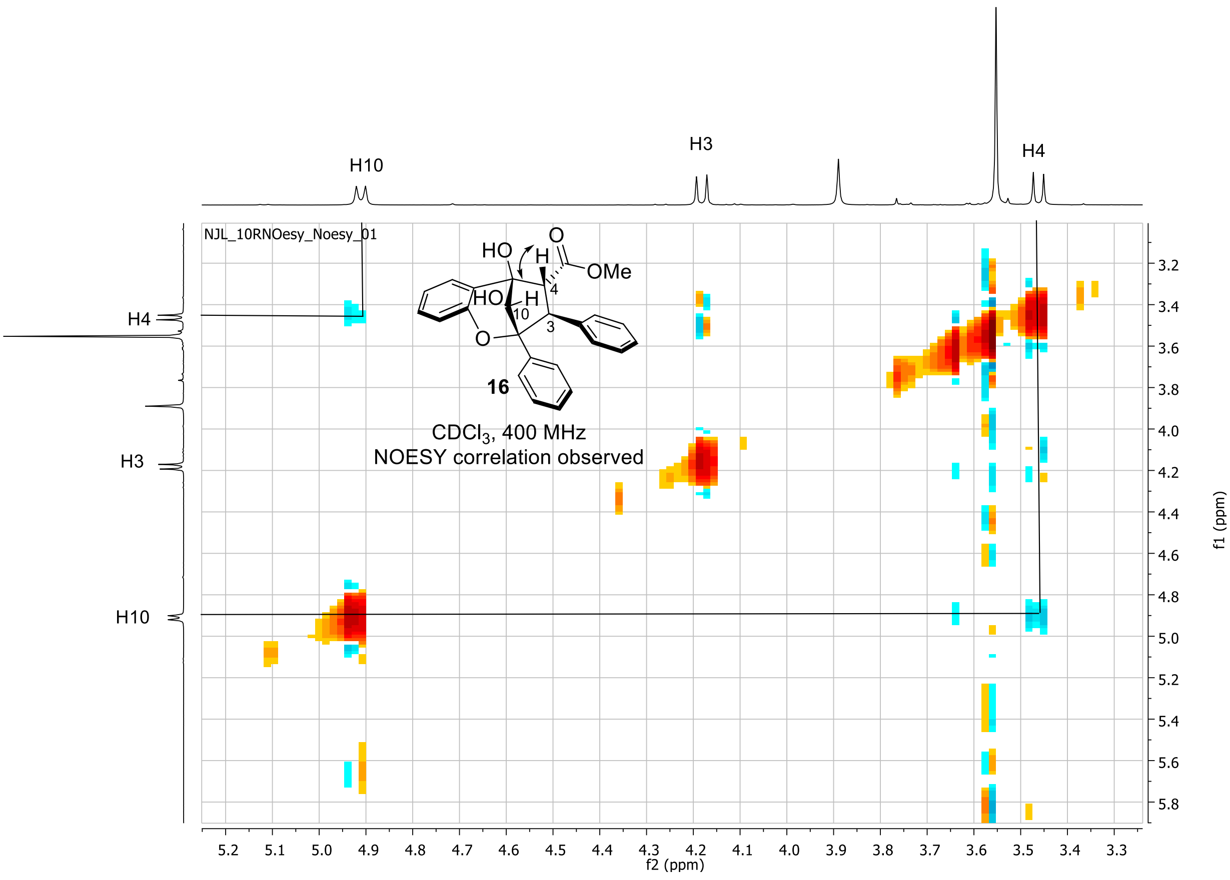

HO
O
OMe
H
OH
O
15
(CD$_3$)$_3$SO, 125 MHz
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
170
160
150
140
130
120
110
100
90
80
70
60
50
40
f1 (ppm)

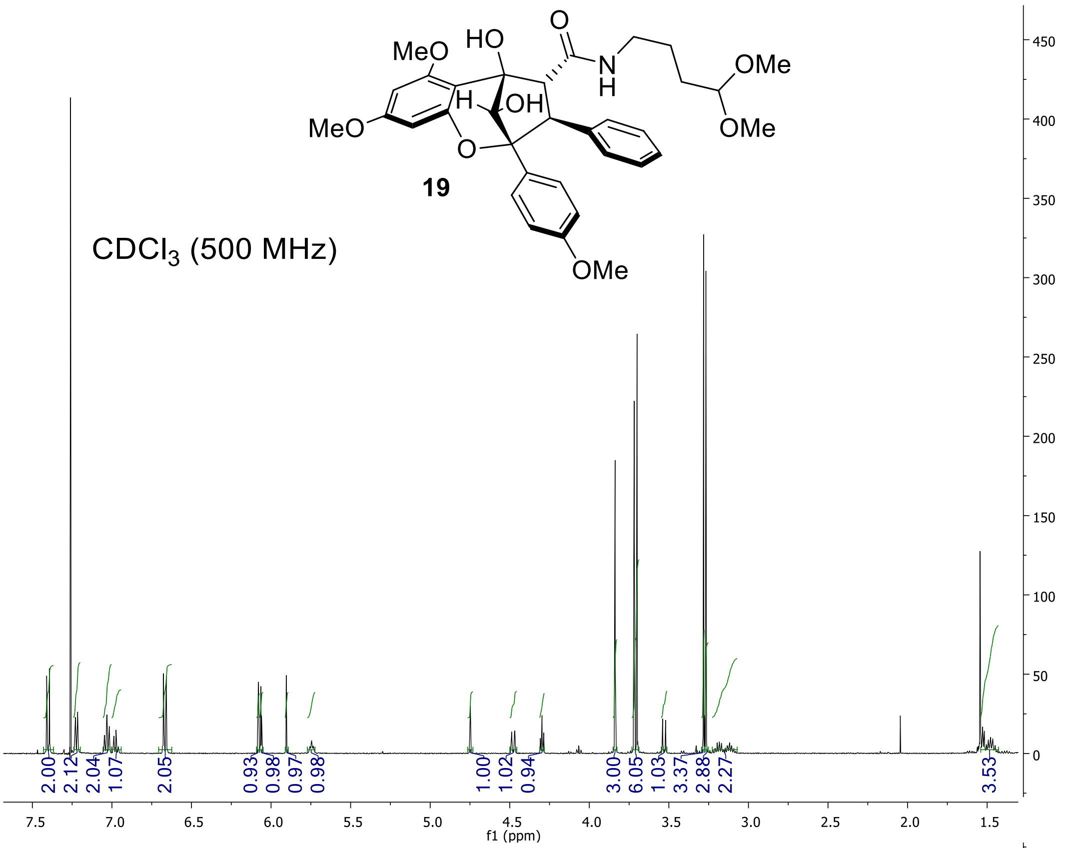

H10
H3
H4
10Smodelaglain_Noesy_01
H4
H3
H10
HO
O
4
OMe
H
OH
10
3
O
15
NOESY correlation not observed between H10 and H4
3.5
3.6
3.7
3.8
3.9
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
f1 (ppm)
4.6
4.5
4.4
4.3
4.2
4.1
4.0
3.9
3.8
3.7
3.6
3.5
f2 (ppm)

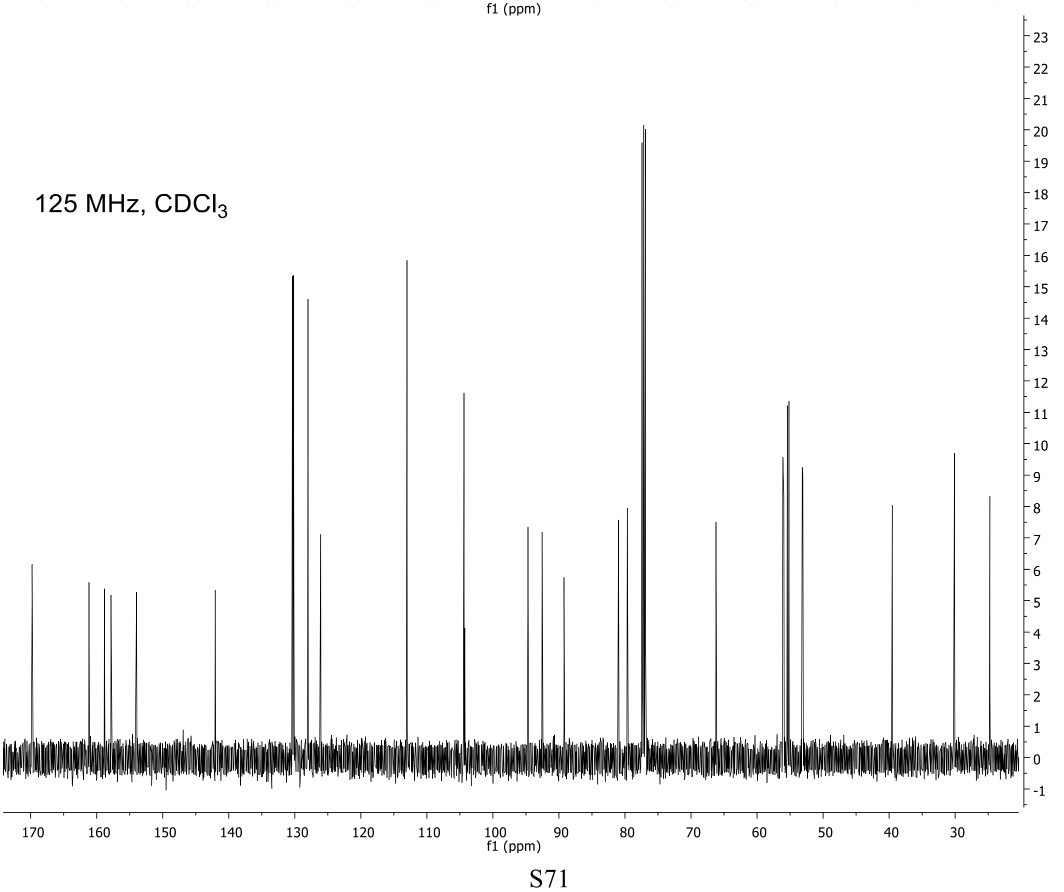

HO
O
OMe
HO
H
O
16
CDCl3, 400 MHz
3.00
1.27
2.15
8.22
1.00
0.97
0.97
3.00
1.05
0.97
7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4
f1 (ppm)
500 450 400 350 300 250 200 150 100 50 0

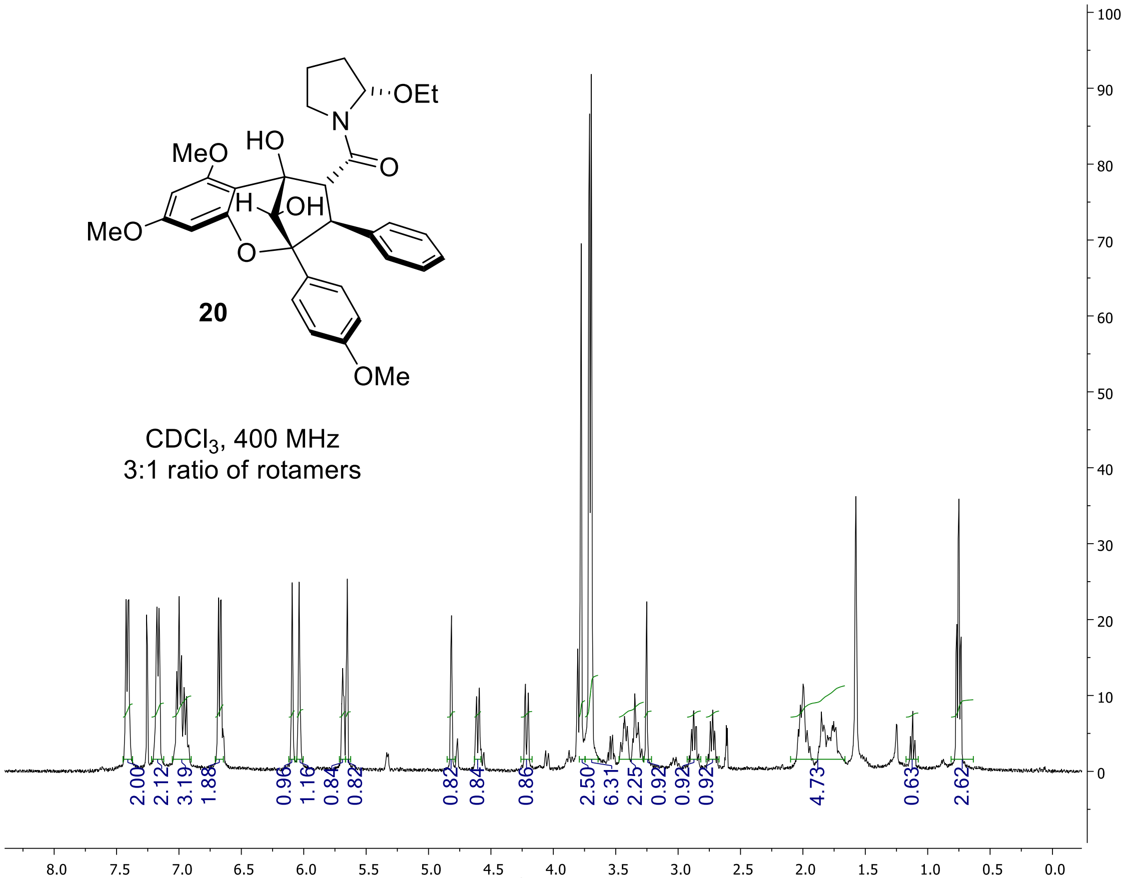

HO
O
OMe
HO
H
O
16
CDCl3, 125 MHz
170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50
f1 (ppm)
65 60 55 50 45 40 35 30 25 20 15 10 5 0 -5


HO
O
OMe
HO
H
O
16
CDCl3, 400 MHz, D2O
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
f1 (ppm)


H10
H3
H4
NJL_10RNOesy_Noesy_01
HO
H
O
OMe
HO
H
4
10
3
O
16
CDCl3, 400 MHz
NOESY correlation observed
H4
H3
H10
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
f1 (ppm)
5.2
5.1
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4.0
3.9
3.8
3.7
3.6
3.5
3.4
3.3
f2 (ppm)

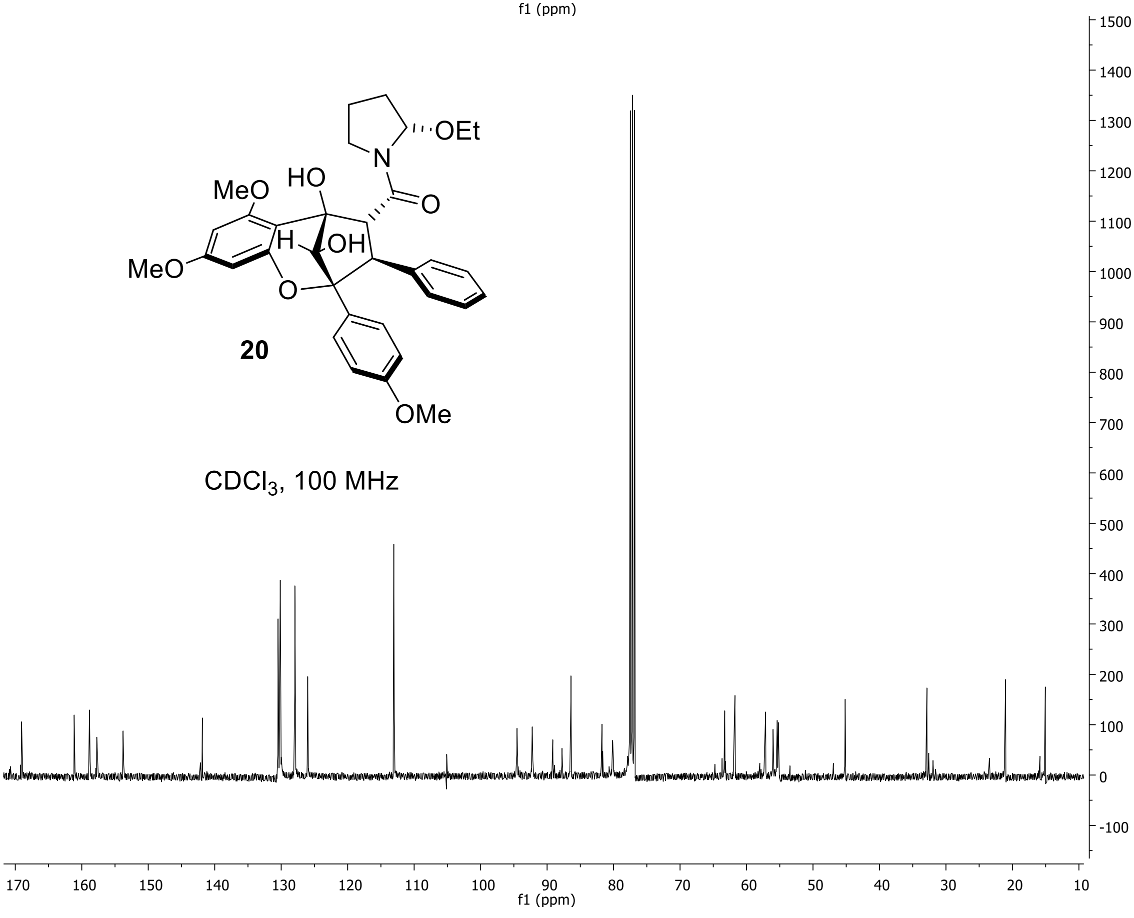

MeO
HO
O
N
H
OMe
OMe
H
OH
MeO
O
19
OMe
CDCl$_3$ (500 MHz)
2.00
2.12
2.04
1.07
2.05
0.93
0.98
0.97
0.98
1.00
1.02
0.94
3.00
6.05
1.03
3.37
2.88
2.27
3.53
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
f1 (ppm)
450
400
350
300
250
200
150
100
50
0


125 MHz, CDCl$_3$
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
f1 (ppm)
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1



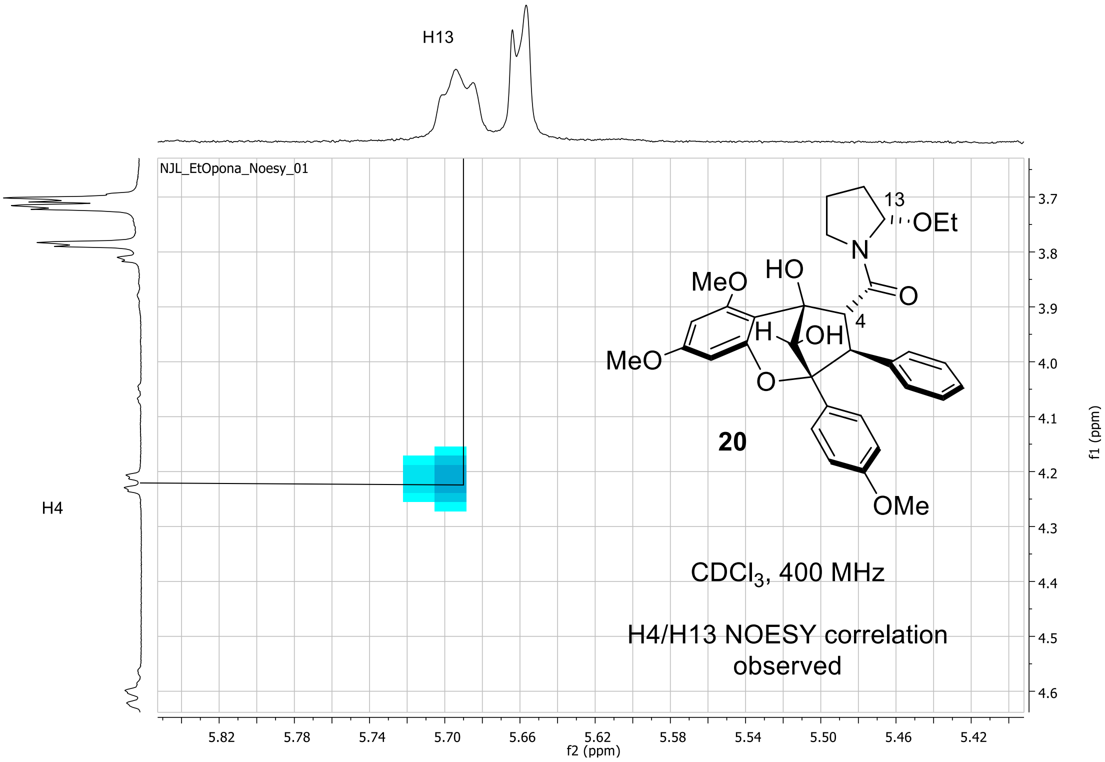
20

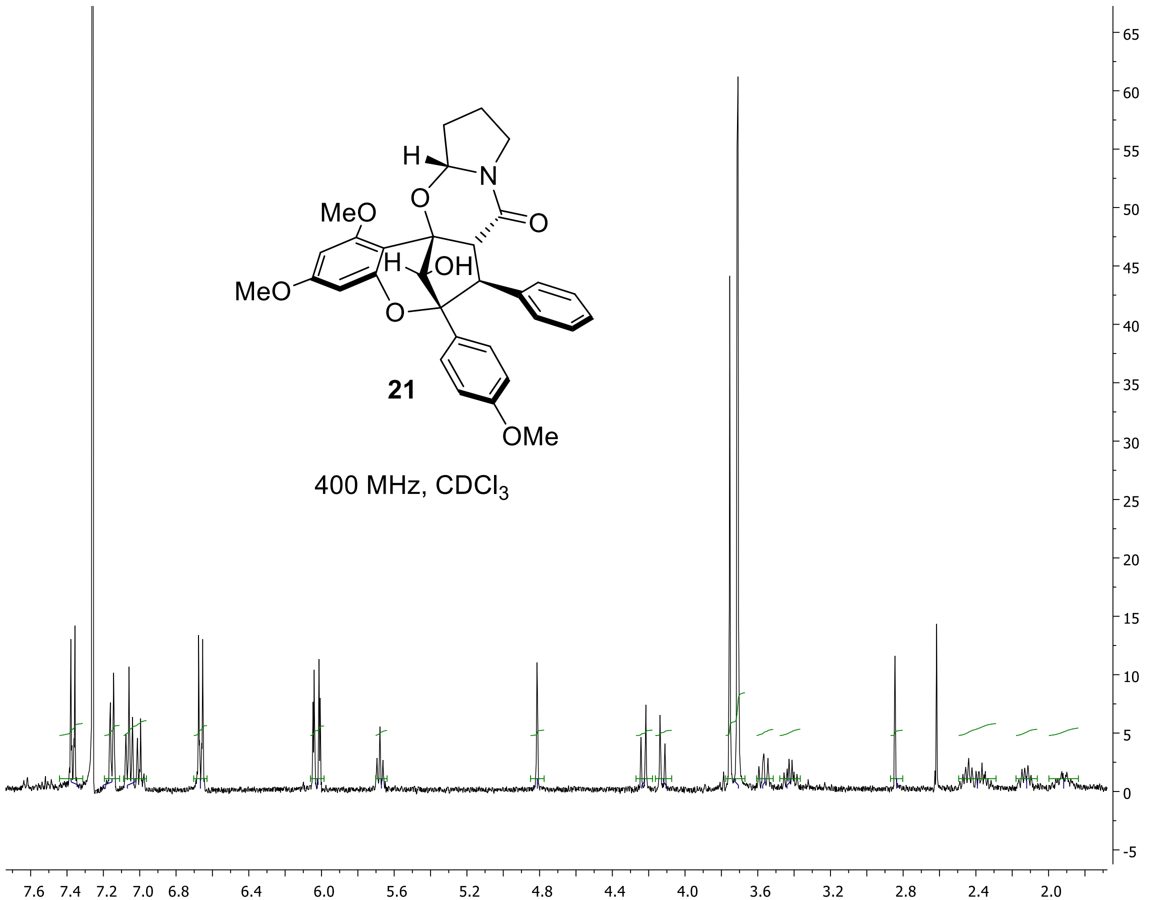
CDCl$_3$, 400 MHz
3:1 ratio of rotamers

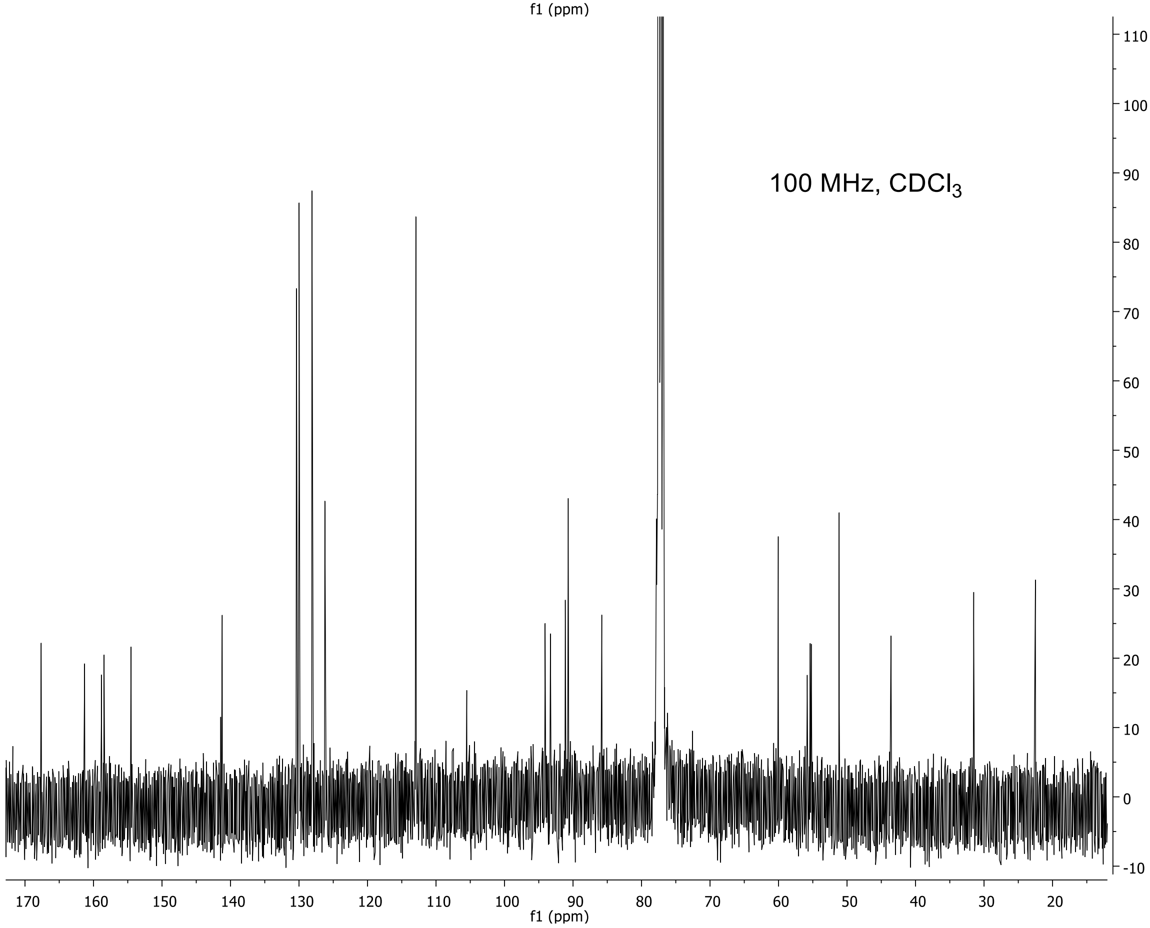


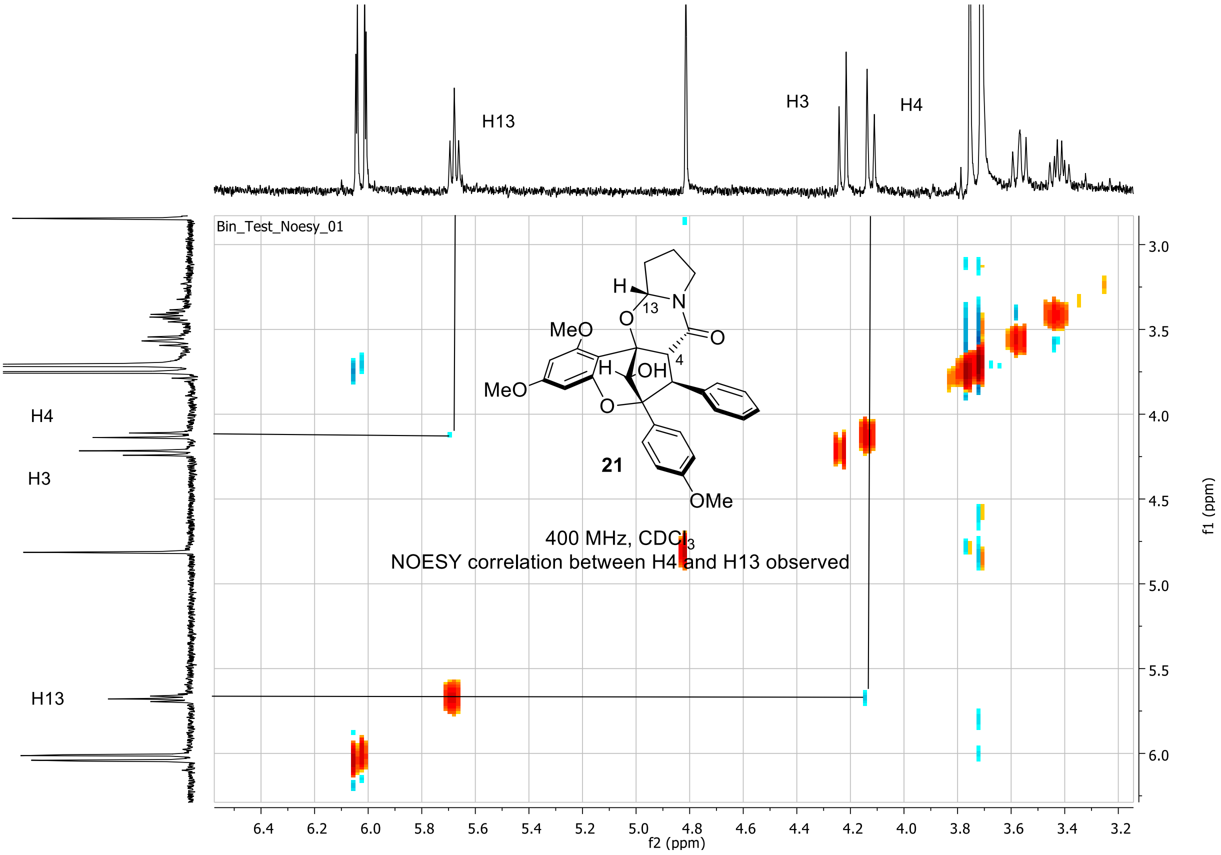
20

CDCl$_3$, 100 MHz

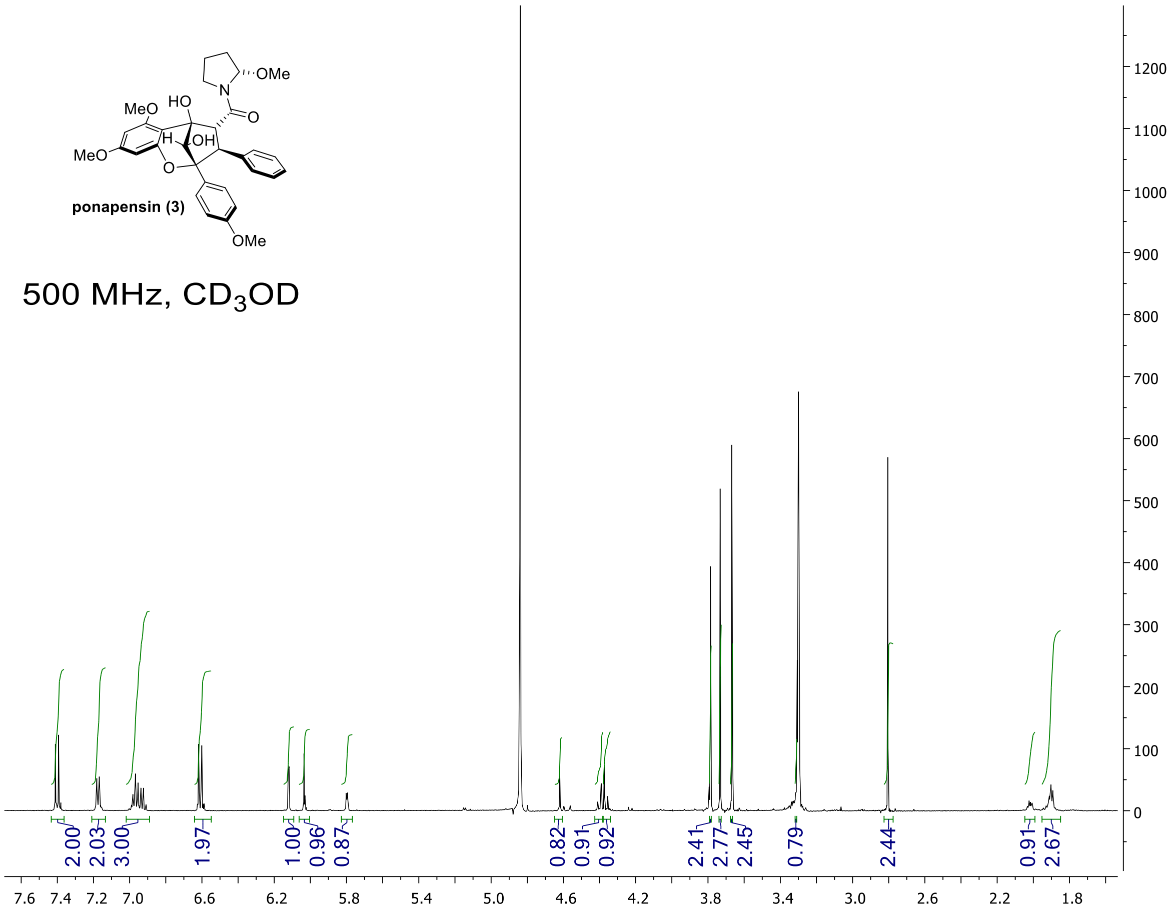

H13
NJL_EtOpona_Noesy_01
H4
13
OEt
N
O
MeO
HO
4
H
OH
MeO
O
20
OMe
CDCl$_3$, 400 MHz
H4/H13 NOESY correlation observed
5.82
5.78
5.74
5.70
5.66
5.62
5.58
5.54
5.50
5.46
5.42
f2 (ppm)
3.7
3.8
3.9
4.0
4.1
4.2
4.3
4.4
4.5
4.6
f1 (ppm)

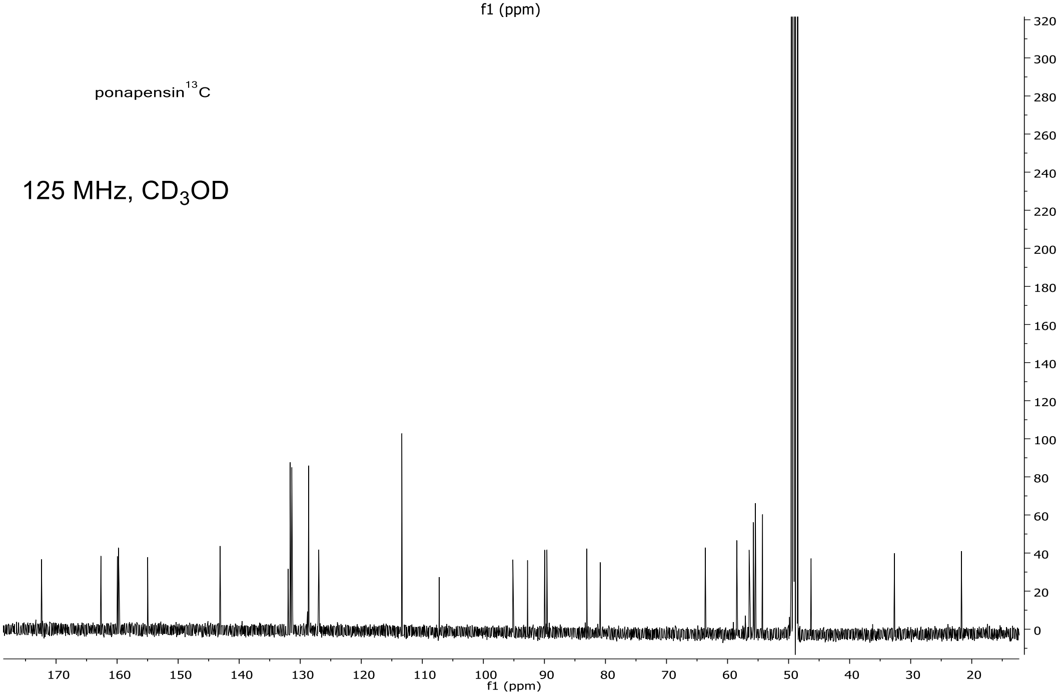

H
N
O
O
MeO
MeO
H
OH
O
21
OMe
400 MHz, CDCl$_3$
7.6 7.4 7.2 7.0 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0
f1 (ppm)
65 60 55 50 45 40 35 30 25 20 15 10 5 0 -5

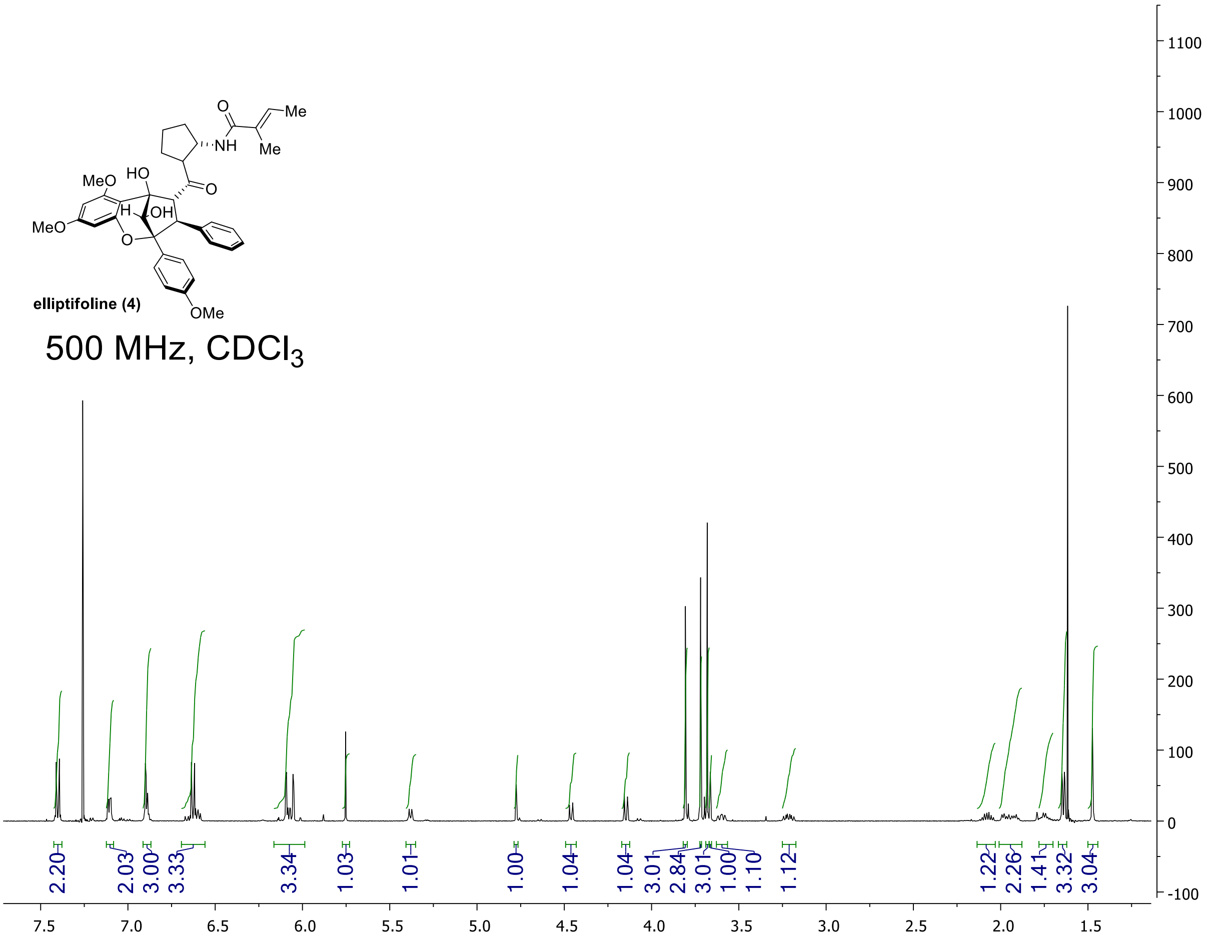

100 MHz, CDCl$_3$
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20
f1 (ppm)
110 100 90 80 70 60 50 40 30 20 10 0 -10

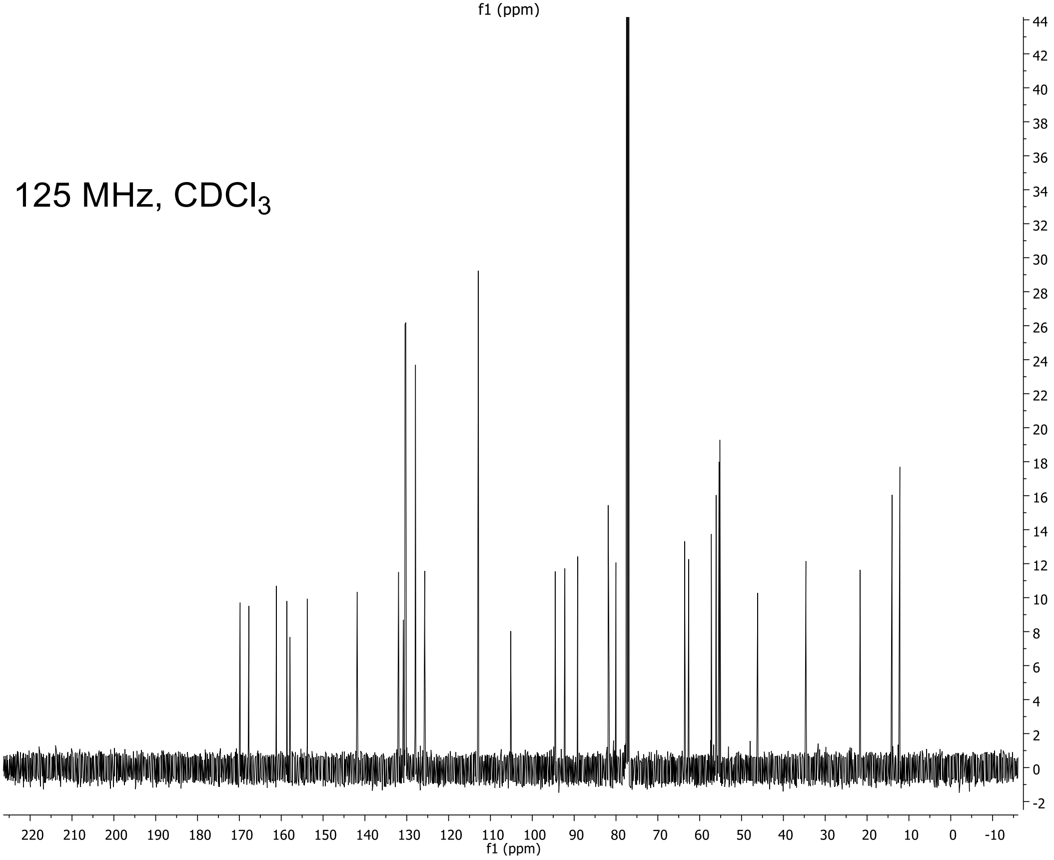

H13
H3
H4
Bin_Test_Noesy_01
H
13
O
N
O
MeO
H
OH
4
MeO
O
21
OMe
400 MHz, CDCl3
NOESY correlation between H4 and H13 observed
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
f2 (ppm)
3.0
3.5
4.0
4.5
5.0
5.5
6.0
f1 (ppm)

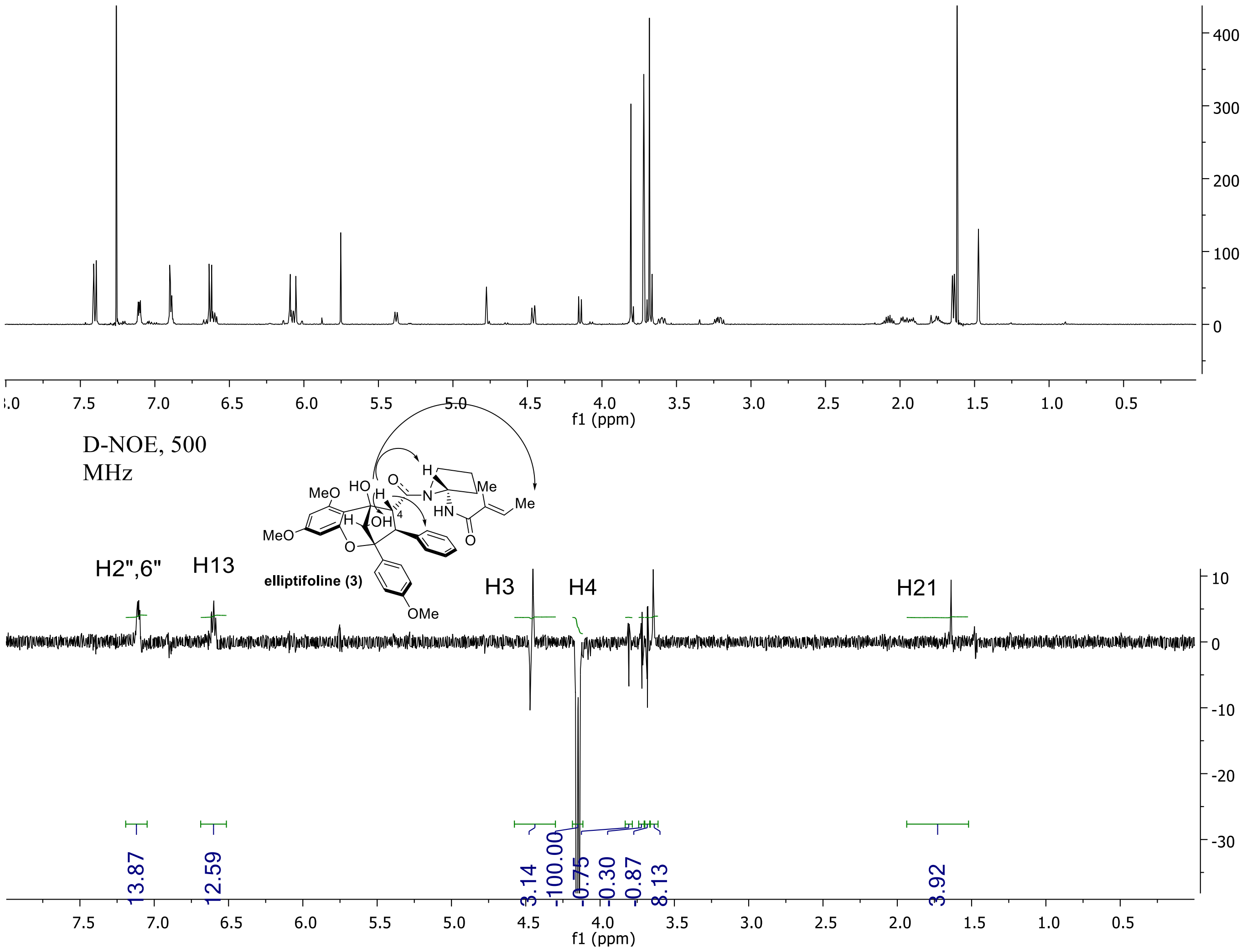
III. NATURAL PRODUCTS SPECTRA






O
Me
NH
Me
MeO
HO
O
H
OH
MeO
O
OMe
elliptifoline (4)
500 MHz, CDCl$_3$
2.20
2.03
3.00
3.33
3.34
1.03
1.01
1.00
1.04
1.04
3.01
2.84
3.01
1.00
1.10
1.12
1.22
2.26
1.41
3.32
3.04
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
f1 (ppm)
1100
1000
900
800
700
600
500
400
300
200
100
0
-100

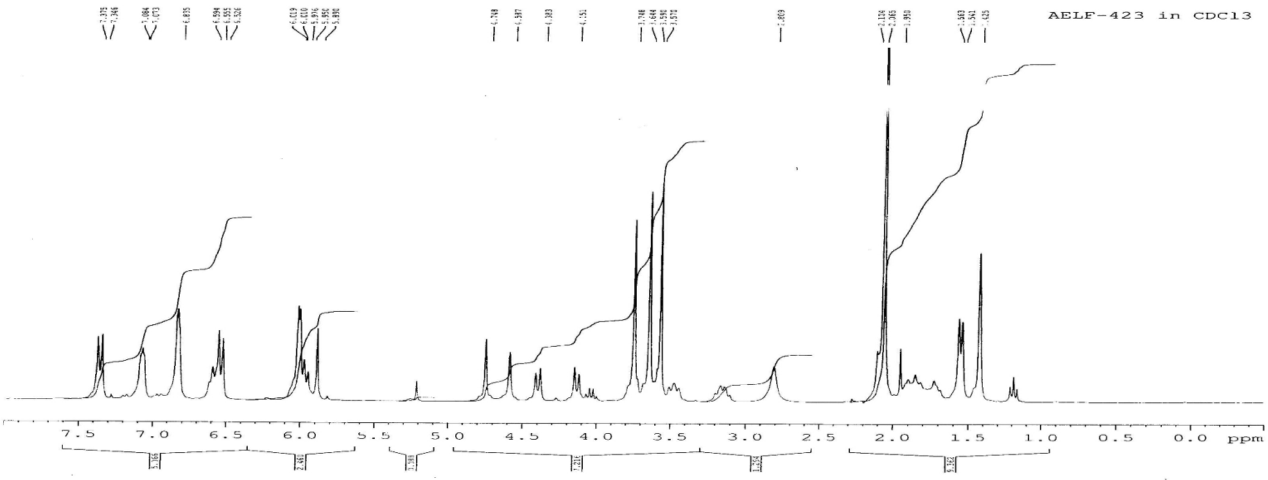

125 MHz, CDCl$_3$
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2



D-NOE, 500 MHz

elliptifoline (3)

^{1}H NMR from Duh and coworkers:[S4]



Synthetic: